
MUSINGS FROM THE OIL PATCH

May 31, 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

Value Investor Favoring Commodity Paradigm Shift Recants

GMO is known for its diligent approach to understanding long-term market forces and attempting to be in front of favorable ones and to avoid being invested in unfavorable ones

Jeremy Grantham, one of the founders of value money manager GMO, is well known for his focus on macro industry trends in seeking value investments. In the firm's first quarter 2016 letter to investors there is a report written by Mr. Grantham titled: Part I: Always Cry Over Spilt Milk (An Admission of a Past Mistake on Resources). GMO is known for its diligent approach to understanding long-term market forces and attempting to be in front of favorable ones and to avoid being invested in unfavorable ones. That is the key skill they employ for allocating assets in investment portfolios. As Mr. Grantham put it: "The defining events at GMO were avoiding some or much of the pain associated with the three great bubbles of the last 100 years: the U.S. housing and finance bubble of 2008, the U.S. tech bubble of 2000, and the Japanese equity bubble of 1989. He even showed a chart through 2012 demonstrating the bubble associated with investing in Japan at a time when the world believed that Japanese managers had a magic touch and had figured out how to innovatively manage companies for outstanding returns, especially manufacturing ones. Maybe you remember that era when the bookstores were full of management tomes detailing how to best employ Japanese management techniques. When you examine the chart in Exhibit 1 on the next page, note Mr. Grantham's wry commentary about investing in Japanese stocks.

"It is easy to be early, and being early may lose you your job, your clients, and your credibility."

Mr. Grantham writes about identifying investment bubbles – they carry a career-risk perspective. Having been in the investment research business for over 45 years, we appreciate Mr. Grantham's observations/humor. "It is easy to be early, and being early may lose you your job, your clients, and your credibility." As he points out, every bull market is called a paradigm shift but seldom ever exists, although he also says that there may be shifts. "In 1999 we

Exhibit 1. The Japanese Bubble Return To The Mean

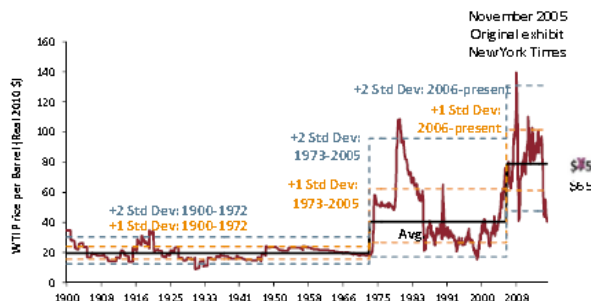
1989 Japan Bubble: Shiller P/E



Source: GMO

presented 29 major bubbles of the past and were able to call the score: Mean Reversion, 28; Paradigm Shift, Nil!” But that record didn’t stop Mr. Grantham from identifying a possible paradigm shift with commodities – starting with oil – in 2005.

Exhibit 2. The Paradigm Shift Evidence For Oil



As of 9/30/15
Source: GMO, Global Financial Data, EIA

Source: GMO

The previous 100 years had produced a price of \$16 a barrel – the odds of such a change was 1 in 1 billion

The trigger for Mr. Grantham’s thinking was his analysis of how oil prices had changed in more recent years. It was then up to him to figure out what was driving the change in data. When he put the history of oil prices into current dollars, he found that in 1979 oil prices had spiked to over \$100 a barrel. The previous 100 years had produced a price of \$16 a barrel – the odds of such a change was 1 in 1 billion. That event was driven by the “newly effective cartel, OPEC.” In his view, the response of oil prices “could not have been caused by any mixture of pre-existing factors.” Of course, cartels can end, so this was a special case of a paradigm shift that would last as long as the new factor stays effective. Part of what convinced him that this was a paradigm shift was the cost of oil production. As a result, Mr. Grantham became a friend and champion of the late Matt Simmons who expounded the view in his

It was the oil development cost issue that caused Mr. Grantham to question whether other finite resources might also be running out

book, Twilight In The Desert, suggesting that Saudi Arabia's oil output was at risk of collapsing due to how their fields had been produced over the years. That collapse would condemn the world to a future of extremely high oil prices forever.

Mr. Grantham today believes the cost to develop new oil reserves has risen to at least \$65 a barrel, a level that will challenge both the petroleum industry and world economies. It was the oil development cost issue that caused Mr. Grantham to question whether other finite resources might also be running out. In this newsletter article, Mr. Grantham focused on what mistakes he had made about his forecast of a long-term shortage of iron ore and how he missed the impact of China's economic slowdown and the timing of investment cycles and their subsequent output growth. He also touched on the grain market. But when he returned to the oil market, he was still positive about the paradigm shift, but is now focusing on the length of time this shift will produce positive conditions. He wrote:

"Oil is indeed the real McCoy, a true paradigm shift. But it too faces a short-term glut caused by U.S. fracking.

"U.S. fracking oil is a small resource, under one and one-half years of global consumption. It will soon run off and show the underlying implacable rising costs of finding ever-diminishing pools of new oil.

"Existing oil wells deplete faster than they used to because enhanced technologies squeeze more into the early years. Over 5 million barrels a day out of a global total of 95 a year now needs to be replaced every year. Half a new Saudi Arabia!

"Today's draconian cutbacks in exploration almost guarantee another sharp price spike in the next two to four years.

"But beyond a five-year recovery for oil prices and oil stocks, there lurks a third paradigm shift"

"But beyond a five-year recovery for oil prices and oil stocks, there lurks a third paradigm shift: the terra incognita of electric, self-driving vehicles; cheap electric storage; climate change; and carbon taxes. Taken together, this shift to alternative fuels is likely to cause oil's final paradigm shift!"

He believes we have seen the peak in oil prices and that we are now in an environment characterized by shorter cycles and increased price volatility

The point of the "third paradigm" identified by Mr. Grantham was similar to one made by Wall Street analyst Paul Sankey, Managing Director, Wolfe Research, at a recent energy conference in Calgary. Mr. Sankey's view was that the 20th Century was driven by oil but the 21st Century will be driven by electricity. He believes we have seen the peak in oil prices and that we are now in an environment characterized by shorter cycles and increased price volatility. In his view, long-term oil demand estimates are too high for a number of reasons including global demographics, the increased electrification of the economy, the loss of the energy impact from the emergence of Eastern European countries from under the rule of communism, but correspondingly, the adoption by Western European countries of

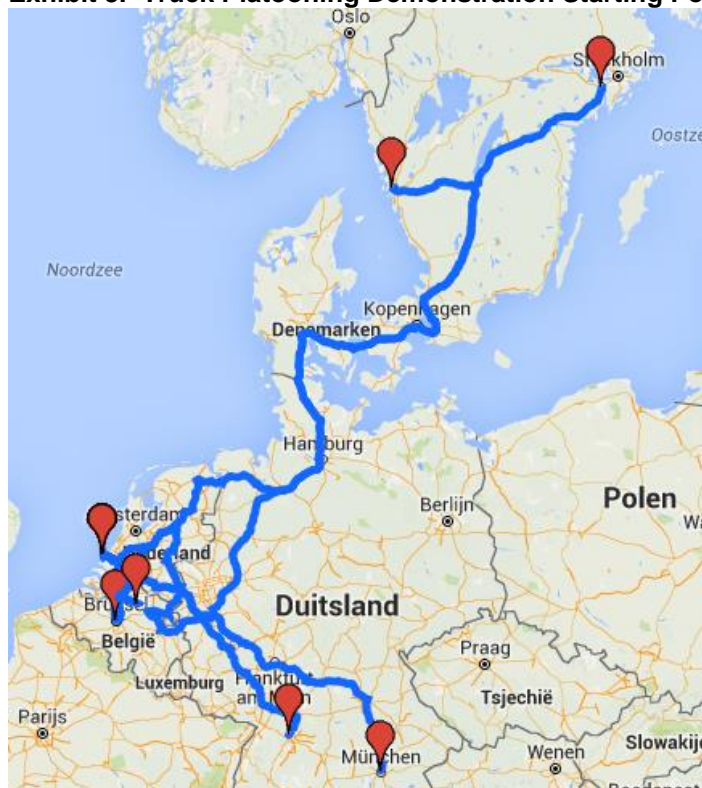
more socialistic philosophies that produce slower economic growth. So just as Mr. Grantham sees a positive environment for oil over the next five years (ten years for Mr. Sankey), both see less positive outlooks longer term. Mr. Sankey characterized his long-term outlook for the petroleum industry as liquidation – something he sees managements reluctant to consider. What an outlook!

Autonomous Truck Technology Being Promoted Over Cars

The truck convoys originated in seven different locations in Europe and drove successfully under autonomous control to Rotterdam

We recently wrote about the experiment in Europe to link up heavy-duty trucks with sensors and Wi-Fi, enabling them to platoon in convoys that then drove across much of the continent before finally arriving in the Netherlands port-city of Rotterdam. As this experiment, organized by the Dutch Ministry of Infrastructure and the Environment, involved heavy-duty trucks from six different European manufacturers (DAF Trucks (PCAR-OTC), Daimler (DDAIY-OTC), IVECO, MAN, Scania AB (SVKBY-PNK), and Volvo (VOLVY-OTC)), it confirmed that this level of technological control over vehicles does work in the real world. The truck convoys originated in seven different locations in Europe and drove successfully under autonomous control to Rotterdam, although each truck did have a driver in the vehicle.

Exhibit 3. Truck Platooning Demonstration Starting Points



Source: Dutch Ministry of Infrastructure and the Environment

In some countries, trucks must maintain a distance of 160 feet between them, while in other countries the distances were less or not specified

If the lead truck needs to slow down or brake, all the trucks in the platoon respond at once.

The trucks in each platoon were connected via Wi-Fi, which enabled them to be synchronized and therefore driven much closer together than would be possible than by just having human drivers on board. One legal agreement the European Union is exploring in light of the success of this platooning demonstration is to standardize the regulations for vehicle spacing in the various member countries. In some countries, trucks must maintain a distance of 160 feet between them, while in other countries the distances were less or not specified. It was interesting to learn that the U.K. recently created a £100 million (\$144.8 million) Intelligent Mobility Fund to finance self-driving technology and has recommended the creation of a national ministry for driverless vehicles. We expect that as countries and U.S. states deal with the need to revise highway rules and regulations and confront other regulatory issues associated with autonomous driving technology that there will be more such agencies and ministries. There is still the issue of liability of autonomous driving and how the insurance industry will deal with it.

There are three immediate advantages of networked trucks. First, there's almost no reaction time within the platoon. If the lead truck needs to slow down or brake, all the trucks in the platoon respond at once. This is a safety advantage. Second, by reducing the spacing between the trucks, they benefit from decreased wind resistance and therefore achieve better fuel economy, up to 10%, which not only saves truck operators money but also means less carbon dioxide emissions – the third advantage.

Understand that we are not talking about completely autonomous vehicles — there was a driver on board each vehicle. The trucks were equipped with radar and optical sensors, making them at least as smart as the semi-autonomous Teslas (TSLA-Nasdaq), Audis, and other cars that are being test-driven now.

Exhibit 4. Platooning Trucks On The Road



Source: *inhabitat.com*

We are now learning about autonomous truck efforts in the United States

We are now learning about autonomous truck efforts in the United States. The most notable one is Otto, a start-up company (founded in January) by Google (GOOG–OTC) car and map veterans, Anthony Levandowski and Lior Ron. Their company has expanded to 41 employees working out of an auto garage close to the freeway entrance in San Francisco’s South of Market neighborhood. Otto is working with three new, sensor-equipped Volvo heavy-duty trucks.

The laser sensor used on the Google car project cost \$75,000

In an interview with *The New York Times*, Mr. Levandowski discussed some of the reasons why autonomous trucks may be on the roads sooner than autonomous cars. The primary reason is the cost of the technology. He pointed out that until recently, the laser sensor used on the Google car project cost \$75,000. Relative to the cost of a car - \$25,000 to \$65,000 – this is a huge expense. On the other hand, since trucks start out costing \$150,000, which can go substantially higher, the impact of the cost of the laser sensor equipment is not as great. One should keep in mind that the technology can lead to meaningful cost savings, further justifying its employment on trucks before cars.

That scenario could lead to eliminating the need for second drivers, which is a huge cost savings

Besides the fuel savings, the primary economic benefit for owner-operator truck drivers is to ease the cost from the new safety rules requiring drivers of over-the-road vehicles to rest for 10 hours a day. As Mr. Levandowski put it, “Initially there will be certain roads that we know we can drive more safely. On those roads, we’ll tell the driver, ‘You’re welcome to go take your nap or your break right now.’ If that’s 500 miles, that’s 10 hours, so he gets his full rest.” That scenario could lead to eliminating the need for second drivers, which is a huge cost savings.

Surprisingly, it also turns out that the lead truck in a platoon can benefit from less drag at its rear as the pressure wave behind the tailing vehicle in effect “pushes” the lead truck forward

The issue of fuel savings uncovers some other possibilities, too. Clearly, the second and subsequent vehicles in the platoon, assuming they are close behind, will have less wind resistance than if they were traveling alone, which would lead to at least 10% fuel savings. The savings come because those trucks are traveling within a cone of smooth air just like Tour de France bike riders encounter when drafting in a line. Surprisingly, it also turns out that the lead truck in a platoon can benefit from less drag at its rear as the pressure wave behind the tailing vehicle in effect “pushes” the lead truck forward. In other words, all vehicles would experience fuel-savings from the platooning effect of autonomous driving regardless of whether it was in the lead or merely following. This understanding of the aerodynamic drag resistance science helps address concerns about how a convoy of trucks employing platooning technology would allocate the fuel savings if only the following-trucks were beneficiaries. To help further improve the “pushing effect” that helps the trucks, trailer tail-ends, such as shown in Exhibit 5, have been developed.

While not many trucks on the road have such a structure attached to their tail end, we have seen several in our recent drives between

Exhibit 5. Truck Tail-ends To Boost Performance



Source: Scania

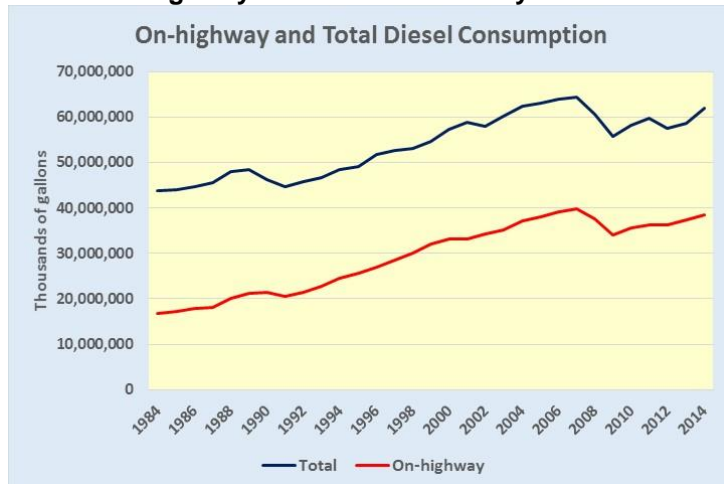
We have seen increasing numbers of trailers sporting wind deflectors

Houston and Rhode Island. We assume the trucking company is experimenting with the technology. As a result, we would not be surprised to see more of them on trucks in the future, much as we have seen increasing numbers of trailers sporting wind deflectors mounted at the bottom of the unit. These wind deflectors, much like the upturned wing-tips on most jet planes, improve the fuel efficiency of the unit.

On-highway diesel fuel consumption represented slightly over 62% of total distillate fuel consumption in 2014

With respect to the United States, as shown in Exhibit 6, on-highway diesel fuel consumption represented slightly over 62% of total distillate fuel consumption in 2014, the latest year for which annual data is available. As a result, if the trucking industry makes any appreciable fuel savings by adopting autonomous technology, it would be noticed in U.S. oil use. The same would be true in Europe, so there are many economic fallouts from autonomous driving technology.

Exhibit 6. Highway Diesel Use Is Primary Market For Diesel



Source: EIA, PPHB

The new topic being opened by efforts such as Otto and the platooning demonstration in Europe is the impact on fuel and labor

Improved fuel savings from autonomous technology could eventually account for upwards of 200,000 barrels a day in savings

costs within the trucking industry. In the United States, trucks drive 5.6% of all vehicle miles and are responsible for 9.5% of highway fatalities, according to Department of Transportation data. Because heavy-duty trucks have a significantly lower fuel-efficiency performance, they account for a larger share of diesel fuel consumption than diesel cars or other types of equipment. Because diesel fuel is included in distillates, we cannot determine the exact weekly volumes. However, we know that for the week ending May 20, distillate volumes of slightly over 4 million barrels a day represented 20% of total fuel supplied in the U.S. By examining the latest inventory data, distillates are broken down by the amount of sulfur in the fuel. Diesel fuel for vehicle use needs to be low sulfur – 15 parts per million or less. That fuel category accounted for 88% of all the distillate in storage, therefore we would think this is a reasonably close approximation of the highway quality diesel fuel being supplied to the U.S. market. If 62% is used by over-the-highway trucks, then the daily consumption is approximately 2.2 million barrels. Improved fuel savings from autonomous technology could eventually account for upwards of 200,000 barrels a day in savings.

The largest impact of the technology, however, may be on the employment of truck drivers

Autonomous vehicle technology is being hailed as a way to reduce the number of accidents. The largest impact of the technology, however, may be on the employment of truck drivers. There are more than three million truck drivers in this country. According to the American Trucking Associations, the truck industry accounts for one of every 15 jobs in the United States. By eliminating the need for second drivers on many trucks due to the ability of the primary driver to fulfill his rest obligations while the truck drives itself, there will be a negative employment impact from autonomous technology.

While younger drivers enjoy the first and last miles of truck driving, they wish to avoid the boring portion, which autonomous technology would eliminate

Although perceived as a negative, autonomous technology might actually become a positive as the trucking industry deals with an aging workforce and a less-than-attractive employment career as long-haul driving can be tedious and keeps drivers away from home for extended time periods. While younger drivers enjoy the first and last miles of truck driving, they wish to avoid the boring portion, which autonomous technology would eliminate. In the U.S., according to consultant Oliver Wyman, by 2023 it is projected that there will be shortfall of 240,000 drivers, or approximately 8% of the estimated current number of truck drivers.

Canada has a similar employment outlook for its highway trucking industry

Canada has a similar employment outlook for its highway trucking industry. According to the Canadian Trucking Alliance there are about 300,000 long-haul truck drivers. Similarly, the Canadian Trucking Alliance estimates that the Canadian industry will have a shortfall of 48,000 drivers by 2024 — about 15 per cent of the total driving force – due to an aging workforce and a less-attractive employment career.

“Right now, if you want to drive across Texas with nobody at the wheel, you’re 100 percent legal”

Another impact of autonomous technology for trucks is that vehicles can be kept on the highway for more hours per day. That could not only reduce the need for additional drivers, but it could also reduce the cost for transporting goods, further contributing to deflationary forces in the economy.

All of these considerations influenced our previous article’s conclusion that autonomous trucks were more likely to be on the roads before autonomous cars. That may be why Mr. Levandowski left Google. He said that his decision to leave was motivated by being eager to commercialize a self-driving vehicle as quickly as possible. At Google, he was responsible for drafting legislation to permit self-driving vehicles, which ultimately became law in Nevada. While certain states such as California have motor vehicle regulations that would prohibit the idea of trucks traveling on the freeway with only a sleeping driver in the cab, other states currently do allow it. “Right now, if you want to drive across Texas with nobody at the wheel, you’re 100 percent legal,” said Mr. Levandowski. Stay tuned for self-driving trucks on a freeway near you.

Oil Flirts With \$50 Price Tag But Rally May Be Ending

The fact that the oil price traded above \$50 is a positive

From the February 11th low of \$26.19 a barrel, oil prices have been on a virtual straight line incline to \$50 a barrel. For other observers, the failure of crude oil to close above \$50 a barrel price is a sign of growing price weakness. The fact that the oil price traded above \$50 is a positive as it puts the price back close to its price at the beginning of November 2015. That is a long time ago in the world of

Exhibit 7. Will Oil Price Recovery Continue Or Retreat?



Source: *Big Charts*

Technical analysis is at its best when fundamentals support the price action

The strength in oil prices has been driven largely by U.S. data showing a nearly 800,000-barrels-a-day fall in domestic output – much sharper than originally anticipated

trading commodities. What we noticed is that if one draws a line connecting the three spikes in prices during August through November 2015, it reaches to a price of about \$51.50 now, suggesting that there still needs to be more upside before oil prices experience a technical breakout.

It is important to note that there are many technical analysts who use various measures to gauge where they believe oil prices are going next. Technical analysis is at its best when fundamentals support the price action. So it becomes important to examine what is behind the sharp rise in oil prices.

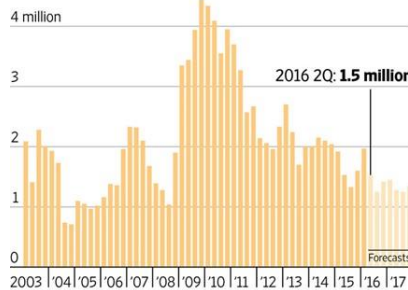
The strength in oil prices has been driven largely by U.S. data showing a nearly 800,000-barrels-a-day fall in domestic output – much sharper than originally anticipated. That decline confirms what happens to shale wells as they age – they experience very sharp production declines. At the same time, the International Energy Agency has revised upward their estimate for global oil consumption, although they have not increased their full-year 2016 demand estimate. Falling supply and rising demand are a good recipe for higher oil prices.

Exhibit 8. Production Outages Help Support Oil Price Rise

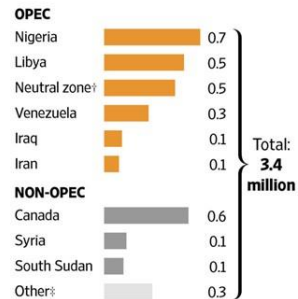
Little to Spare

The Organization of the Petroleum Exporting Countries' ability to respond when oil supplies fall has dwindled in recent years.

OPEC's spare crude oil-production capacity
Millions of barrels a day, quarterly data



Oil-production outages for May 2016*
Millions of barrels a day



*Numbers may not add up due to rounding †Neutral zone: An area between the borders of Saudi Arabia and Kuwait
‡Includes Colombia, Ghana, Italy, North Sea and Yemen
Sources: Energy Information Administration (capacity); Energy Aspects (outages)

Source: *The Wall Street Journal*

THE WALL STREET JOURNAL.

The unanticipated production outages in Nigeria and Libya have offset the more rapid growth in Iranian oil exports

Of particular help, both psychologically and physically, has been the increase in OPEC production outages along with the forced shutting-in of Canada oil sands output due to the forest fires surrounding Fort McMurray. The unanticipated production outages in Nigeria and Libya have offset the more rapid growth in Iranian oil exports, which have already returned to volumes shipped immediately prior to the imposition of western sanctions on the country. At the same time, expectations are that the political problems in Venezuela and Brazil will eventually impact the oil output from these two countries, placing further upward pressure on global oil prices. As long as the world

"In our business, the dirty little secret is you can't really spend within cash flow and grow production"

economy, and especially China, does not experience an economic slowdown or recession, undercutting demand, oil prices are heading higher. How high?

If \$50 a barrel is not high enough to stimulate producers to begin drilling or at least completing some of their "drilled but uncompleted" wells, then oil prices will have to move higher in search of the price point that does stimulate the "animal spirits" in oil men. That price point may be higher than many currently expect if the comments of Tom Ward, CEO of Tapstone Energy and former co-founder of Chesapeake Energy Corp. (CHK-NYSE), are correct. He recently told anchors on CNBC that "In our business, the dirty little secret is you can't really spend within cash flow and grow production." If that business model is to prevail once again, then commercial banks will need to be ready to loan money to producers and debt and equity markets will have to be open to a wide range of oil and gas producers, in terms of quality. While the capital markets are open, they have largely been restricted to companies in solid financial positions. Although a few recent capital market transactions have been done by lower-quality producers to shore up their balance sheets in the form of equity-for-debt swaps or debt-for-debt swaps – there doesn't appear to be an unsatisfied hunger by investors for low quality paper. Commercial banks are still focused on sorting out the damage to their existing energy loan portfolios from the downturn, making it unlikely they will be ready to embrace energy loans soon.

Producers will have to earn their investment funds the old fashioned way – they will have to earn it through higher commodity prices and/or more efficient operations

Therefore, we believe it is unlikely we will go back to the business environment when investors threw money at producers in order to encourage them to grow reserves and output regardless of cost. If the funds are not available, producers will have to earn their investment funds the old fashioned way – they will have to earn it through higher commodity prices and/or more efficient operations. We doubt there is another significant step down in producer finding and development costs, as much of those reductions have come on the back of the oilfield service industry, which is slowly liquidating. Be prepared for higher than expected oil prices in the near-term, but then possibly lower prices after that as the efficiencies adopted in recent times work their way through the industry's cost structure.

El Niño Over; What Comes Next Will Impact Nat Gas Market

The warm weather caused the industry to exit winter with nearly 2.5 trillion cubic feet of gas in storage

Natural gas prices remain in the doldrums as a result of the warm winter due to the strongest El Niño weather event in decades that reduced demand at the same time producers failed to curtail output leading to bloated inventories. Due to the strong growth in natural gas output, the industry entered last year's winter withdrawal season with nearly four trillion cubic feet of gas in storage. The warm weather caused the industry to exit winter with nearly 2.5 trillion cubic feet of gas in storage, meaning we burned barely 1.5 trillion cubic feet of gas to heat our homes and generate our electricity. That was the least amount of gas consumed in a winter, matching

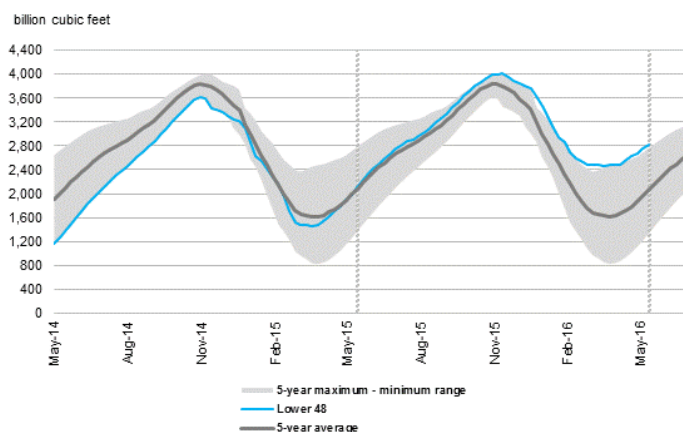
As we approached the start of the 2015-2016 winter, gas storage volumes reached the top of the 5-year range and have remained there

almost exactly the volume used during the 2005 winter. Importantly, this low volume of gas consumption compared to 2005 happened at the same time the U.S. is using more gas to generate electricity.

The problem for the natural gas industry is shown in the Energy Information Administration's (EIA) latest chart of weekly storage data. The chart in Exhibit 9 shows gas storage volumes for the past two years. The chart shows current storage volumes compared to the most recent 5-year average and the 5-year maximum and minimum gas storage volumes. As shown, gas in storage was at the 5-year minimum in 2014, but rose to the middle of that range by early 2015. As we approached the start of the 2015-2016 winter, gas storage volumes reached the top of the 5-year range and have remained there. Such a high level of gas in storage explains the sub-\$2 per thousand cubic foot price.

Exhibit 9. Natural Gas In Storage Above 5-Year High

Working gas in underground storage compared with the 5-year maximum and minimum



Source: U. S. Energy Information Administration

Source: EIA

The industry produced slightly over 92 billion cubic feet of gas per day in February 2016, up 1% from January 2016 and 2.6% higher than a year ago

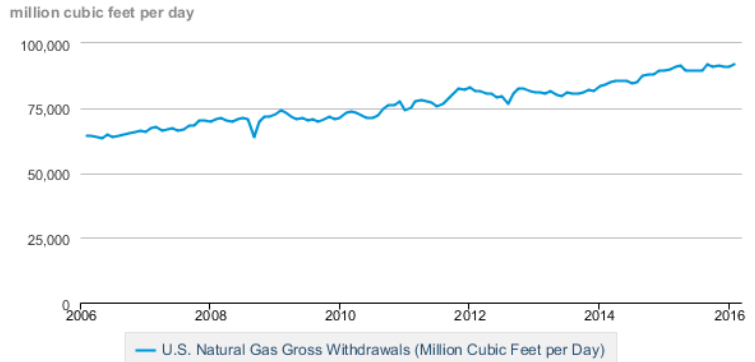
What could change that picture? First would be a decline in natural gas output. According to the EIA's data, the industry produced slightly over 92 billion cubic feet of gas per day in February 2016, up 1% from January 2016 and 2.6% higher than a year ago. Second, an increase in gas demand could alter the current picture. That would require a warmer than normal summer, boosting the air conditioning load met by generating greater amounts of electricity from natural gas, or a colder than normal winter, too.

We can expect "well-above average" warmth throughout the nation from June to August

According to the National Oceanic and Atmospheric Administration's (NOAA) Climate Prediction Center, we can expect "well-above average" warmth throughout the nation from June to August. The warmth will be concentrated in New England, the West Coast, Hawaii and Alaska. According to NOAA, the probability of this greater warmth ranks in the top third of the historical average of probabilities. The highest warmth chances are in the West and

Exhibit 10. Natural Gas Output Continues To Rise

U.S. natural gas production (gross withdrawals)



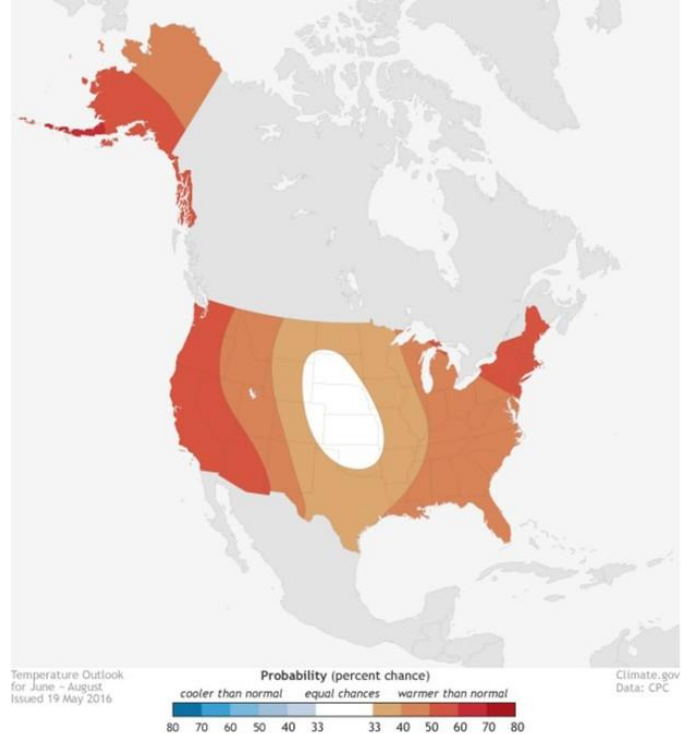
Source: U.S. Energy Information Administration

Source: EIA

The lowest probability is in the center of the nation

Northeast with 50-60% probabilities - the deep red areas displayed on the map in Exhibit 11. The lowest probability is in the center of the nation. For the Great Plains, it means the odds of “well-above average” temperatures are the same as the odds of “near-average” or “well-below average” temperatures are the same at 33% each.

Exhibit 11. Where Odds Are Highest For Hot Summer



Source: NOAA

There is speculation that the ending of El Niño will enable the formation of La Niña

This analysis raised a question in our minds of whether the ending of El Niño, as officially declared by the Bureau of Meteorology in Australia. The Bureau was the first to identify the emergence of El Niño a year ago. There is speculation that the ending of El Niño will enable the formation of La Niña. The Bureau reports that six of its eight models suggest La Niña is likely to form during the austral winter from June to August. If that happens, it likely will bring cooler temperatures and greater moisture for most of the United States, not good news for gas demand this summer.

Exhibit 12. Expected Weather Impact From La Niña



Source: NOAA

For North America’s winter, Alaska through western Canada and into the Plains region of the United States usually experience much colder temperatures

The following two charts show how La Niña impacts the world’s climate during the respective summer and winter months of the year. For North America’s winter, Alaska through western Canada and into the Plains region of the United States usually experience much colder temperatures, but it doesn’t hit the more populous areas of the country. The map also shows that the southern tier of the U.S. and northern Mexico are usually warmer. That pattern reminds us of a past winter when the weather and temperatures in Calgary were so bitterly cold and snowy for so long that many Calgarians sought relief by going to Southern California, the Desert Southwest or Mexico. Could the 2016-2017 winter bring a repeat of the past?

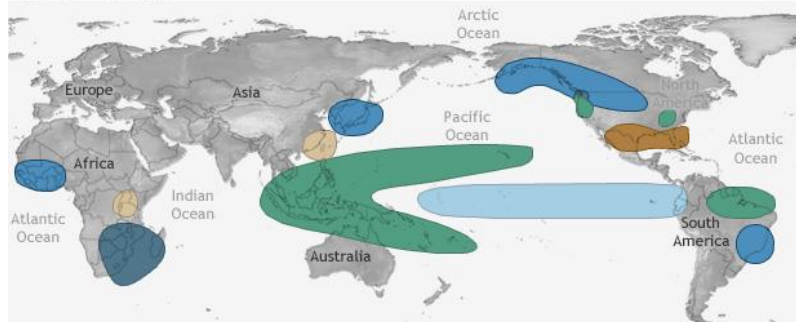
Is there a linkage between El Niño events and La Niña?

Based on a chart of sea surface temperatures spanning 1986 through 2016, we see the extreme warmth associated with significant El Niño weather events as well as the cool waters associated with La Niña. Given the dramatically different impacts on weather and temperatures, a critical question becomes: Is there a linkage between El Niño events and La Niña? If there is, then we

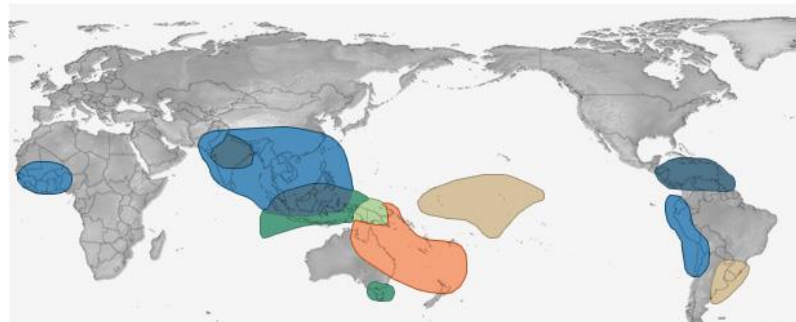
Exhibit 13. La Niña Impact On World Weather

LA NIÑA CLIMATE IMPACTS

December-February



June-August



NOAA Climate.gov

Source: NOAA

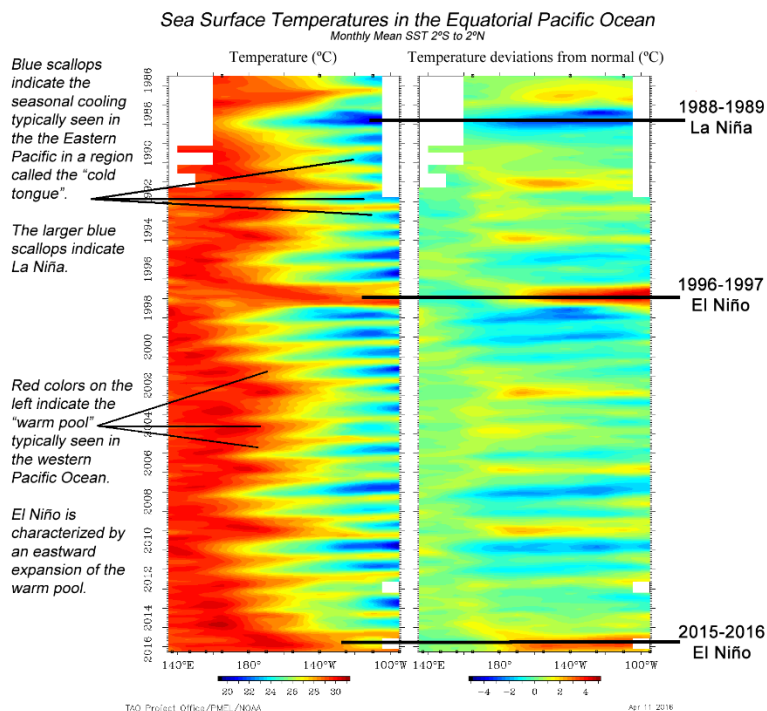
might expect to be heading into a colder phase that could boost energy demand this winter, helping natural gas consumption.

There does not appear to be a strong linkage of a cold winter immediately following an extremely warm winter

In examining the record of these two major weather forces, we find that the very strong 1982-1983 El Niño was followed by a weak La Niña. On the other hand, the strong El Niño experienced in 1997-1998 was followed by only a moderate La Niña. Based on the relative strengths associated with these weather events, there does not appear to be a strong linkage of a cold winter immediately following an extremely warm winter.

In looking at all the NOAA data for 1951-2016, we find that there were three strong El Niño events. One of them was followed by a strong La Niña, although another was followed by a weak one. The third El Niño found no La Niña associated with it during the following winter.

Exhibit 14. El Niño And La Niña Temperature Records



In the meantime, the path to higher natural gas prices will depend on a decline in output due to reservoir performance and the absence of new well drilling and completion

The absence of any clear pattern showing that a La Niña weather event follows a strong or very strong El Niño event means we will have to wait for the meteorologists to deliver their short-term weather forecasts to know if, and by how much, natural gas demand may be impacted by the winter temperatures. In the meantime, the path to higher natural gas prices will depend on a decline in output due to reservoir performance and the absence of new well drilling and completion. The Obama administration’s push for the closing of additional coal-fired power plants, which are likely being replaced by natural gas-fired plants, will help bolster demand growth. Without a hot summer, a recovery in natural gas prices will depend on a colder than normal winter in 2016.

New England Grapples With Its Future Electricity Supply

With opposition to the \$700 million power plant strong, it was not surprising that reporters noted opponents at the hearing outnumbered supporters by a 6-to-1 majority

On May 23rd, the third public hearing since March 31st was held dealing with the politically sensitive proposal for a natural gas power plant in Burrillville, Rhode Island, in the northwest corner of the state. With opposition to the \$700 million power plant strong, it was not surprising that reporters noted opponents at the hearing outnumbered supporters by a 6-to-1 majority. The 900+-megawatt power plant is to be built by Invenergy, a Chicago-based developer, owner, operator and manager of large-scale electricity generation assets. The company, on its web site, claims that its portfolio of

Invenergy says it is the largest independent wind power generation company in North America

electric generating projects includes more than 13,719 megawatts of wind, solar, natural gas and energy storage projects in advanced development, construction and operation in the United States, Canada and Europe:

Invenergy says it is the largest independent wind power generation company in North America. It is also focused on the development and long-term ownership and operation of solar photovoltaic projects for producing utility-scale electricity. The company has a portfolio of natural gas-fueled electric generating projects and its senior management team has more than 30 years of experience in the development, permitting, financing, construction and operation of combined heat and power generation facilities. Invenergy reports that it has more than 88 megawatts of energy storage projects in operation or construction.

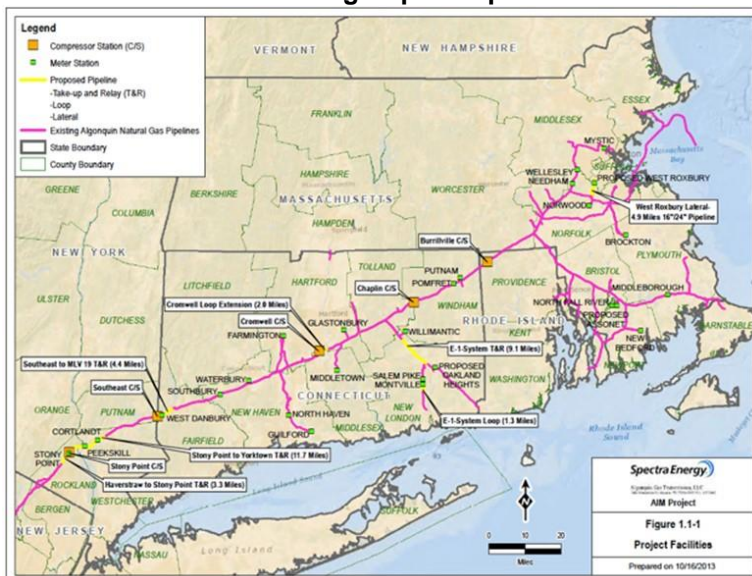
Due to pipeline capacity limitation in the region, it is impossible for local utilities to secure long-term supply contracts, something that would contribute to lower electricity costs

A key point about the proposed power plant is that the New England region, especially Rhode Island and Massachusetts, need additional electricity in light of several large coal-fired power plants in the region being shut down. The New England region is also losing the electricity output from the Vermont Yankee nuclear power plant. To meet the region's power needs, more natural gas-powered generating plants need to be constructed, but first the owners must be able to secure supplies of natural gas. Due to pipeline capacity limitation in the region, it is impossible for local utilities to secure long-term supply contracts, something that would contribute to lower electricity costs. During many winter months, the lack of gas and coal supplies forces utilities to burn oil to generate electricity. Many utilities are forced to buy natural gas supplies in the spot market, which during high demand periods is always much higher than long-term contract prices. In the winter of 2014 when the Polar Vortex descended on New England bringing bitter cold temperatures, natural gas prices exploded – rising six fold – as utilities clamored for more supply. As a result, natural gas pipeline operators sought to expand their pipelines into the region or build new lines in order to deliver more supply. Much of the new supply is destined to come from the prolific neighboring Marcellus formation in Pennsylvania, West Virginia and Ohio.

The supply expansion is designed to provide additional natural gas for power plants and home heating and is expected to be in service in November 2018, assuming it can receive the necessary permits

The proposed Invenergy power plant is to be located adjacent to an upgraded compressor station in Burrillville, Rhode Island that is owned by Spectra Energy Corporation's (SE-NYSE) Algonquin natural gas pipeline. Spectra Energy and its 50% partner, Northeast Utilities, now known as Eversource Energy (NU-NYSE), are in the process of expanding their Access Northeast project with a \$3 billion investment to increase the capacity of both the Algonquin and Maritimes pipeline systems by as much as one billion cubic feet per day. The supply expansion is designed to provide additional natural gas for power plants and home heating and is expected to be in service in November 2018, assuming it can receive the necessary permits.

Exhibit 15. The Planned Algonquin Expansion



Source: Spectra Energy

After 50 years of operation, the compressor station suddenly was identified as a source of noise pollution and the cause of other illnesses and environmental problems

The expansion of the Algonquin line, which necessitated upgrading the compressor station in Burrillville has created a firestorm of environmental opposition. After 50 years of operation, the compressor station suddenly was identified as a source of noise pollution and the cause of other illnesses and environmental problems. While the protests have had limited impact on the approval process for the Algonquin expansion, the January announcement of Invenergy’s plans for building a natural gas-fired power plant created a new catalyst for environmental opposition. The announcement of the plant was made by Rhode Island Governor Gina Raimondo and it gained the support of climate-change champion Senator Sheldon Whitehouse (RI-Dem). As the environmental opposition has increased and local opposition has grown, especially since the power plant plans to tap a source of contaminated water in Burrillville for cooling the turbines, the battle over the permit for the plant has escalated. The water was contaminated by a leaking gas tank and residents are concerned that use of this polluted water will cause health issues. In response to this issue, Sen. Whitehouse has reportedly altered his support for the power plant. Since both Sen. Whitehouse and Senator Jack Reed (RI-Dem) had their offices disrupted by environmental protestors fighting the Algonquin expansion earlier in the year, we wonder how much that protest influenced Sen. Whitehouse’s change of heart.

Political pressure is now building for Gov. Raimondo to change her position. Her latest comments about the power plant suggest she is wavering in response to the growing local opposition. Gov. Raimondo’s spokesperson Marie Aberger issued the following

“A large part of the Governor’s strategy is to adopt new solutions that will lead us to a cleaner, more reliable energy system in the future, including offshore wind and solar power”

The Act requires reductions from all sectors of the state’s economy to reach its target of a 25% reduction in greenhouse gas emissions by 2020 and an 80% reduction by 2050

In the press release issued at the time of the initial agreement, the utility company estimated that this contract alone would increase ratepayers’ monthly bills by 1-2%

statement: “The Governor and her team are closely monitoring the plans and listening to community feedback and concerns. We will be learning more about the health and environmental impacts of the plans as the Energy Facility Siting Board (EFSB) continues its review of the proposal, and reviewing those impacts carefully.

“At the same time, the Governor believes we need to take action to address our energy costs in the present for all Rhode Island families and businesses. A large part of the Governor’s strategy is to adopt new solutions that will lead us to a cleaner, more reliable energy system in the future, including offshore wind and solar power.” The EFSB is scheduled to hold two more hearings – one in June and another in September or October. A final decision is expected by February 2017. We wonder what a cold winter causing a spike in electricity rates will do to community opposition to the power plant.

In neighboring Massachusetts, the electricity debate is taking a slightly different course due to the state’s carbon emissions policy. In August 2008, Massachusetts enacted the Global Warming Solution Act that created a framework for reducing carbon emissions in an attempt to minimize the effects of global warming. The Act requires reductions from all sectors of the state’s economy to reach its target of a 25% reduction in greenhouse gas emissions by 2020 and an 80% reduction by 2050.

From the time the Act was unveiled, environmentalists worked to block utility company efforts to import Canadian hydropower in order that the long-expected deluge of cheap, locally-produced wind energy could meet the state’s green energy requirements. This battle was a backdrop to the Cape Wind offshore wind farm project proposed for Nantucket Sound. Due to barriers erected in response to the environmental movement’s efforts to promote local clean energy resources – especially offshore wind – prevented the state’s utilities from buying renewable energy from outside Massachusetts. Consultants were employed to demonstrate to the public utility commission that by requiring the state’s utilities to buy local wind energy, all power prices would decline. This rationale was used to justify the payment of very high prices for offshore wind power. The first Cape Wind power purchase agreement for 50% of the wind farm’s output was signed in 2010 and called for an initial price of 18.7 cents per kilowatt-hour. The contract extended for 15 years and included a guaranteed 3.5% annual increase in the power price. In the press release issued at the time of the initial agreement, the utility company estimated that this contract alone would increase ratepayers’ monthly bills by 1-2%. This was important when one realizes that we are discussing only 50% of the electricity generated by 130 offshore wind turbines. To have such an impact on the monthly bill demonstrated how high the purchase price for offshore wind power was compared to the cost of electricity at that time.

The Massachusetts Supreme Judicial Court has issued a ruling holding the state to a strict reading of the 2020 goal

Since at least 2008, the Massachusetts utilities have promoted the development of wind and solar power as the solution to the CO₂ reduction mandate. The key technology promoted by the industry has been offshore wind because of its projected abundance plus the fact that it presents fewer social issues – siting problems, visual pollution, bird and bat kills. For this reason, everyone involved in the clean energy movement worked to get offshore wind projects moving while continuing to block Canadian hydropower. Now that the deadline for meeting the 25% carbon emissions goal is drawing near and the Massachusetts Supreme Judicial Court has issued a ruling holding the state to a strict reading of the 2020 goal, politicians are moving to hedge their bets on offshore wind by allowing Canadian hydropower into the market.

They are motivated by the view that the waters off Massachusetts are destined to become the “Saudi Arabia of wind”

Governor Charlie Baker (MA-Rep) is supporting legislation that would allow the state’s utilities to solicit large long-term contracts for Canadian hydropower. As the legislature is negotiating the bill, a contingent of politicians from the New Bedford area remains committed to carving out support for offshore wind, possibly including mandates for utilities to purchase that power. These politicians perceive offshore wind as the driver for a new industry for the New Bedford region, formerly the center of the whaling industry. They are motivated by the view that the waters off Massachusetts are destined to become the “Saudi Arabia of wind.”

Utilities must steadily increase the share of power they buy from the cleanest renewable energy sources, a category that includes wind but not large-scale Canadian hydropower

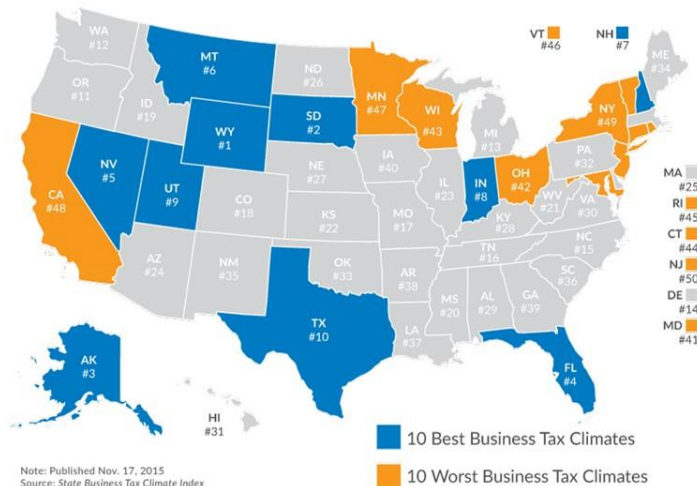
There remain powerful incentives in the existing law for utilities to purchase offshore wind – incentives that are not available to hydropower. Utilities must steadily increase the share of power they buy from the cleanest renewable energy sources, a category that includes wind but not large-scale Canadian hydropower. According to environmentalists, the escalating requirement will put increased pressure on utilities and make offshore wind more feasible. That logic implies that the mandate will drive the development of offshore wind regardless of what it costs because the failure to comply with the energy law would be too embarrassing, plus the requirement to comply with the law will become the justification for ramming high-cost power prices into the ratepayers’ bills.

As of February 2016, electricity costs for the New England region are the second highest (16.70 cents per kilowatt-hour) in the nation

It is interesting that neither conservation nor nuclear are considered options for meeting the carbon emissions reduction targets. Keeping greater amounts of low-cost natural gas out of the future power mix will ensure Massachusetts power consumers will pay higher rates. This has important implications for the state’s economy. As of February 2016, electricity costs for the New England region are the second highest (16.70 cents per kilowatt-hour) in the nation, trailing only the Pacific Non-contiguous region (20.66 cents per kilowatt-hour), composed of Alaska and Hawaii. Within New England, Massachusetts power cost (17.07 cents per kilowatt-hour) is second behind Connecticut’s and slightly ahead of Rhode Island’s.

Exhibit 16. Ranking Of Best And Worst State's For Business

2016 State Business Tax Climate Index



TAX FOUNDATION @TaxFoundation
Source: Tax Foundation

We would suggest that by adhering to their electricity supply policies, these states will continue to struggle to improve their economic performance, which is not good news for their residents

Power costs are an important indicator of the health of a state's economy. According to the 2015 ranking of the best states for business prepared by CNBC, Massachusetts was in 20th place, Connecticut in 33rd place and Rhode Island in 48th place. In terms of business tax environments, the rankings of these three states was similar – Massachusetts (25th), Connecticut (44th) and Rhode Island (45th). We would suggest that by adhering to their electricity supply policies, these states will continue to struggle to improve their economic performance, which is not good news for their residents.

A Sinking Florida Is Not A New Climate Change Phenomenon

The environmentalists have targeted South Florida as a symbol of the catastrophe we are about to experience as lapping waves often wet the streets of Miami

Environmentalists have been warning that one of the major impacts of global warming is the melting of the world's glaciers, which will result in rising sea levels threatening all low-lying cities and regions. In reality, this phenomenon has been ongoing for centuries as the Earth is currently caught in a global warming period. The environmentalists have targeted South Florida as a symbol of the catastrophe we are about to experience as lapping waves often wet the streets of Miami. Recently, a warning was issued in conjunction with a political attack on the presumptive Republican presidential nominee Donald Trump. The attack says that if he is elected president, given his views about climate change, South Florida is doomed to be overwhelmed by the rising oceans as glaciers melt due to global warming. Therefore, the attack ad encourages South Florida residents to leave the area and seek higher ground.

An interesting commentary about this issue of rising sea-levels comes with the publication of research into how Florida's first residents dealt with rising seas some 4,000 years ago

“One of the things that I did learn during my research is that environmental change on the coast is a normal part of life”

These islands were found to contain archaeological deposits from human settlements extending as far back as 4,000 years

Nowhere is there any mention of the possibility that some of South Florida's problems with rising sea levels is due to subsidence caused either by the pumping of subsurface water in the Florida peninsula and/or a slight tilting of the tectonic plate upon which North America sits. An interesting commentary about this issue of rising sea-levels comes with the publication of research into how Florida's first residents dealt with rising seas some 4,000 years ago. The investigation was conducted by a postdoctoral researcher at the Florida Museum of Natural History at the University of Florida and commenced in 2009.

Regional studies have suggested that sea levels began rising along the Gulf Coast following the Last Glacial Maximum, when the climate in the Northern Hemisphere began to substantially warm, and glaciers began to melt. The University of Florida researcher, Paulette McFadden, told *The Washington Post*, “One of the things that I did learn during my research is that environmental change on the coast is a normal part of life, or it certainly was for the people in the past. So I wanted to know: What kinds of strategies did they use when sea-level rise on the shoreline began to move inland?”

Exhibit 17. Sea Level Research In Big Bend Area



Source: *WOW.com*

Ms. McFadden's research focused on an area of Florida's Gulf Coast known as Horseshoe Cove, which is located in the Big Bend, the general region where the panhandle meets the peninsula. The area is marked by wide marshes, a network of tidal creeks and numerous small islands. These islands were found to contain archaeological deposits from human settlements extending as far back as 4,000 years. In order to reconstruct the region's coastal evolution over thousands of years, Ms. McFadden took sediment core samples from both exposed and submerged land along the coast and analyzed them to find out what kinds of materials they contained and how old they were. She also conducted archaeological excavations in the same region and used radiocarbon dating techniques to determine how old the human items she found were.

They tended to settle in areas bordering the marshes that were protected from flooding and storm surges

The reconstructed maps of Horseshoe Cove from 2800 BC to after 200 AD, using Ms. McFadden's data, show how the coastline – once dominated by land – gradually flooded and became characterized by salt marshes. The maps also showed that the locations where humans settled were dictated by the land available at the time. According to Ms. McFadden's research, the humans targeted very specific areas on the landscape when they were forced to move. In particular, they tended to settle in areas bordering the marshes that were protected from flooding and storm surges, but that also offered easy access to fishing and other marine resources.

"The modern coastline in the Big Bend region is largely shaped the way it is because people lived there in the past," said Ms. McFadden. "They piled up shell and they piled up debris in an area, and some of those islands that I did the archaeological work on only survived today because the elevation was increased by people living in them."

Scientists sometimes use data from one part of the world as a proxy for past sea-level rises all over the world, which may not be accurate

The research demonstrated that the study area has remained relatively stable over the past 1,500 years, however, the east coast of Florida shows rapid erosion. This significant difference in regions separated by approximately 100 miles demonstrates why this type of research needs to be conducted locally. As one of Ms. McFadden's supervisors, Neill Wallis, pointed out, scientists sometimes use data from one part of the world as a proxy for past sea-level rises all over the world, which may not be accurate. As he said, "Those don't really tell us always what happens in any particular location, because the sea level can rise globally and we might not see much change in one area. In that sense, I think all archaeological research that relates to climate change has to be done locally." This would seem to be one more inconvenient truth about climate change claims.

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