
MUSINGS FROM THE OIL PATCH

September 8, 2015

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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

China Concerns Create Energy And Stock Market Turbulence

The question is can the companies figure out what the new model requires in order to survive the downturn?

It is hard to image that anyone could ignore the stock market turbulence of the past two weeks, which was often matched by high levels of volatility in the crude oil market. A recent column by Leonid Bershidsky of *Bloomberg View* began with the following statement: "Now that Chinese industry is slowing down, countries that became dependent on its spectacular growth -- especially raw materials suppliers -- will need to adjust. In some cases, they'll have to reinvent their economies." What Mr. Bershidsky predicts is necessary for some nations is what almost every energy company is now undertaking. The question is can the companies figure out what the new model requires in order to survive the downturn? If companies can't determine the new model they are likely to succumb to financial destruction.

China is pointed to as the culprit for the sharp fall in global stock markets and the recent collapse in global crude oil prices

China is pointed to as the culprit for the sharp fall in global stock markets and the recent collapse in global crude oil prices. If we think about it, China could be substituted for Russia in Winston Churchill's quote from a radio broadcast in October 1939. Mr. Churchill said, "I cannot forecast to you the action of Russia. It is a riddle, wrapped in a mystery, inside an enigma; but perhaps there is a key. That key is Russian national interest." There can be no doubt that China's national interest drives its government policy.

Modern China's history commenced in the 1920s

The history of China under its dynastic leaderships was one of constant promotion of self-interest, whether that involved reaching out to the western world or totally withdrawing from interacting with the outside world. Modern China's history commenced in the 1920s when a farmer/school teacher, Mao Tse-tung, learned of the Russian Revolution and the rise of communism. He helped found the Chinese Communist Party, but decided to follow the course pioneered by Vladimir Lenin rather than Russian communism,

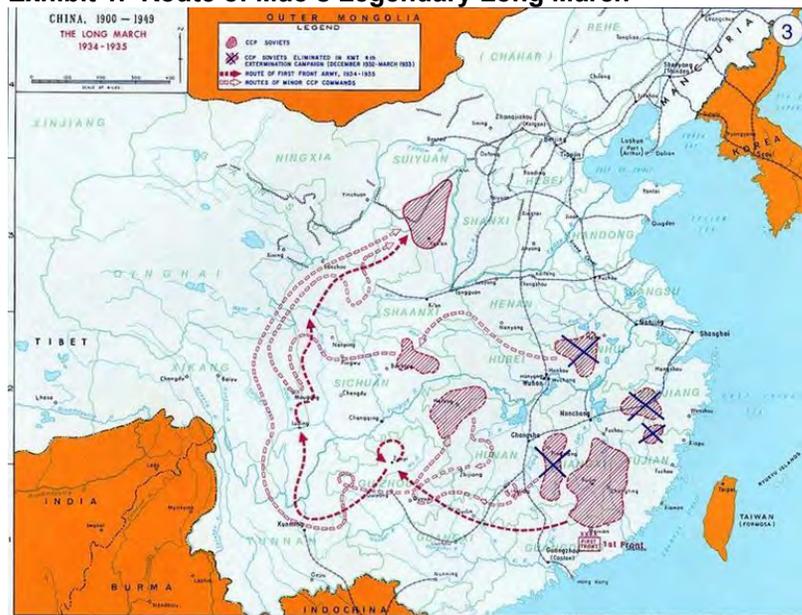
He solidified his power by torturing and executing any dissidents to his rule

From that point forward, China was governed by a ruling elite that was highly focused on controlling the economy and the nation's society

which meant focusing on the peasants in the countryside rather than the intellectuals in the cities. Mao mobilized the locals and led a peasant army against the Kuomintang, the official Chinese government, headed by Chiang Kai-shek who had succeeded China President Dr. Sun Yat-sen in 1925, but was defeated. Along with the remnants of his army, Mao fled to Jiangxi Province, where he reorganized. He helped establish the Soviet Republic of China in the mountainous area of Jiangxi and was elected chairman of the small republic. He then developed his army into a well-schooled guerilla force. He solidified his power by torturing and executing any dissidents to his rule.

Soon, Chiang Kai-shek, concerned about Mao's potential rivalry, moved troops to encircle Mao and his followers leaving them a single route out. Mao took that route and eventually led 100,000 followers on what is known as the "Long March," an 8,000 mile journey from Jiangxi Province to Suiyuan Province in northern China. While many of his followers walked the entire distance, Mao mostly was carried in litters. The description of the Long March and the battles supposedly fought along the way were mostly made up or enhanced. From the mid-1930s onward, Mao and the nationalists fought each other, but then allied to fight the invading Japanese until they were defeated at the end of World War II. Then Mao and the nationalists resumed fighting each other until the civil war ended in the late 1940s with Mao's victory. From that point onwards, China was governed by a ruling elite that was highly focused on controlling the economy and the nation's society.

Exhibit 1. Route of Mao's Legendary Long March



Source: *Wikimedia*

One aspect of the government’s operation of the economy is its control over information about its workings

In modern times, the Chinese leadership has worked hard to develop its economy to where it is ranked among the largest and most powerful in the world, depending on how the economy is valued. With the country’s huge labor force and its low wages/cost of living, China rapidly became the manufacturing center for the world. Now, the government is deep in transitioning from an industrial/manufacturing-based economy to one centered more on its consumers, of which there are hundreds of millions. One aspect of the government’s operation of the economy is its control over information about its workings. For years the Chinese economy grew at a very high rate – in excess of 10% per year – as it developed its industrial sector and infrastructure. After the Summer Olympics of 2008, China began the transformation into a consumer-driven economy. That shift meant that economic growth (GDP) slowed into the 7%-8% range. Because most outsiders found that they couldn’t trust the government’s statistics or that the statistics failed to accurately reflect what was happening in key sectors of the economy, they began focusing on basic economic data or constructing indices of activity to better capture what they felt was actually occurring in the country.

Exhibit 2. Growing China Economy Slowdown



Economist.com
Source: *Economist.com*

The government reported that growth in 2015’s first and second quarters was 7% in real terms

The most recent growth statistics for China reflect the economy’s slowing from the very high rates of a few years ago. The government reported that growth in 2015’s first and second quarters was 7% in real terms compared to the comparable quarters in 2014. However, the economy’s nominal growth rates were 5.8% and 7.1%, respectively, for the first and second quarters. The difference

The comparison between the first and second quarters makes more sense if one believes China was suffering deflation in its producing sector but a strengthening consumer sector

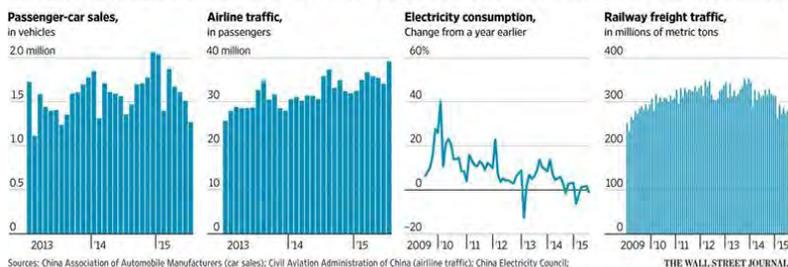
between the two rates implies that the GDP deflator, which measures price changes in the economy, was a negative 1.2% in the first quarter and a positive 0.1% in the second quarter. As pointed out by the *Financial Times*, these price changes create some difficulties for outside economists to fathom and suggest that the government is not manipulating the statistics outright but likely fudging them a little.

The -1.2% deflator in the first quarter suggests serious economic deflation, which doesn't seem to mesh with consumer prices that were reported to have risen 1% in the quarter. The comparison between the first and second quarters makes more sense if one believes China was suffering deflation in its producing sector but a strengthening consumer sector. One of the strange adjustments the government's statisticians made was the 0.1% reduction in the annual growth rate of the second quarter of 2014, which has the effect of lowering the base for comparing the growth in 2015's second quarter. Given these small manipulations of the data, economists and investors will continue to focus on other data series seeking better measures of the health of the Chinese economy. That means following data such as passenger car sales, airline traffic, electricity consumption and railway freight traffic.

Exhibit 3. Struggling To Read Health Of China

Looking to the Consumer

China's government sees big hopes in unlocking the buying power of its population, and some indicators of consumerism have bucked economic weakness.



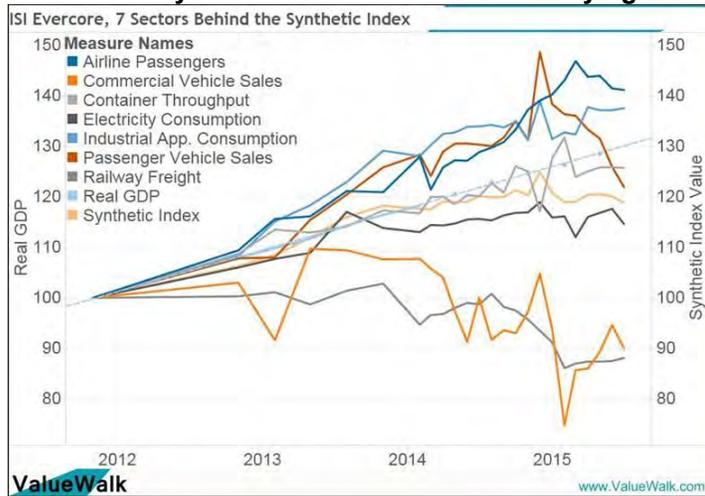
Sources: China Association of Automobile Manufacturers (car sales); Civil Aviation Administration of China (airline traffic); China Electricity Council; China Railway Corporation

Source: *The Wall Street Journal*

The synthetic growth index has been caused by deterioration in Commercial Vehicle Sales and Railway Freight volumes

One long-time China analyst is Donald Straszheim with the investment firm Evercore ISI. He has developed a synthetic growth index that is based on seven economic data series to try to measure Chinese GDP on a monthly basis. The seven measures and their contribution to the index and China's GDP trend are shown in Exhibit 4 on the next page. The chart shows the seven data series movements since 2012 along with the official Chinese GDP number and the Evercore ISI index through the second quarter of 2015. What the data series show is that the deterioration in the synthetic growth index has been caused by deterioration in Commercial Vehicle Sales and Railway Freight volumes. More recently, there was also a massive decline in Passenger Vehicle Sales.

Exhibit 4. Key Industrial Data Reflects Underlying Economy

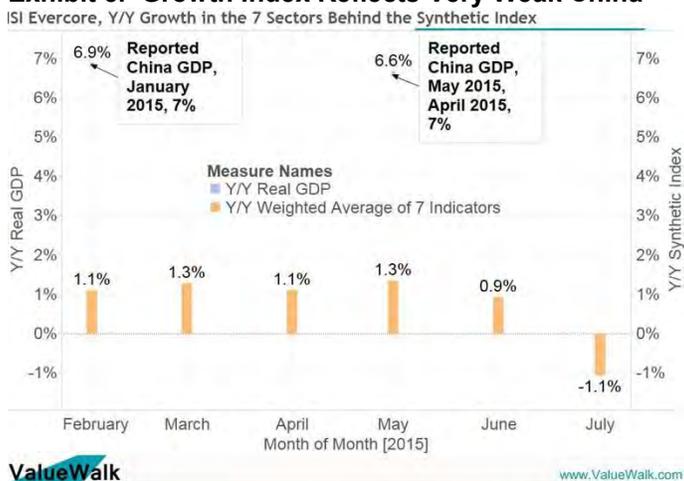


Source: ValueWalk.com

There is a significant gap between the monthly index values and the reported quarterly GDP figures

It is interesting to see how the performance of these data series have translated into monthly economic performance estimates for the past six months. Although Chinese GDP is reported quarterly, the monthly Evercore ISI index is able to give a picture of underlying economic activity and whether there are changes developing. The chart in Exhibit 5 shows the Evercore ISI synthetic growth index for February through July against the reported quarterly GDP estimates for the first and second quarter of 2015. As shown, there is a significant gap between the monthly index values and the reported quarterly GDP figures.

Exhibit 5. Growth Index Reflects Very Weak China

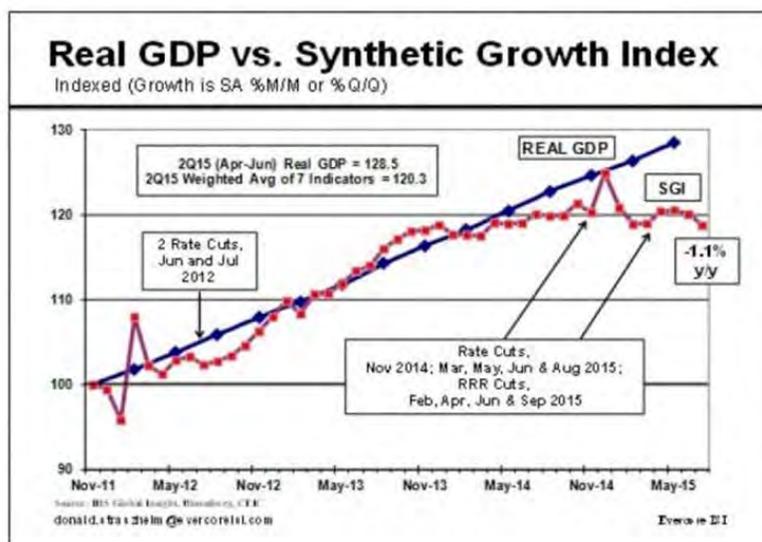


Source: ValueWalk.com

On the surface, government actions during periods where the Evercore ISI synthetic growth index was underperforming China's official GDP growth suggest that the official data was overstating the real performance of the Chinese economy

It is interesting to see how the Evercore ISI index has tracked against the official Chinese GDP measure. Although the index underperformed the official GDP number during most of 2012, as the notation on the chart shows, that period was marked by the Chinese government cutting bank interest rates in June and July of that year. The action by the Chinese would suggest that it acted in response to weaker than desired economic performance. The index then outperformed the GDP data during the summer and fall of 2013. But as the Chinese economy moved into 2014, the index was nearly flat and well below the GDP number. As the performance gap widened during 2014 and 2015, the government reacted with further rate cuts and bank reserve reductions – all actions designed to boost bank lending in hopes of promoting greater economic growth. On the surface, government actions during periods where the Evercore ISI synthetic growth index was underperforming China's official GDP growth suggest that the official data was overstating the real performance of the Chinese economy.

Exhibit 6. Growth Index Gives More Accurate China Read



Source: Zerohedge.com

China has now become the world's largest crude oil importer

For the energy business, understanding the health of the Chinese economy is important since it has now become the world's largest crude oil importer, surpassing the United States. According to Chinese customs data for the month of April China imported 7.4 million barrels per day (mmb/d). That topped the U.S.'s 7.2 mmb/d oil imports that month. The U.S. also routinely exports about 500,000 barrels per day, which has the impact of lowering the net amount of imported oil used in the United States to 6.7 mmb/d.

What the weak Chinese GDP data suggests is that the country's oil consumption will not be as strong as analysts and commodity traders have been assuming. Based on the April import data and

That volatility will eventually stop and crude oil prices will once again be influenced by fundamental trends of which the health of China's economy is an important one

the International Energy Agency's 2015 estimate of 93 mmb/d of global oil and liquids consumption, China's imports account for 8% of world consumption. What we know about the oil market in China is that the country has been buying more oil this year to fill its expanding strategic storage reserve. In addition, China has started up about 650,000 barrels per day of new refining capacity, all of which is exported. Therefore, year over year a large portion of the country's consumption increase is either going into storage or is being refined and exported; in other words, it is not for domestic consumption. While cutting back on refining volumes for export wouldn't seem to make much sense, reducing purchases of oil for storage, especially as oil prices stopped falling and began rising in late spring, does make sense. Then, if actual economic activity is weakening, there would be less need for oil. All in all, the facts suggest that China's use and purchases of oil are declining putting downward pressure on crude oil prices. The turmoil in the oil trading pits points more to the actions of commodity speculators unwinding their bearish bets on the trend in oil prices and less on China's oil purchases. That volatility will eventually stop and crude oil prices will once again be influenced by fundamental trends of which the health of China's economy is an important one. We will continue to report on the Evercore ISI synthetic growth index, but given its recent rise in media prominence, it may become a front page story.

Eni's Egypt Gas Find Further Scrambles LNG Market's Future

Eni called the field a "supergiant" gas field and claimed that it "could become one of the world's largest natural-gas finds"

Last week we were treated to a headline that Italian oil company Eni SpA (E-NYSE) has made a huge natural gas find off the coast of Egypt and will move quickly to delineate and develop the field. The field, located in the Mediterranean Sea at the company's Zohr prospect about 120 miles off the Egyptian coast in the Shorouk block, is estimated to contain potentially 30 trillion cubic feet of natural gas, or 5.5 billion barrels of oil equivalent. Eni called the field a "supergiant" gas field and claimed that it "could become one of the world's largest natural-gas finds." Eni expects to make a final investment decision about developing the field later this year, setting up development drilling in 2016 and 2017 with initial production on stream by 2018. This fast track is helped by the field's location allowing it to access neighboring production infrastructure.

"This historic discovery will be able to transform the energy scenario of Egypt"

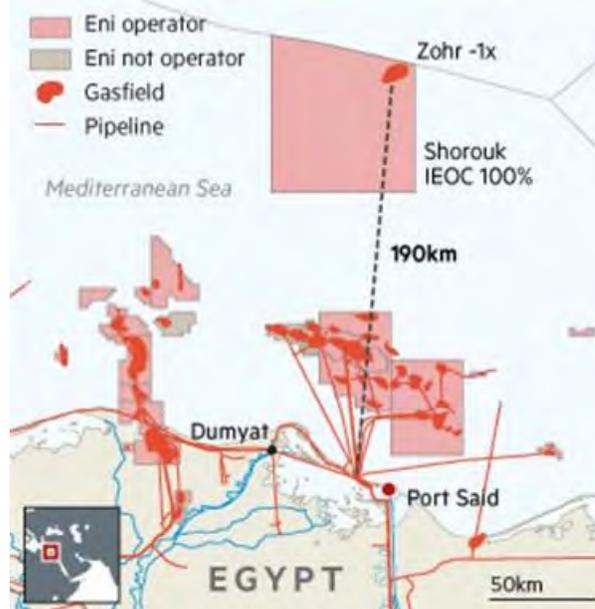
Claudio Descalzi, chief executive of Eni, discussed the results of the drilling with Egyptian president Abel Fattah Al-Sisi on Cairo a little over a week ago. Following the meeting, Mr. Descalzi said, "It's an exciting moment for us and also for Egypt. This historic discovery will be able to transform the energy scenario of Egypt." How might that be?

The Zohr discovery is located in a block that covers an area of 100 square kilometers (38.6 square miles) and is in 1,450 meters (4,800 feet) of water depth. Mr. Descalzi told the *Financial Times* that he

“Egypt can rely on this discovery for the next decade”

believes the field could contain as much as 40 Tcf of gas and oil that could be found with additional exploration. Since Eni controls the block 100%, it is likely that further exploration will be conducted given this recent discovery. He told the *Financial Times* that “Egypt can rely on this discovery for the next decade. They have found a very important supply for the future.”

Exhibit 7. Eni Gas Discovery Will Change Egypt



Source: *Financial Times*

Egypt’s gas output has been declining since 2011 as the revolution that ended Hosni Mubarak’s regime curtailed investments in exploration and production. With electricity demand, mostly generated by natural gas, growing by more than 7% a year, the most populous Arab country with 87 million people began buying liquefied natural gas (LNG) to meet domestic needs.

Before the revolution, Egypt shipped natural gas to Jordan and Israel by pipeline and processed LNG at plants in Idku and Damietta for sale overseas. According to the Energy Information Administration (EIA), Egypt is the second largest natural gas producer in Africa after Algeria.

Both of these potential deals are suddenly being reviewed in light of the Zohr discovery, which will change energy development in this region

In response to the declining natural gas output and growing gas demand, Egypt had been considering building a pipeline to a field off Cyprus as well as securing supplies from the giant Leviathan field offshore Israel. Both of these potential deals are suddenly being reviewed in light of the Zohr discovery, which will change energy development in this region of the Mediterranean Sea. The Egyptian government suggests the discovery will not upend those private company deals.

The Leviathan field is estimated to contain 22 Tcf of natural gas, putting it in the giant category, but the plan to use idled Egyptian LNG facilities owned by BG Group to export LNG will need to be reassessed

The Leviathan field is estimated to contain 22 Tcf of natural gas, putting it in the giant category, but the plan to use idled Egyptian LNG facilities owned by BG Group (BG-NYSE) to export LNG will need to be reassessed. The investors in the Leviathan field recently agreed to supply gas to Jordan, but that was expected to use the existing pipeline from Egypt. That deal may be subject to review given the potential for Egypt to be able to continue to supply Jordan from this new field. The Zohr discovery announcement came at the same time the Israeli Knesset was scheduled to debate the cabinet's decision to allow the Leviathan development to move forward. Members of the opposition party in the Knesset believe that the Leviathan deal is too lucrative for the investors and results in gas prices that are too high for Israeli consumers. A rejection of the Leviathan deal could force the owners of the field to reconsider its development, which has been delayed since its discovery in 2010, and pressure the Israeli government to strive for an agreement with more favorable prices for consumers.

Could this corner of the world become a new source of global natural gas supply?

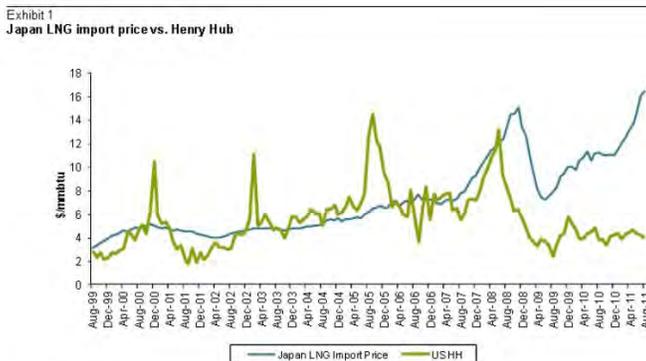
The interesting scenario to consider is what the Zohr discovery, coupled with the Cyprus and Israeli discoveries and the possibility that Egypt's economy might recover to the point that it can support more domestic exploration and development means for future gas discoveries? Could this corner of the world become a new source of global natural gas supply? If so, what might that mean down the road for the LNG market, which has been going through its own recalibration? These questions sent us to re-examine the current state of the LNG market.

The Great Recession ended the rise in LNG prices near the \$15/mmbtu level, sending them back into the \$6-\$8/mmbtu range

In our review, we went back and re-read some reports about the LNG market and its expectations from earlier periods, along with looking at the state of the current market. A 2006 report on LNG by the *Oil & Gas Journal* was focused on the amount of LNG that would be flowing into the U.S. and where that supply would come from. However, a report we found most relevant for contrasting today's situation was produced in November 2011 by Neil Beveridge of Bernstein Research. His report contained a chart on Japanese LNG prices compared to Henry Hub natural gas prices from late summer 1999 to 2011.

Japanese LNG import prices started at around \$3 per million British thermal units (mmbtu) in 1999 but quickly rose to above \$4/mmbtu in 2000 and stayed in the \$4-\$6/mmbtu range until 2005 when they began trading in the \$6-\$8/mmbtu range until 2008 at which point they soared, along with global crude oil prices, since LNG was priced off indices that were tied to oil prices. The Great Recession ended the rise in LNG prices near the \$15/mmbtu level, sending them back into the \$6-\$8/mmbtu range. The low price didn't last long as LNG prices followed global oil prices higher reaching the \$17/mmbtu level by late summer 2011.

Exhibit 8. Record Of Japan LNG Price And US Gas Prices



Source: Bloomberg

Source: **Bernstein Research**

“...this differential is not sustainable if market forces are allowed to operate”

The most interesting aspect of this chart is that following the Great Recession, while Japan’s LNG import price was climbing back to new highs, U.S. natural gas prices were falling due to the shale gas revolution’s success. What this produced was a scenario that Mr. Beveridge described thusly: “Over the last 12 months, however, the divergence in global gas prices has taken the differential between US and LNG prices to levels not seen before. With Henry Hub trading at less than \$4/mscf and LNG contract prices reaching over \$16/mscf in Japan, we are seeing a difference in price of over \$12/mscf which is equivalent to an oil equivalent price of US\$7/bbl. Given it costs less than \$1/mscf to ship gas from Canada to Japan and less than \$3/mscf to ship gas from the US Gulf Coast to Asia, this differential is not sustainable if market forces are allowed to operate.”

While LNG import prices remained very high early in 2014, the slid into the summer before jumping back up but then began dropping rapidly to below \$8/mmbtu by early 2015, where they remain today

Despite that view of the unsustainability of the differential between Japan’s LNG import prices and U.S. Henry Hub gas prices, this spread lasted until late in 2014. In late 2014, global oil prices collapsed under pressure from OPEC’s decision to continue pumping large oil volumes despite a growing global oil glut. These lower oil prices pulled down LNG prices linked to oil. In Exhibit 9 on the next page, we show the monthly contract and spot LNG prices for import into Japan between March 2014 and July 2015, as reported by METI. The zero monthly prices in the chart reflect months when METI did not report a price. While LNG import prices remained very high early in 2014, they slid into the summer before jumping back up but then began dropping rapidly to below \$8/mmbtu by early 2015, where they remain today.

Exhibit 9. Japan LNG Prices Went From High To Low



Source: METI, PPHB

These price declines have erased much of the arbitrage advantage owners of new LNG terminals

While the high LNG price in northern Asia – Japan and Korea – has fallen dramatically in recent months, landed LNG prices globally have also declined as global oil prices have fallen. These price declines, as highlighted by the chart in Exhibit 10, have erased much of the arbitrage advantage owners of new LNG terminals were hoping to capture when they filed for permits to build, or actually began construction of new LNG export terminals.

Exhibit 10. Non-No. American LNG Prices In \$6-\$8 Range

National Natural Gas Market Overview | World LNG Landed Prices

Federal Energy Regulatory Commission • Market Oversight • www.ferc.gov/oversight

World LNG Estimated June 2015 Landed Prices



Source: Waterborne Energy, Inc. Data in \$/USMMBtu. Landed prices are based on a netback calculation. Note: Includes information and data supplied by IHS Global Inc. and its affiliates ("IHS"). Copyright (publication year) all rights reserved.

Updated: August 2015

Source: FERC

The Bernstein report contained a chart showing LNG terminals in existence, under construction and planned globally as of late 2011. The chart actually understates the number of LNG export terminals in the United States.

Exhibit 11. Asia And Australia Locus Of New LNH Output

Exhibit 7
Location of LNG projects; current, in construction, likely and possible



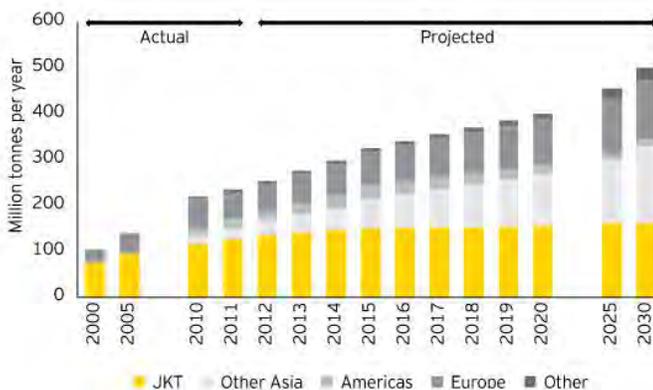
Source: Bernstein Analysis

Source: Bernstein Research

One area of concentration is Australia where huge offshore gas reserves and gas from coal fields are feeding into new LNG export terminals that when all are completed will position the country as the world's largest gas exporter, surpassing Qatar

One area of concentration is Australia where huge offshore gas reserves and gas from coal fields are feeding into new LNG export terminals that when all are completed will position the country as the world's largest gas exporter, surpassing Qatar. Virtually all of this gas has been targeting Asian markets, but with the slowing economies there and now the resumption of nuclear power plants in Japan, that may be smaller than previously anticipated. A report from consultant EY shows projected global LNG demand beginning in 2012 through 2030. While the demand from Japan and Korea was projected to grow, it rose very slowly. The more dramatic growth was projected to come from other Asian countries including China. Since this forecast, China and Russia have agreed to a deal to ship Siberian natural gas into the Chinese pipeline system reducing the need for China to buy as much LNG as originally planned.

Exhibit 12. Global LNG Demand Expected To Grow

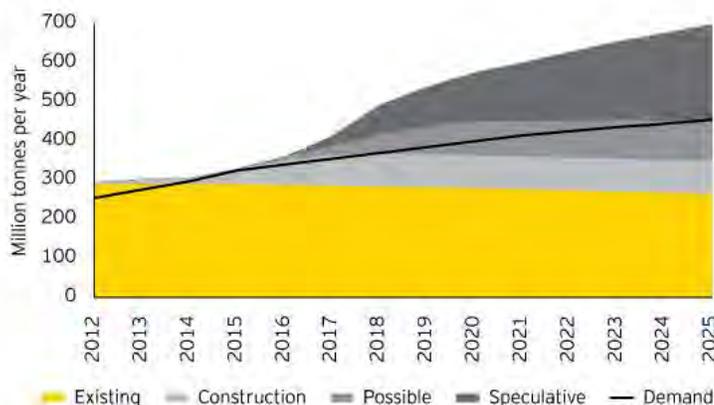


Source: EY

Even with the projected demand growth, the EY report shows that the planned construction of LNG export terminals globally would exceed demand beginning as early as 2015 but certainly by the end of the forecast period in 2025. At that point, all the speculative

liquefaction capacity as of 2011 would be surplus for meeting the world's gas needs.

Exhibit 13. Projected Global LNG Supply



Source: EY

As more natural gas supplies around the world become available and the technology to produce smaller natural gas deposits with movable liquefaction plants improves, it is difficult to see how LNG prices return to the lofty levels experienced in northern Asia in recent years

Given this picture of LNG supply and demand, one has to wonder what impact Eni's recent natural gas discovery off the coast of Egypt may have on the market. As more natural gas supplies around the world become available and the technology to produce smaller natural gas deposits with movable liquefaction plants improves, it is difficult to see how LNG prices return to the lofty levels experienced in northern Asia in recent years. Yes, LNG prices are likely to go higher over time, especially if the oil-linked pricing contracts remain in place and crude oil prices climb higher, but the rise is more likely to be tied to customer desires to lock up new large gas supplies at what are seen as reasonably attractive long-term levels, even if they are above spot market prices. In the same vein, it is highly likely we will see further development of a global natural gas spot market, something that has been largely restricted by the nature of the capital intensity of LNG liquefaction and regasification facilities and the ships necessary to move the gas from producing to consuming locations. All of these shifts will make the future LNG market more dynamic, but less predictable than in the past.

How Clean Energy Impacts Power Costs In New England

Invenergy plans to sign a contract with Spectra Energy to lock in capacity

Early in August, Rhode Island's governor, Gina Raimondo (Dem.), and Michael Polsky, president and founder of Clean River Energy Center, announced plans to construct a 900-megawatt natural gas-fired power plant in Burrville, Rhode Island, on property adjacent to the Algonquin pipeline that is planning to expand in order to handle additional capacity on the line. The plant, which is estimated to cost \$700 million, will be built by Chicago-based power operator Invenergy Corporation that will own Clean River Energy Center. Invenergy plans to sign a contract with Spectra Energy (SE-NYSE) to lock in capacity on its subsidiary Algonquin's pipeline, one of two

Only the local distribution companies (LDCs) that provide natural gas for home heating sign long-term supply capacity agreements in this region

major natural gas supply systems to New England. While this contract will obligate Invenergy to pay for expanding parts of the pipeline, it marks a major change for electric utilities in New England who normally operate on day-in-advance natural gas purchases. Only the local distribution companies (LDCs) that provide natural gas for home heating sign long-term supply capacity agreements in this region.

On the day of the announcement, two groups of protestors showed up – one representing environmentalists and the other construction workers

On the day of the announcement, two groups of protestors showed up – one representing environmentalists and the other construction workers. Reminiscent of the battles over the approval of the Keystone XL pipeline that is violently opposed by environmentalists who believe that the “dirty” oil sands output to be shipped in the line should be left in the ground in northern Canada to prevent further environmental damage to the planet. On the other side of the ledger are the pipeline construction workers who see the economic potential of Keystone XL by the creation of 40,000 jobs for the two years it will take to build the line.

Their belief is that a seismic shift is underway in domestic energy markets and this plant could become a stranded asset

As one would expect, the media interviewed leaders from each side and obtained the appropriate quotes highlighting the battle between environmental concerns and economic benefits, something certainly needed in Rhode Island where the state’s economy continues to struggle seven years after the 2008 financial crisis. Nearly a month after the plant’s announcement, an op-ed appeared in the *Providence Journal* authored by Dawn King, a lecturer in environmental studies at Brown University, and Jules Kortenhorst, the CEO of Rocky Mountain Institute, an environmental advocate. Their belief is that a seismic shift is underway in domestic energy markets and this plant could become a stranded asset. The first problem with the authors’ argument is that the state is not putting any money in the plant and it will be owned by a private company, so the management/shareholders are assuming the risk of it becoming a stranded asset. If they make a mistake in judgment, that is their problem.

They claim renewable power creates a greater number of permanent jobs for the money being invested

The authors claim this investment is wrong based on five criteria: jobs, price, lifespan, predictability and a livable future. They argue that the construction jobs will be gone in 30 months and the plant will only create 25 permanent jobs. In contrast, they claim renewable power creates a greater number of permanent jobs for the money being invested. That seems to depend on how one counts clean energy jobs, and their greater maintenance demands.

On the issue of price, they write, “Unlike volatile fossil fuel prices, solar and wind prices keep going down, while supply disruptions common to fossil fuels do not turn off the wind or sun and send prices spiking.” We guess they haven’t heard of night and cloudy days when solar doesn’t work, or hot days when the wind doesn’t blow. They claim wind power costs 3.25 cents per kilowatt-hour (kWh), but we know that is based on a 100% uptime assumption,

The cost of solar power has come down from \$60/watt in the 1970s to \$0.60/watt today

which is unrealistic. They also mentioned how solar power's cost is coming down. However, a few weeks later in the same paper, a feature story on a research team working on developing new crystals for solar film that would be cheaper and perform better than current crystals, pointed out that the cost of solar power has come down from \$60/watt in the 1970s to \$0.60/watt today. Later we will show that despite the decline in solar power costs, they are still not competitive with natural gas produced electricity.

In Texas, our electricity cost is \$0.054/kWh, which comes from a mix of power sources

To reflect on electricity costs in Rhode Island, residents are upset with the \$0.244/kWh cost for electricity to be provided by the Deepwater Wind offshore project. For a reference point, the cost of electricity in Rhode Island, provided by National Grid (NNG-NYSE) and based on my July bill, is \$0.104/kWh. That does not include the cost of delivering the power. In Texas, our electricity cost is \$0.054/kWh, which comes from a mix of power sources.

“However, with modern day weather forecasting, renewables’ output is proving predictable and manageable”

The writers are concerned that the power plant will limit the state to move forward on its environmental objectives. As they wrote, “...gas-fired power plants are built for 25-year lives; some stay online longer. This will stall our state’s efforts to wring fossil fuels out of our economy and meet state, regional and national climate commitments.” We guess the fact that the natural gas-powered plant will further cut the region’s emissions is a problem. The authors went on to address the issue of the performance of solar and wind. They wrote, “Solar and wind are often labeled as intermittent and unpredictable, while gas could provide ‘base load’ power to fill the gaps when it’s cloudy and calm. However, with modern day weather forecasting, renewables’ output is proving predictable and manageable.” We guess the writers haven’t reviewed the 2015 report of ISO New England, the organization that oversees the functioning of the region’s electricity system.

“The region is now experiencing wholesale electricity price volatility because the markets are signaling that investment in energy infrastructure...”

In that report, Gordon van Welie, President and CEO, wrote the following about the adequacy of the supply of natural gas in the region and its impact on electricity markets: “Natural gas supplies in the region have become insufficient to serve power generation needs during cold winter days. Rapid retirements of non-gas power plants are straining the grid’s ability to meet New England’s peak electricity demand and, coupled with the development of renewable resources, will continue to increase dependence on natural gas to produce electricity. The region is now experiencing wholesale electricity price volatility because the markets are signaling that investment in energy infrastructure is needed for the power system to continue to provide a reliable supply of competitively priced electricity through this transition.”

Later in the report, there was a section about the evolving grid and its increased reliance on renewables. The title of the section was: “The Hybrid Grid: Moving toward a Greener, More Distributed, Less Predictable, More Vulnerable Power System.” It would seem

Denmark also has the highest electricity cost in Western Europe followed by Germany, which is also on a mission to power its industry largely with renewables

that the use of the terminology “less predictable, more vulnerable” would seem to refute Ms. King’s and Mr. Kortenhorst’s contention that weather forecasting is so good that it overcomes the intermittent performance of wind and solar power.

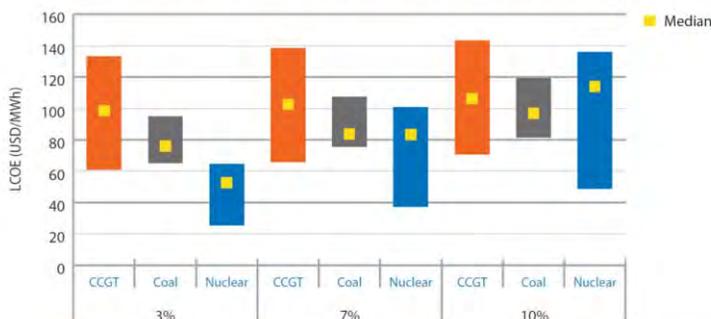
Lastly, the op-ed’s authors trot out the performance of Denmark’s renewable energy market without acknowledging the unique characteristics of that country and its power cost. Denmark is unique because it ships its excess power to Norway who then returns power to Denmark when it needs it. Rhode Island doesn’t have that luxury. Denmark also has the highest electricity cost in Western Europe followed by Germany, which is also on a mission to power its industry largely with renewables. So far the efforts have been devastating to German electricity consumers and its industries. The renewable power surges are also angering neighboring countries that have had their power grids harmed by the sudden surges of surplus power making it difficult for them to operate their own systems.

A new report by the International Energy Agency (IEA) and the Nuclear Energy Agency (NEA) shows the cost of conventional, nuclear and renewable power from actual projects being constructed in 18 countries around the world. Exhibits 14 and 15 show the conclusion of the analysis, which is based on the levelized lifetime costs for a broad set of generation technologies that are being built now and/ or planned for up to 2020. The analysis did not include grid integration and variability issues. The analysis utilized three discount rates – 3%, 7% and 10% - to estimate the final costs. The two charts show the range in costs and the median figure for each fuel.

Exhibit 14. Cost Of Conventional And Nuclear Power



**Overview of results –
conventional and nuclear technologies**



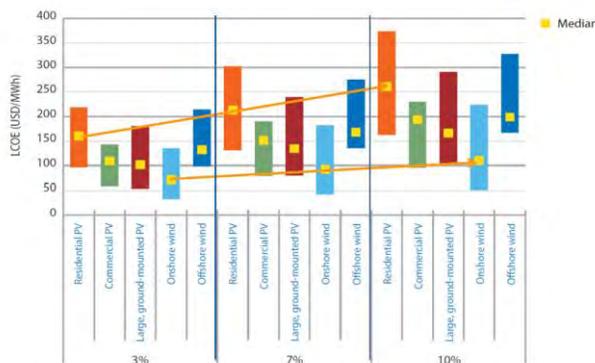
Note: Assumes region-specific fuel prices for US, Europe, Asia; 85% load factor; CO₂ price of 30 USD/tonne.

Source: IEA

Exhibit 15. Renewable Energy Cost Estimates



Overview of results – solar PV and wind



Source: IEA

Residential PV (solar) has a median value at a 3% discount rate that is 50% greater than that for combined-cycle natural gas

We suggest that readers examine the two charts and pay attention to the axis values. Residential PV (solar) has a median value at a 3% discount rate that is 50% greater than that for combined-cycle natural gas at the same discount rate. By not including the additional costs for grid integration and variability, (the cost of backup power for intermittent power sources) the renewables estimates are lower than they would be in actual operation.

Rhode Island needs additional natural gas supply in order to generate more electricity, especially during winter months when the utilities are often forced to rely on older and very expensive coal- and oil-fired power plants. The environmentalists who are fighting the pipeline expansion and now the new gas power plant should be more concerned with keeping those older plants off-line rather than inflicting higher costs and increased power delivery risk with their renewable push, especially when natural gas offers a viable alternative, both economically and environmentally.

Thoughts About Recent Readings and News:

Arctic or Bust:

in 1998 Shell became one of the first major oil companies to acknowledge climate change and the role of humans

A recent article in *Business Week*, titled “Arctic or Bust” focused on Royal Dutch Shell’s (RDS.A-NYSE) offshore drilling venture in the Arctic. The article was written at the time Shell began mobilizing rigs and equipment to the Arctic shortly before issuance of a drilling permit by the Obama administration, much to the consternation of environmentalists. In the article was a discussion of Shell’s history of using scenario planning, which we have followed with great

“Shell has convinced itself that renewable energy can’t grow fast enough to meet growing energy demand”

interest over the years. The article pointed out that due to its scenario planning, in 1998 Shell became one of the first major oil companies to acknowledge climate change and the role of humans. The company even moved to endorse the imposition of taxes on the burning of carbon-fuels. (Does anyone remember BP – Beyond Petroleum, or CEO Lee Raymond expounding on ExxonMobil being an oil and gas company?) After finding that other oil companies did not follow in advocating for a carbon tax, nor did governments such as China and the U.S. support such a move, Shell began downplaying the concept.

The most telling point in the article was the comment about global energy from Dave McCormick, a 30-year Shell employee who worked on the Scenarios team from 2002-2009. He was quoted saying, “Shell has convinced itself that renewable energy can’t grow fast enough to meet growing energy demand.” Therefore, in Shell’s view, it has no choice but to focus on how best to deliver energy supplies for society. As he put it, it is “the responsibility of oil and gas companies to meet that demand in as reasonable a way that they can.” As for Shell’s exploration in the Arctic, as Mr. McCormick put it, “It’s society that is demanding this energy.” Environmentalists refuse to acknowledge that fossil fuels have done more for society’s well-being than it has hurt due to emissions.

Who’s Drilling And Who’s Not?

The article contained information and discussion about various sized oil companies and their actions

We were intrigued by a chart accompanying an article in *The Wall Street Journal* focused on how oil producers are working to reduce costs. The article contained information and discussion about various sized oil companies and their actions including selling licenses, cancelling exploration drilling plans and delaying projects. The chart, reproduced in Exhibit 16, shows the number of exploration wells drilled worldwide by company type. The time period covered began in 2011 and includes the wells drilled and those planned to be drilled as it relates to 2015. While we don’t know the exact number of wells each year, it is clear that for 2011-2014, the industry drilled slightly over 1,200 wells to as possibly as many as 1,350 wells in a given year.

We found the following points interesting: 1) the total of exploration wells declined steadily from 2011 to 2013; 2) the number of wells drilled in 2014 surged by at least 10%; 3) national oil companies drilled or will drill only half the number of exploratory wells they drilled in 2014, which was at the end of gradual slide in wells these oil companies drilled in prior years; and 4) it looks like almost all the other oil company categories reduced their drilling by about the same percentage.

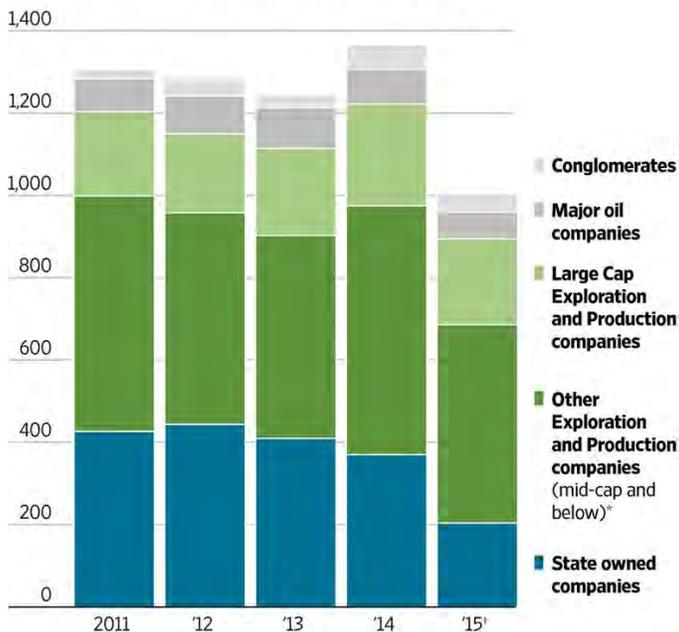
The interesting thing is that exploration drilling in 2011-2014 was conducted during a period when global oil prices were extremely

high. In fact, the greatest number of exploratory wells drilled was in 2014 as oil prices peaked in June and began declining. Some of that drilling probably was planned in earlier years, something we

Exhibit 16. 2015 Exploratory Drilling Falling Sharply

Drilling Decline

Number of exploration wells drilled, by type of company



*Includes private companies †Drilled and planned

Source: 1Derrick

THE WALL STREET JOURNAL.

Source: *The Wall Street Journal*

The decline in drilling in 2015 as suggested by the data in the chart certainly explains why no oilfield service sectors have escaped the damage caused by low oil prices

can't tell from the data in the chart, but it makes the fall in drilling this year worse than had the falloff occurred against the total of 2013 wells drilled. It will be interesting to see whether the 2015 total of exploration wells drilled matches the current estimate. The decline in drilling in 2015 as suggested by the data in the chart certainly explains why no oilfield service sectors have escaped the damage caused by low oil prices.

The study examined in detail the coal used as fuel in China

Study Shows China's Emissions Lower

The New York Times carried an article about a study published in the peer-reviewed journal *Nature* that concluded that the level of emissions reported for China was too high. The study examined in detail the coal used as fuel in China, finding that it is generally less rich in carbon and is burned less efficiently than scientists have assumed. These conclusions mean that for each ton of coal burned in China there is less carbon dioxide released. There is also less

The new estimate is 14% lower than the emissions reported by other studies

energy produced and more coal ash generated than previously assumed.

The study determined that China produced 9.1 billion metric tons of carbon dioxide from fossil fuels and cement production. The new estimate is 14% lower than the emissions reported by other studies. The study also found that China's energy consumption was about 10% higher for 2000-2012 than assumed. The key conclusions from this study are that China may not be as much of a polluter as assumed, so it may not need to give up as much as everyone currently believes in order to secure a global climate change agreement this December. The study also raises legitimate questions about the measurement of emissions from other countries, even though overall global emissions are measured independently.

The key point in the article was the following: "The researchers found that, on average, each lump of coal in China was 40 percent less potent as a source of carbon dioxide emissions than the default figure used for coal by the United Nations' scientific panel on climate change." So maybe there is chink in the UN's climate manifesto.

Rhode Island's Clean Energy Economy And Financial Reality

The lack of job growth is cited by many economists and policy makers as the primary reason why the state's youths leave for jobs elsewhere once they complete their education

Last Tuesday's edition of *The Providence Journal* carried an article trumpeting the fact that Rhode Island's clean energy economy is now supporting 10,000 jobs. More importantly, the article boasted that the clean economy was adding jobs at a much faster rate than the rest of the state's economy, something heralded as significant for the future of Rhode Island. Job growth has been a significant problem for Rhode Island since the "Great Recession" of 2008-2009. The lack of job growth is cited by many economists and policy makers as the primary reason why the state's youths leave for jobs elsewhere once they complete their education. The paper's article was based on data from the "2015 Rhode Island Clean Energy Jobs Report" provided by the Executive Office of Commerce and the Rhode Island Office of Energy Resources. While this is the inaugural report by these organizations, it was prepared by BW Research Partnership, and based on surveys and interviews.

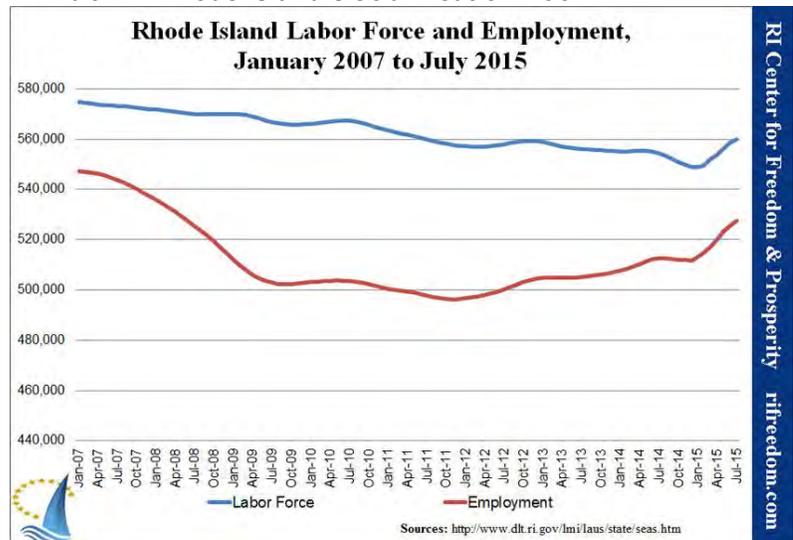
Currently, clean energy employers support 2.1% of all jobs in Rhode Island

The report found that as of the end of the first quarter of 2015, Rhode Island's clean energy economy supported 9,832 jobs at 1,295 businesses. The employment number was considered remarkable since 40% of the firms identified as part of the clean energy sector only began providing these services within the last five years. This economic sector added 613 jobs over the last 12 months, growing at a 6.6% rate between 2014 and 2015, or a rate 3.6 times faster than the state's overall employment growth rate of 1.8%. Projections based on the survey's results suggest that the clean energy sector will add 1,600 jobs in the next 12 months. Currently, clean energy employers support 2.1% of all jobs in Rhode Island.

There are several regional economists who are puzzled by the recent rapid employment growth in Rhode Island as it is outpacing the rate of overall job growth throughout New England

The timing of this report with its conclusions is interesting when taken in the context of the overall employment record of Rhode Island as shown in Exhibit 17. Once the initial job growth recovery following the 2008-2009 recession failed to continue in the spring of 2010, job growth fell until the end of 2011. At that point, the state’s employment began a slow and undulating recovery until the fall of 2014 when it then began falling again. Since the start of 2015, both job growth and the overall labor force began growing. Interestingly, there are several regional economists who are puzzled by the recent rapid employment growth in Rhode Island as it is outpacing the rate of overall job growth throughout New England.

Exhibit 17. Rhode Island’s Job Creation Poor



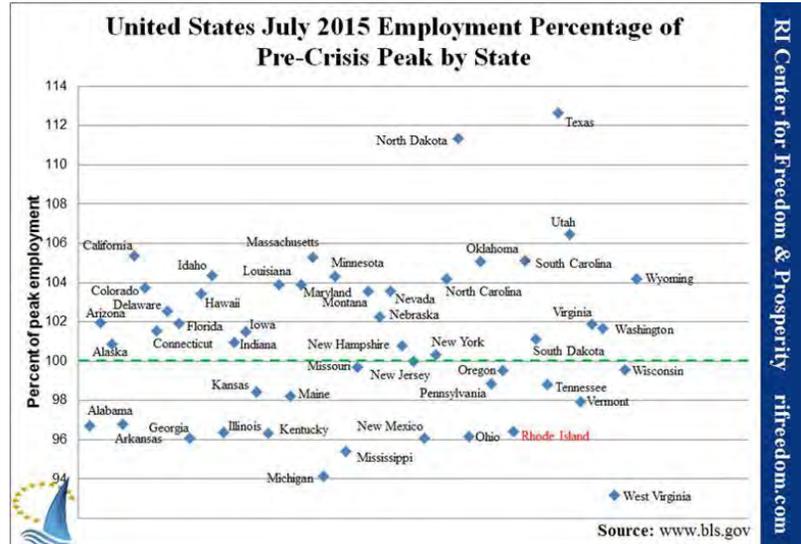
Source: *The Ocean State Current*

The worst job creating economy was West Virginia, but that is not surprising given the Obama administration’s war on the coal industry, which is the state’s primary employer

To put the state of Rhode Island’s employment growth in perspective, the chart in Exhibit 18 on the next page shows how each state’s July 2015 employment compares with its 2008-2009 pre-crisis peak employment. The worst job creating economy was West Virginia, but that is not surprising given the Obama administration’s war on the coal industry, which is the state’s primary employer. Michigan and Mississippi were the next worst state economies, while Rhode Island, at a little over 96% of its past peak, is in a group of states including Alabama, Arkansas, Georgia, Illinois, Kentucky, New Mexico and Ohio. Topping the state employment performance were the two states most impacted by the shale oil and gas revolution – Texas and North Dakota.

The report pointed out that the health of the clean energy sector was dependent on government policy and continued recovery for the Rhode Island economy. More than half of Rhode Island’s clean energy workers (52.5%) were employed in energy efficiency related jobs, with 27.3% involved in renewable and efficient heating and

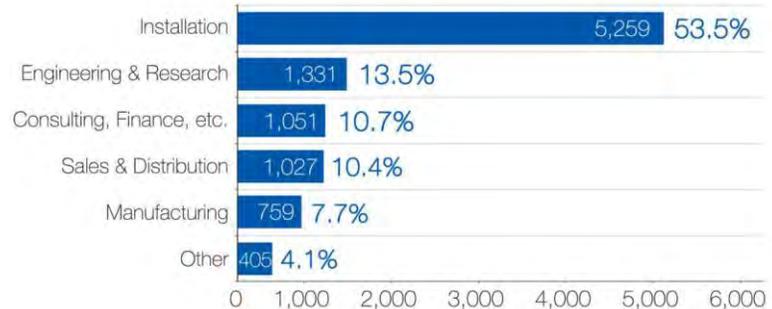
Exhibit 18. Rhode Island’s Job Performance Has Been Poor



Source: *The Ocean State Current*

cooling, and 11% working in renewable energy electric power generation. The remaining 9.2% of workers is divided among other small sectors. The report highlighted the nature of clean energy employment among small and young firms and that this puts some of these jobs at risk if proper economic and regulatory policies are not adopted by the state.

Exhibit 19. Energy Retrofit Dominates Clean Energy



Source: EOC & RIORP

The energy efficiency and building envelope sector employs 5,163 Rhode Island workers, or 52.5% of the clean energy workforce

Nearly 5,300 Rhode Island employees work in renewable and efficient energy installations, representing 53.5% of the state’s clean energy workforce. Interestingly, energy efficiency retrofits comprise the bulk of the state’s clean energy industry. The energy efficiency and building envelope sector employs 5,163 Rhode Island workers, or 52.5% of the clean energy workforce. Some 27.3% of total clean energy employment is found at businesses whose primary service is delivering “renewable and efficient heating and cooling.” We found these statistics both interesting and troubling given that we reported in our last *Musings* on recent studies of the performance of energy

The benefits are determined by the “avoided costs” work done by a consulting firm whose model was utilized by various New England states several years ago to support their green energy mandates

efficiency retrofits showing that the promises of the economic gains were 2.5 times greater than the actual savings. In fact, many of the people who paid for these retrofits actually will never recover the cost of the upgrades.

Rhode Island’s energy efficiency program, as developed by National Grid under the specifics of a master plan of the state’s Public Utility Commission, is supposed to have a benefit/cost of 2.45 for electricity and 1.94 for natural gas. That means for each \$1 of cost, an electricity participant should receive \$2.45 in benefits, while it would be \$1.94 for each natural gas participant. The benefit/cost performance is supposed to be measured by National Grid through studies of usage, surveys, site visits, consultant reports, etc. The benefits are determined by the “avoided costs” work done by a consulting firm whose model was utilized by various New England states several years ago to support their green energy mandates.

Financial incentives for consumers would best accelerate the adoption of clean energy goods and services

So what is critical for the clean energy sector’s continued success? Nearly three-quarters (71.7%) of clean energy businesses reported that financial incentives for consumers would best accelerate the adoption of clean energy goods and services. At the same time, 22.1% of businesses added that a lack of consumer incentives is currently the greatest barrier to their growth.

Financial incentives are rated the most important factor, which is not surprising, but nearly 9% of respondents stated that regulatory changes were also important

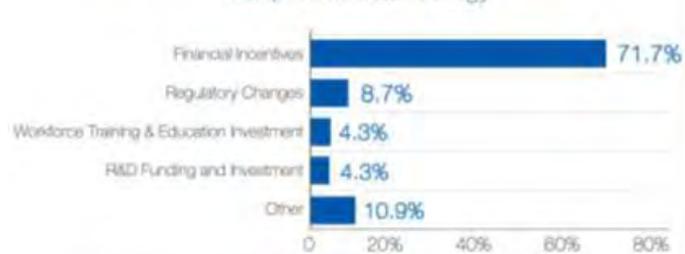
The report’s conclusions point out why policies such as solar and wind electricity incentives have been and remain important to the success of the clean energy industry. Exhibit 20 on the next page shows a table from the clean energy report showing which policy or program, based on the survey, would have the greatest impact on the adoption of clean energy. Financial incentives are rated the most important factor, which is not surprising, but nearly 9% of respondents stated that regulatory changes were also important. Since the questionnaire was not included in the report, it is difficult to assess what regulatory changes might have been considered. This question leads to another aspect of Rhode Island’s clean energy industry – revamping the regulatory process to promote specific clean energy projects.

FERC, rather than taking action, however, directed Mr. Riggs to file a complaint in court

Recently, a lawsuit was launched against the Deepwater Wind farm being constructed off the Block Island coast. The lawsuit was mandated by the actions of the Federal Energy Regulatory Commission (FERC). A Rhode Island resident, Ben Riggs, previously filed two separate complaints with FERC asking it to intervene in the approval of the Deepwater Power Purchase Agreement, which he believed did not comply with the state’s regulatory system and federal law. The state Public Utilities Commission, National Grid (NNG-NYSE) the purchaser of the power, and Deepwater Wind all filed multiple motions to have Mr. Riggs’ complaint dismissed. They were unsuccessful. FERC, rather than taking action, however, directed Mr. Riggs to file a complaint in court. This is not the first time this particular issue has been raised

in federal courts. In 2014, federal court decisions in both New Jersey and Maryland declared that this kind of power purchase agreement is illegal, and those decisions were upheld by two separate appeals courts.

Exhibit 20. Financial Incentives Key To Green Energy
Policy or Program that Would Have "Greatest Impact" on Adoption of Clean Energy



Source: EOC & RIORP

According to National Grid, the excess, above-market cost to ratepayers will be about \$497 million over 20 years

Obviously, a ruling against the agreement will force the parties to have to negotiate another agreement, which will likely reduce the price of electricity to ratepayers

As pointed out in an op-ed authored by the executive director of the Rhode Island Manufacturers Association, which is supporting the lawsuit, the high cost of offshore wind power will hurt the global competitiveness of manufacturers, especially those based in New England where electricity costs are among the highest in the nation. Deepwater Wind's power will cost 24.4 cents per kilowatt-hour, or four to five times that of natural gas and other renewable energy sources, plus it will enjoy an annual 3.5% escalation. According to National Grid, the excess, above-market cost to ratepayers will be about \$497 million over 20 years and that figure does not include investment tax credits, the cost for the oversize power cable from Block Island to shore, and other project costs.

With the Deepwater Wind project nearly half completed, it will be interesting to see whether the federal court rules that this power purchase agreement is illegal as the courts did with the other agreements. Obviously, a ruling against the agreement will force the parties to have to negotiate another agreement, which will likely reduce the price of electricity to ratepayers. Any reduction in power costs, and possibly the annual escalation factor, will impact the returns earned by Deepwater Wind and its owner, the D.E. Shaw hedge fund. It will be interesting to see if such a decision is reached, and what the impact will be on other U.S. offshore wind projects? Could Deepwater Wind be "one and done?"

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