
MUSINGS FROM THE OIL PATCH

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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

New Year's Greetings:

This *Musings* issue is shorter than usual as will be the next one due to the holiday season and our travels that have limited both our research capabilities and our writing time. As you read this issue, we will be sailing around Antarctica observing the ice and the native penguins and whales. By mid-January we anticipate being back to writing our standard *Musings*. Happy New Year!

Why The Natural Gas Supply Debate Is Important

Saudi strategy is creating substantial turmoil within the energy business and among the leaders of many governments around the world

Most of the energy world has been focused on answering the question of where the crude oil price decline this year may bottom out and what its impact may be on future oil supplies, oil demand growth and activity levels for the oilfield service industry in the coming year. We have been reading all sorts of articles discussing and speculating on why Saudi Arabia staked out a position of sustaining its global oil market share at the expense of lower crude oil prices. By not agreeing to cut its oil output, at least until all non-OPEC producers had agreed to reduce theirs, the Saudi strategy is creating substantial turmoil within the energy business and among the leaders of many governments around the world.

Saudi Arabia's no-output-cut strategy is designed to inflict significant pain on America's shale producers

Most of these articles focus on the role North America's shale production has played in altering the global oil market and that Saudi Arabia's no-output-cut strategy is designed to inflict significant pain on America's shale producers in order to restore "economic discipline" to them. The entire topic of global oil production and energy strategy is worthy of numerous articles, and we will have more to say about it later, but today we are more fascinated with the growing debate over the large discrepancies among several important forecasts for future natural gas production in the United States.

Our conclusion was that the BEG forecast, which was lower than the EIA forecast calls into question the assumed bright future for U.S. gas exports

While these exports would generate profits for the companies, keep energy employees employed and provide favorable trade benefits for the United States, domestic natural gas prices would remain historically low

The Nature article compared and contrasted the methodologies employed by the EIA and BEG in producing their forecasts

As we have written about in several recent *Musings* articles, a Texas Bureau of Economic Geology (BEG), in conjunction with the University of Texas at Austin, study about potential natural gas production from the four principle shale basins in the U.S. differs materially from a similar forecast prepared by the Energy Information Administration (EIA). We highlighted that difference in a mid-November *Musings*' article as we discussed a presentation by University of Texas at Austin Jackson School of Geosciences geology professor Dr. Scott Tinker and the current head of the BEG and its shale gas study team. In his presentation, Dr. Tinker showed a slide that compared the BEG production forecast against the EIA's prediction and one from the Rice University's natural gas model. As soon as we saw the slide flash on the screen, we were struck by the difference between the BEG and the EIA outlooks. Our conclusion was that the BEG forecast, which was lower than the EIA forecast calls into question the assumed bright future for U.S. gas exports.

The narrative from federal government energy agencies, the Obama administration and the natural gas industry has been that exporting gas in liquefied form (LNG) into the world gas market would allow companies to capture the difference between our low gas price and high LNG prices in consuming markets such as Europe and Asia. More importantly, while these exports would generate profits for the companies, keep energy employees employed and provide favorable trade benefits for the United States; domestic natural gas prices would remain historically low. Dr. Tinker's slide cast doubt that these benefits would accrue to the various players and suggested that U.S. residents could soon face much higher natural gas prices than forecasted by the federal government. The conclusion presented by an objective view of the slide was that there would not be sufficient gas supply at the EIA's projected low gas prices and that prices would have to rise substantially in order to incentivize producers to drill and develop greater supply. The future for gas markets would be considerably different from that envisioned as recently as three years ago.

Little did we know as we were publishing our article that a free-lance writer was authoring a paper that would be published in the scientific journal *Nature*, raising similar concerns about our future natural gas supply. The article was published December 1st and soon received significant mainstream media publicity both because it was published in a well-respected journal and that its title ("The Fracking Fallacy") and conclusions were shocking to those who have not been closely following the shale revolution and merely accepting the established narrative about abundant and cheap future natural gas volumes. The *Nature* article compared and contrasted the methodologies employed by the EIA and BEG in producing their forecasts. The conclusion of the author, Mason Inman, was that the BEG study employed greater granularity than did the EIA study and as such, he reasoned, its conclusions should be considered stronger – meaning the lower supply forecast carries greater weight.

Nature's editors have also replied, and are standing by the conclusions of Mr. Inman's article

The idea that this more detailed study is calling for lower gas output in the future than the government projects created a firestorm among some in the media and within the industry. The content of the *Nature* article and its implications motivated both the EIA and the BEG to respond by writing letters to the editor rebutting the article's conclusions and asking that their letters be printed or, in the case of the BEG that it be permitted to author its own editorial in response. While those letters haven't received much publicity yet, within certain energy analyst groups the agencies' claims generated interesting commentary. *Nature's* editors have also replied, and are standing by the conclusions of Mr. Inman's article.

The use of the Reference case as a forecast is, and has become, important for its role in the development of America's energy policy

We don't intend to discuss the EIA and BEG rebuttal claims other than to note that the EIA repeatedly claims that its scenarios are not forecasts, despite the fact that other governmental agencies and the energy industry utilizing the Reference case in their applications and/or policy determinations refer to that case as the EIA's forecast. The use of the Reference case as a forecast is, and has become, important for its role in the development of America's energy policy, for example, in relation to the Environmental Protection Agency's (EPA) new rules to cut carbon emissions from both new and existing power plants and the applications for building natural gas export facilities.

When Cheniere Energy (LNG-NYSE) applied for a permit to build a natural gas liquefaction plant it utilized reports from energy industry consultants Advanced Resources International, Inc. (ARI) and Navigant Consulting, Inc. (NCI), to evaluate the scope of natural gas resources in the United States and their potential for production along with an evaluation of the price impact of LNG exports on domestic natural gas prices. Quoting from the Sabine Pass Liquefaction Project Initial Draft Resource Report I, "Both the ARI Report and the NCI Report, as well as publically available information, indicate that the U.S. has significant natural gas resources available at prices that are sufficient to meet projected domestic needs here in the U.S."

All reports conclude that there are sufficient reserves present to allow exports while still meeting domestic gas consumption needs

The Cheniere application points to the May 2010 U.S. dry gas production figure of 59.3 billion cubic feet per day (Bcf/d), which was 1.69 Bcf/d higher than May 2009's volume. It also highlighted that the estimated gas resources in the United States, both proven and technically recoverable, based on data from the Potential Gas Committee of the Colorado School of Mines, the "Future of Natural Gas" report published by the Massachusetts Institute of Technology and the ARI Report all conclude that there are sufficient reserves present to allow exports while still meeting domestic gas consumption needs.

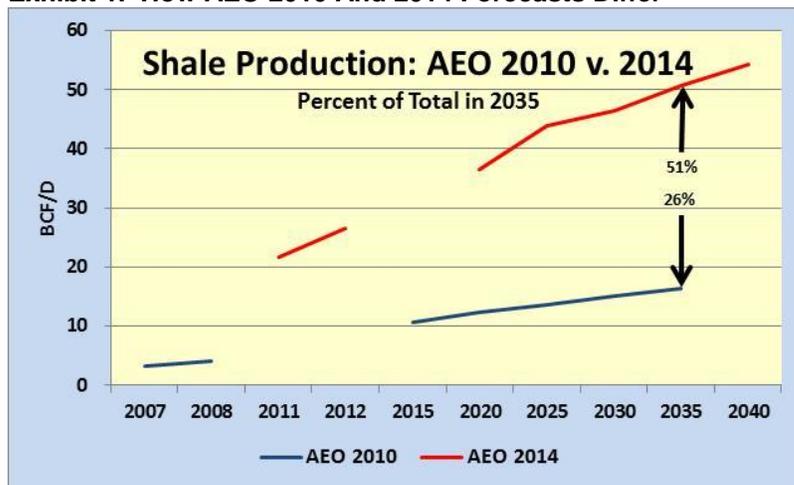
ARI employed its Technology Model for Unconventional Gas Supply "to re-assess the outlook for domestic unconventional gas productive capacity given the EIA's projected track for future U.S.

According to the AEO 2014 forecast, shale gas production by 2035 is projected to be nearly double the percentage of total U.S. gas production that was forecasted in the AEO 2010 forecast

natural gas prices.” The Cheniere application pointed out that “this substitution is appropriate given that EIA historically has underestimated the future contributions of unconventional gas, and particularly shale gas, to domestic markets. These underestimation issues remain a concern in EIA’s AEO 2010 forecast, which appears 4.5 Bcf/d too conservative in its estimate of current U.S. shale gas production.” One should note the ARI’s and Cheniere’s use of the term “AEO 2010 forecast,” which neither the Federal Energy Regulatory Commission (FERC) nor the Department of Energy (DoE) took issue with in their review and ultimate approval of the LNG export terminal permit.

The EIA’s rebuttal letter to the *Nature* article made the following statement. “We agree with *Nature* on some points, including that the rapid growth of shale gas production since 2007 was not anticipated in earlier projections by EIA or most others, that U.S. shale gas production in recent years has generally surprised to the upside, and that the outlook for future U.S. shale gas production is uncertain.” Exhibit 1 shows the difference between the EIA shale production forecasts made in their respective Reference cases for 2010 and 2014. As shown in the chart, each forecast provides two years of historical data along with the agency’s forecast, which in the case of AEO 2010 went to 2035 and for AEO 2014 went to 2040. According to the AEO 2014 forecast, shale gas production by 2035 is projected to be nearly double the percentage of total U.S. gas production that was forecasted in the AEO 2010 forecast. This difference clearly supports the EIA’s statement.

Exhibit 1. How AEO 2010 And 2014 Forecasts Differ



Source: EIA, PPHB

In the AEO 2010 report, the EIA discussed the potential for natural gas to play a greater role in the nation’s power generation business. Their statement is a precursor to the path taken by the Obama administration’s EPA to restrict the use of coal in the power

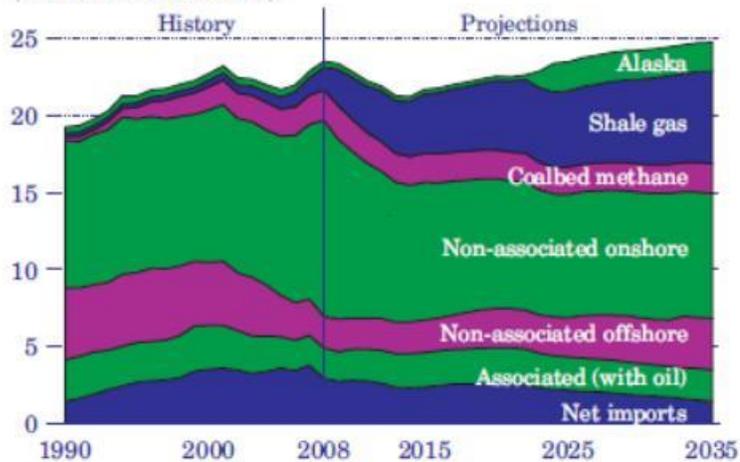
generation industry due to restrictions against carbon emissions associated with these power plants. The EIA wrote in AEO 2010: “There also are uncertainties about the potential role of natural gas in various sectors of the economy. In recent years, total natural gas use has been increasing, with a decline in the industrial sector more than offset by growing use for electricity generation. In the long run, the use of natural gas for electricity generation continues growing in the Reference case. However, over the next few years the combination of relatively slow growth in total demand for electricity, strong growth in generation from renewable sources, and the completion of a number of coal-fired power plants already under construction limits the potential for increased use of natural gas in the electric power sector. The near- to mid-term downturn could offset, of course, if policies were enacted that made the use of coal for electricity generation less attractive, if the recent growth in renewable electricity slowed, or if policies were enacted to make the use of natural gas in other sectors, such as transportation, more attractive.”

Shale gas was considered an important new source of gas supply back in 2010

The chart in Exhibit 2 shows the EIA’s outlook for domestic natural gas supply over its forecast period as contained in the AEO 2010. Shale gas was considered an important new source of gas supply back in 2010, but nowhere near as important as now projected.

Exhibit 2. AEO 2010 Forecast For Natural Gas Supplies

Figure 3. U.S. natural gas supply, 1990-2035 (trillion cubic feet)



Source: EIA

ARI estimated that the U.S. unconventional gas productive capacity would grow to 69.0 Bcf/d in 2035 from 36.3 Bcf/d in 2010

Due to concern over the EIA’s understating the amount of shale gas production that would be available, Cheniere and its consultants worked to modify the EIA’s AEO 2010 forecast to compensate. ARI estimated that the U.S. unconventional gas productive capacity would grow to 69.0 Bcf/d in 2035 from 36.3 Bcf/d in 2010. By utilizing this more optimistic outlook for shale gas production, ARI

The conclusions of the Drilling Deeper and BEG studies are closer to being correct, and both are meaningfully below the EIA's forecast

and BEG forecasts. He, too, performed an analysis of all the shale wells that have been drilled through 2013. The summary data in Exhibit 4 shows that, in his opinion, the conclusions of the Drilling Deeper and BEG studies are closer to being correct, and both are meaningfully below the EIA's forecast. If true, then the narrative of abundant supplies of cheap natural gas will prove false with significant ramifications for gas consumers.

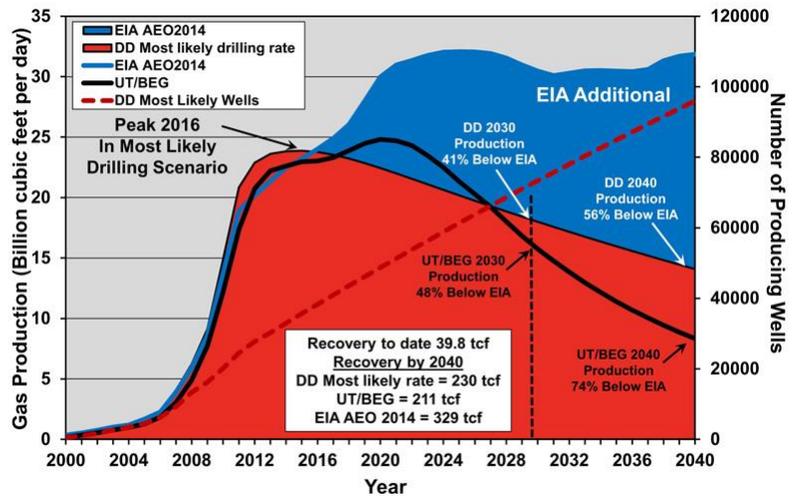
Exhibit 4. Three Views Of Gas Supply From Four Basins

TCF	Drilling Down ML Case	UT/BEG	EIA
Barnett	39	46	56
Fayetteville	23	19	42
Haynesville	39	46	103
Marcellus	130	100	129
TOTAL	230	211	329
PCT OF EIA	70%	64%	100%

Source: David Hughes

In contrast to the slide from Dr. Tinker's late October Houston presentation that compared the BEG, EIA and Rice University gas production forecasts, Mr. Hughes has presented a chart showing the EIA, BEG and Drilling Deeper study results (Exhibit 5).

Exhibit 5. Both BEG and DD Outlooks Below EIA's

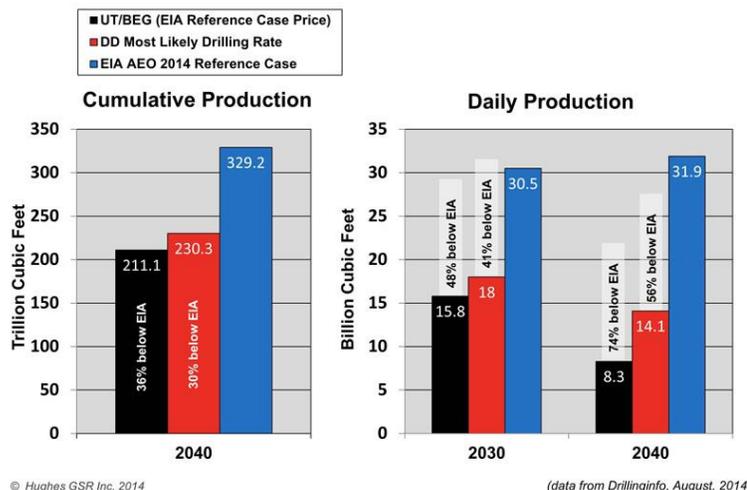


Source: David Hughes

A summary of the cumulative production through 2040, along with projections for daily output from the three studies in 2030 and 2040, is shown in Exhibit 6. The charts in both exhibits clearly demonstrate that there is a significant difference between the Drilling Deeper and BEG outlooks and that of the EIA. The one good

outcome from this chart is the projection by Mr. Hughes of the number of wells that will need to be drilled to support gas output, which should warm the hearts of contract drillers in North America.

Exhibit 6. Overly Optimistic EIA Gas Production Forecast



Source: David Hughes

The EPA’s carbon emissions restriction plan is built on four “building blocks” identified by the agency

While LNG exports represents one challenge from the potentially lower estimates for gas production, a greater problem may come from the EPA’s efforts to reduce carbon emissions by forcing the closure of much of the U.S.’s coal-fired electricity generation capacity. As pointed out by the Center for Climate and Energy Solutions’ analysis of the EPA’s carbon emissions restriction plan, it is built on four “building blocks” identified by the agency. They include:

1. Make fossil fuel power plants more efficient.
2. Use low-emitting natural gas combined cycle plants more where excess capacity is available.
3. Use more zero- and low-emitting power sources such as renewables and nuclear.
4. Reduce electricity demand by using electricity more efficiently.

The EIA states the case for the abundance of natural gas, which will enable the shutting down of a significant portion of our coal-fired power plants. As the agency states in AEO 2014, “Natural gas is an attractive fuel for new generating capacity. In some regions, natural gas-fired generation captures markets formerly supplied by coal-fired and nuclear plants, and by 2035 natural gas surpasses coal as

“If additional existing coal-fired and nuclear generating capacity were retired, natural gas-fired generation could grow more quickly to fill the void”

If the gas shortage proved even more severe, we would probably begin restarting coal-fired power plants, much like the UK is doing this winter at a significant cost

Not only would we have misallocated energy capital for decades, but we would have significantly altered the health of our public utility industry

the nation’s largest source of energy for electricity generation (including the power sector and end-use sector generation) in the Reference case.”

The EIA later makes the following point about its scenario in which there is even greater closures of coal-fired power plants, which was authored prior to the EPA’s introduction of its new carbon emission restriction plans for existing power plants. “If additional existing coal-fired and nuclear generating capacity were retired, natural gas-fired generation could grow more quickly to fill the void. In recent years, the number of coal and nuclear plant retirements has increased, in part due to a decline in profitability as low natural gas prices have influenced the relative economics of those facilities. The Accelerated Coal Retirements case assumes that both coal prices and coal plant operating costs are higher than in the Reference case, leading to additional coal plant retirements. In this case, natural gas-fired generation overtakes coal-fired generation in 2019, and by 2040 the natural gas share of total generation reaches 43%. In the Accelerated Coal and Nuclear Retirements case, the natural gas share of total generation in 2040 grows to 47%.”

What if there isn’t sufficient natural gas available, at least at reasonable costs? That would create a serious economic hardship on Americans and the American economy. We suspect one immediate remedy would be to ban the export of all LNG from this country. If possible, there could also be some restrictions imposed on gas exports to Canada and Mexico. If the gas shortage proved even more severe, we would probably begin restarting coal-fired power plants, much like the UK is doing this winter at a significant cost merely to ensure that the UK has sufficient power generating capacity available. What would that cost our economy both financially and in greater carbon emissions? Maybe by the time the gas shortages become severe, we will have addressed the storage challenge for intermittent renewable power sources. Building new nuclear power plants might become an option, but we know that they take years to be constructed so they are not a short-term solution. In either case, the EPA is counting on the EIA’s abundant gas supply scenario as it moves forward with power plant shutdowns.

While this debate over gas production forecasts may seem like a tempest in a teapot, its significance should not be understated. The impact on the future economic strength of the United States if insufficient gas resources are available cannot be underestimated. Not only would we have misallocated energy capital for decades, but we would have significantly altered the health of our public utility industry, possibly leaving it so weak it could not meet the needs of its customers, forcing the federal and state governments to have to bail out the industry. Maybe we need a “time out” before we rush to implement the EPA’s plan to restrict the carbon emissions for power plants to the degree that we force the retirement of much of our coal-fired generation capacity. Rest assured that the gas production

forecast debate, while seemingly academic at the moment, will become a much more serious and a more mainstream issue in the coming years.

President Obama And Keystone XL Pipeline – Minimal Impact

One of the softballs the President got to hit out of the park came from *The Washington Post's* Juliet Eilperin and dealt with what President Obama plans to do about possible Keystone XL pipeline legislation mandating its approval

One wonders what to believe of the comments about the Keystone XL pipeline made by President Barack Obama at his year-end press conference the Friday before Christmas as he prepared to jet off to Hawaii for a 17-day holiday vacation with his family. It turns out the press conference established a new record when the President only asked for questions from female reporters – eight questions in total. One of the softballs the President got to hit out of the park came from *The Washington Post's* Juliet Eilperin and dealt with what President Obama plans to do about possible Keystone XL pipeline legislation mandating its approval, which incoming-Senate Majority Leader Mitch McConnell has signaled will be the Republicans' first order of business when the new Congress commences business in January.

The President used the question possibly to signal to his environmental supporters that he would reject the permit application

With her question, Ms. Eilperin commented that President Obama has in past comments "minimized the benefits and you highlighted some of the risks associated with that project." The President used the question for an extensive discourse on the macroeconomics of the pipeline and possibly to signal to his environmental supporters that he would reject the permit application. Maybe, however, they should begin to worry that he will double-cross them as he has with other supporters of critical administrative policies.

A substantial volume of the shipping commitments signed up by TransCanada and recommitted to by the shippers represents Canadian oil owned by American energy companies

With the question posed, President Obama used his remarks to state his case for why Keystone is not a good thing for America and American drivers expecting lower gasoline pump prices. Unfortunately, the President continues to get key facts wrong, maybe signaling that he missed attending all those government economic briefings. According to the President, "It's [Keystone is] very good for Canadian oil companies and it's good for the Canadian oil industry, but it's not going to be a huge benefit to U.S. consumers. It's not even going to be a nominal benefit to U.S. consumers." His argument is that this oil is all Canadian (wrong, as there will be pipeline spur carrying 100,000 barrels a day from the U.S. Bakken formation) and it will merely traverse the U.S. continent in order to allow the oil to flow directly into the world oil market. Actually, a substantial volume of the shipping commitments signed up by TransCanada (TRP-NYSE) and recommitted to by the shippers represents Canadian oil owned by American energy companies. This oil will flow to the Gulf Coast refinery complex where most of it will be transformed into petroleum products – some of which will be sold here while the remainder will be exported. The President's idea that Canadian oil flowing into the global oil market won't have any impact on U.S. oil prices and especially our gasoline prices is also false. The U.S. gasoline price is heavily influenced by

Once the State Department has ruled, presumably favorably, but with environmentalist John Kerry as Secretary of State who knows, then the President can decide

the world oil price as the U.S. East Coast imports gasoline from the world market.

What the President did say about Keystone, which has potential significance, was his description of the status of the permit approval process. "So, in terms of process, you've got a Nebraska judge that's still determining whether or not the new path for this pipeline is appropriate. Once that is resolved, then the State Department will have all the information it needs to make its decision." That sounds like he expects the State Department to make its decision almost immediately after the Nebraska Supreme Court rules on the appeal of the district court's decision that the law that allowed for the approval of the pipeline route was unconstitutional. Once the State Department has ruled, presumably favorably, but with environmentalist John Kerry as Secretary of State who knows, then the President can decide.

TransCanada and Nebraska Governor Dave Heineman (Rep.) made a strong argument that the three landowners who brought the suit had not been, and would not be harmed by the pipeline route

On an interesting side note, we recently read a comment from a legal expert who obviously has been following this case closely, who suggested that "standing" might play a key role in the Nebraska Supreme Court decision. We had written about that issue earlier at the time of the district court's decision, which ignored the question. The defendants, TransCanada and Nebraska Governor Dave Heineman (Rep.), made a strong argument that the three landowners who brought the suit had not been, and would not be harmed by the pipeline route. In other words, the pipeline would not touch or cross their land. If they haven't been harmed, then they have no right (standing) to bring the lawsuit. Wouldn't that be an interesting twist if the court throws out the case? While that would appear to clear up the pipeline route issue, it could open the door to the opponents finding a landowner whose property is impacted by the pipeline's route to refile the lawsuit. Would they be able to return to the same district court that had previously ruled in their favor? If so, could we be looking at another year-long legal process in Nebraska that would provide the State Department and the Obama administration an excuse to put off making a decision? What happens then if the Republican-controlled Senate passes legislation mandating that the Keystone pipeline permit be approved? Would a presidential-veto gain Democratic support to prevent an override since President Obama could make the case that since there is an on-going legal case in Nebraska it is premature to approve the pipeline? These are all possible scenarios, but maybe we will know which course we will be on soon.

In the end of his comments, President Obama made the Keystone decision all about climate change

In the end of his comments, President Obama made the Keystone decision all about climate change, which he believes is serious and imposes significant costs on Americans. Again, he brought out that old saw about climate change causing more flooding, wildfires and droughts - claims that have been thoroughly discredited by the facts, but certainly make for good sound bites for the media.

Maybe President Obama is embracing his Cuba policy as a way to let Venezuela out of the financial box of continuing to supply the Castro-led country with cheap oil at a time its finances are in tatters due to the fall in global oil prices

We wonder whether the Nebraska court will rule between Christmas and New Year's Day or wait until early January. Once the ruling comes out, however, the playing field will be set and the battles will begin – oh they already have. Maybe President Obama is embracing his Cuba policy as a way to let Venezuela out of the financial box of continuing to supply the Castro-led country with cheap oil at a time its finances are in tatters due to the fall in global oil prices. If Keystone exists, there likely will be less need for Venezuelan oil in the U.S. as the Canadian oil sands bitumen can be directly substituted in American refineries. The change in U.S. policy towards Cuba will open the country up to greater tourism and trade with the U.S., meaning that Venezuela can charge the Cubans more for the oil it supplies them and improve Venezuela's finances. What a web of possible knock-on effects from President Obama's shift in America's diplomatic policy toward Cuba. These are interesting times, and January promises to be equally as interesting.

An Interesting Wind Power Story From Chile

In the heart of the Chilean archipelago are Puerto Chacabuco and the city of Coyhaique. The city of Coyhaique has about 60,000 residents out of the roughly 100,000 people who inhabit the Northern Patagonia region. This is largely a farming community, although it also supports a major army base. Salmon farming is another significant industry in the region.

Exhibit 7. Wind Turbines Near Coyhaique, Chile



Source: Allen Brooks

These three wind turbines supply the city with 10% of its electricity

As we were touring the area, we passed the three wind turbines on the top of a hill pictured above. Our guide, Benjamin, a native of Coyhaique, told us that these three wind turbines supply the city with 10% of its electricity. The remaining 90% comes from several small hydroelectric power plants. Most of the region's structures use wood for heating and LP gas for cooking, so the electricity needs are not particularly large. Because the region has many hills and

The latest major hydroelectric power project proposed was rejected by the locals

receives substantial snowfall every year, it is a prime location for dams and hydroelectric power. Benjamin told us that the latest major hydroelectric power project proposed was rejected by the locals because it would have dammed one of the major lakes in the area and it would have required the erection of a massive power transmission line to carry the power approximately 900 miles north to Santiago, the nation's leading and largest city. This is proof that the "NIMBY" - not in my back yard - mentality extends well beyond the U.S.'s border.

Correction:

Several *Musings* issues ago we discussed some of the history of how hardball negotiating had resulted in the creation of Baker Hughes Inc. (BHI-NYSE). We described how then-Baker Oil Tools Chairman James Woods brought along noted Houston attorney Joseph Jamail to a meeting with Hughes Tool Company's Chairman Jim Lesch with the implied threat that if Hughes continued balking at closing the merger of the two companies due to their concerns about the anti-trust settlement with the federal government, Baker would bring legal action to force the deal. We described how Mr. Jamail had recently won the case between Pennzoil and Texaco over the latter's interference in the former's deal to buy Superior Oil Company. We said that decision forced Texaco to file for bankruptcy because it could not pay the \$10 billion in damages awarded by the jury. We were corrected by a friend and former Texaco lawyer. It wasn't the damage claim that forced Texaco's bankruptcy but rather its inability to raise the full amount of the award necessary to meet the bonding requirement in order to appeal the decision.

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