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## MUSINGS FROM THE OIL PATCH

May 8, 2012

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Managing Director

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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

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### Keystone Pipeline: The Next Battle Lines Forming

**Based on the continued opposition by environmental groups in Nebraska and nationally, the antipathy toward the “dirty” oil sands output by environmentalists may impact the timing of the decision**

TransCanada (TRP-NYSE) has submitted a new proposed route for the section of the Keystone pipeline that transects Nebraska and originally crossed the Sandhills region to the agency responsible for evaluating the proposal. The company followed that up late last week with a new permit application for the entire pipeline route. The new route through Nebraska was developed in response to the rejection of the original pipeline route proposal by President Barack Obama despite the route being favorably reviewed by the U.S. State Department, which has primary jurisdiction over the approval process since the pipeline crosses an international border. The Keystone pipeline project approval has been, and remains highly contentious. It will only become less topical if President Obama finally approves the project, but based on the continued opposition by environmental groups in Nebraska and nationally, the antipathy toward the “dirty” oil sands output by environmentalists may impact the timing of the decision. We don’t expect any outcome before the election. Now that TransCanada has officially reapplied for a permit to construct the pipeline, excluding the southern leg from Cushing, Oklahoma to the Gulf Coast that doesn’t need State Department approval and for which the company has already commenced construction, we will see whether President Obama approves it.

**The new pipeline route skirts the eastern edge of the Sandhills region**

The newly proposed route in Nebraska, compared to the original pipeline route, is displayed in Exhibit 1, and was critical in enabling TransCanada to apply for the federal permit. The new pipeline route skirts the eastern edge of the Sandhills region in the northwestern part of the state although it still goes over the Ogallala aquifer. The submission of the new route clears the way, based on legislation passed a few weeks ago by the Nebraska Legislature, for state authorities to begin reviewing the revised project. That bill was passed 44-5 in the Legislature and reflects the growing realization of

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how important this pipeline is both for the nation's energy supply and our employment outlook.

### Exhibit 1. New Keystone Route

Original proposed route  
Preferred alternative route



Sources: TransCanada Corp., U.S. Fish and Wildlife Service

Source: Los Angeles Times

**The way in which this legislation was enacted has raised the possibility that environmental groups may challenge the law's constitutionality**

**We guess the Sierra Club is only concerned with the constitutional process for approving legislation when it doesn't go their way**

The recently passed Nebraska legislation sidesteps the law enacted in a special session of the Legislature last fall at the height of the political battle over Keystone's approval that requires most new oil pipelines to undergo a rigorous review process through the publicly-elected Public Service Commission. If the Nebraska Department of Environmental Quality (NDEQ), the new pipeline review authority, approves the pipeline's new route, the legislation allows the governor to decide whether to approve or deny the permit. The way in which this legislation was enacted has raised the possibility that environmental groups may challenge the law's constitutionality, even though the governor has signed it into law. An official of the Sierra Club pointed to the provision that sidesteps the Public Service Commission review that was added to the draft legislation late in its review process without the benefit of public comment as the grounds for potentially challenging the law.

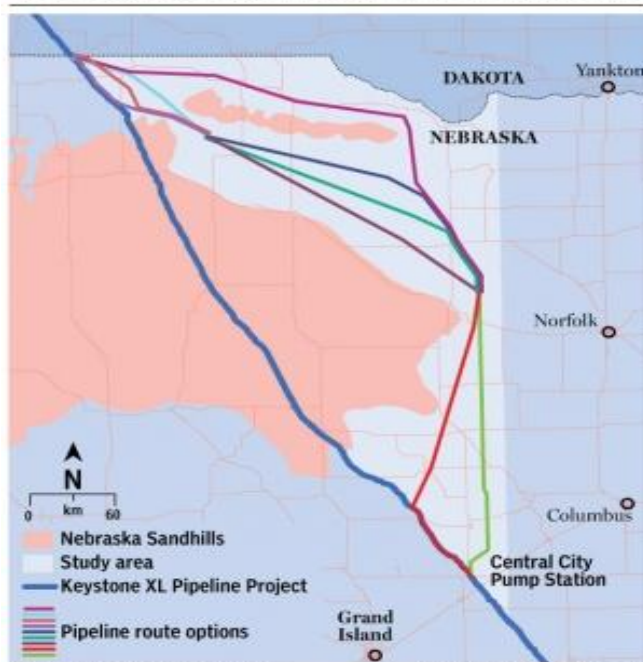
We noticed that the Sierra Club was supportive of the Rhode Island legislature's drafting of a law defining exactly what information and issues the state's Public Utilities Commission had to consider, and what data and information they could not use when they reviewed the second submission of the power purchase agreement for the offshore Block Island wind project in state waters. We guess the Sierra Club is only concerned with the constitutional process for approving legislation when it doesn't go their way.

**It was the battle between the State Department and the Environmental Protection Agency that delayed the original Keystone approval process for over a year**

The U.S. State Department will also be conducting new environmental studies of the proposed route. TransCanada contends that the new environmental review should be limited to the new route. Environmentalists are claiming that an entirely new environmental review needs to be undertaken because of a conflict involving the hiring of the consulting firm who prepared the study. Those claims were made earlier, were investigated and were rejected by the federal government. But readers should remember that it was the battle between the State Department and the Environmental Protection Agency (EPA) that delayed the original Keystone approval process for over a year. The EPA criticized the State Department’s environmental studies as being inadequate forcing it to do a second study and report, which came to the same conclusion as the earlier study. It was this favorable environmental evaluation that had the State Department ready to grant its approval of the permit to construct Keystone when President Obama decided he would make the final decision, usurping the responsibility he had assigned to the Department. That move was made when it became clearly evident that the pipeline project would be rejected based on political considerations and not the science of the pipeline.

**Exhibit 2. Alternative Routes Considered For Keystone**

*KEYSTONE PROPOSES NEBRASKA OPTIONS FOR DISPUTED PORTION OF PIPELINE*



Source: *National Post*

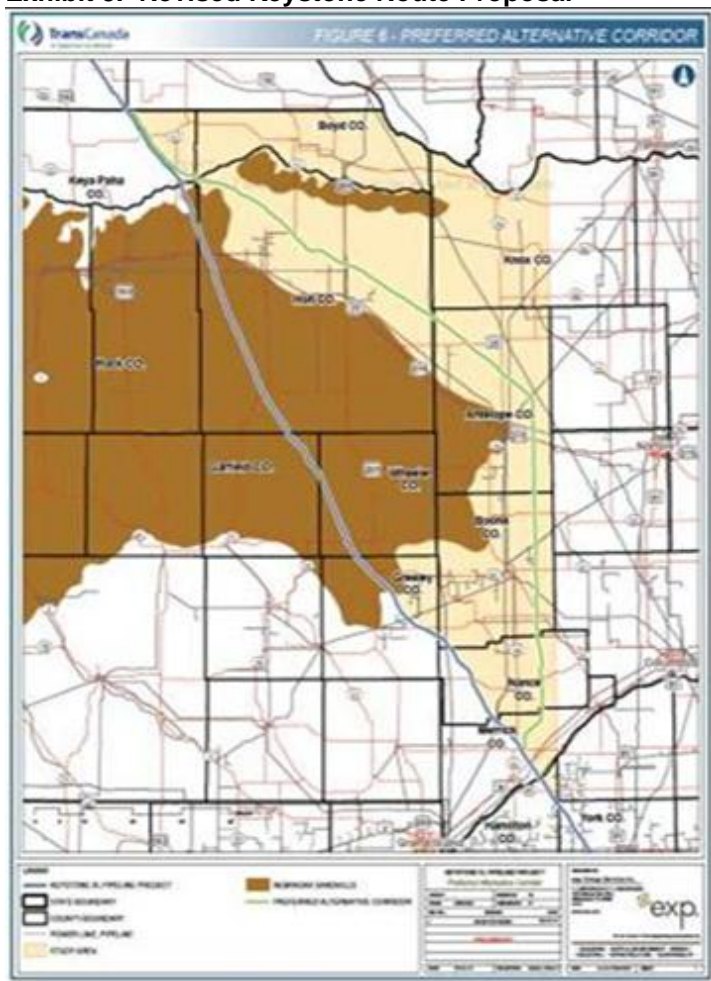
**Late last year, the NDEQ determined the boundaries of the Sandhills region**

In the new Keystone pipeline route submission, TransCanada spelled out its process for selecting the new route. Late last year, the NDEQ determined the boundaries of the Sandhills region. NDEQ realized that this was the first step necessary before TransCanada could consider alternative routes. After examining this information and all the areas surrounding the original pipeline route, the new route was selected. The new route is actually an amalgamation of several of the alternative routes studied.

**TransCanada considered eight alternative route segments**

TransCanada considered eight alternative route segments. Three of them were from the South Dakota/Nebraska border to a point designated Node 1. Three alternative routes covered the distance between Nodes 1 and 2. Finally, there were two routes studied between Node 2 and the Central City pump station. One route was selected from each of the three sections studied and now forms the proposed Keystone route. All the alternative routes are displayed in

**Exhibit 3. Revised Keystone Route Proposal**



Source: TransCanada



**Favorable terrain and fewer waterbody crossings seem to be the primary condition in the selection process for each of the pipeline segments**

**We understand TransCanada is planning to build the northern part of Keystone up to the 30-mile segment that crosses the US/Canadian border**

Exhibit 3 (Previous page). The selection process involved evaluating a large number of physical conditions and many other issues. For example, in the first section, the route selected maximized the use of the Keystone’s existing federal environmental impact statement, meaning that fewer additional landowners would be impacted by a new study. The selected route has the fewest waterbody crossings and a more favorable terrain. Favorable terrain and fewer waterbody crossings seem to be the primary condition in the selection process for each of the pipeline segments. The final route selected is shown in green on the map in Exhibit 3.

We understand TransCanada is planning to build the northern part of Keystone up to the 30-mile segment that crosses the US/Canadian border. The company would then wait for approval of that final segment. The justification for moving quickly to build this northern segment even without the cross-border approval is the increasing need for more transportation outlets for the growing Bakken oil output. In 2005, the Bakken produced less than 100,000 barrels per day (b/d) of crude oil, but it is now pumping in excess of 500,000 b/d. Production is projected to continue to rise with the basin output expected to reach 1 million b/d or more by 2020.

**Exhibit 4. Prolific Bakken Oil Resource**



Source: USGS

**TransCanada desires to be one of those pipeline options**

At the present time, approximately 62% of Bakken output moves out of the basin via pipeline, 23% by rail and 5% by trucking. About 10% of the basin’s output goes to the 58,000 b/d Tesoro (TSO-NYSE) refinery in Mandan, North Dakota. Companies involved in transportation are planning numerous expansions, primarily by pipeline and railroad. TransCanada desires to be one of those pipeline options, which given the route of the Keystone pipeline offers an attractive alternative transportation option in contrast to some of the existing arrangements. In our view, pipeline transportation options are preferable to rail or truck as these options tend to create greater emissions and are less efficient for the

**We expect that at any sign of approval delay, TransCanada will move forward in constructing everything up to the US/Canada border**

volumes of fluid handled. If the approval process for Keystone is dragged out, something the environmental movement will attempt to accomplish, TransCanada may be left out as an option to compete for Bakken oil transportation. We expect that at any sign of approval delay, TransCanada will move forward in constructing everything up to the US/Canada border. The key to that move will be Nebraska's approval, something that can come in a matter of months.

## **New Fracking Study Suggests Possible Water Contamination**

The investigative reporting web site, *ProPublica*, which often works in conjunction with The New York Times, is reporting on a new study published in *Ground Water*, the journal of the National Ground Water Association, a non-profit organization of scientists, engineers and businesses involved in ground water. The study was conducted by Dr. Tom Myers, an independent hydrogeologist, and paid for by Catskill Mountainkeeper and the Park Foundation, two upstate New York organizations opposed to natural gas drilling and hydraulic fracturing (fracking) in the Marcellus formation underlying New York, Pennsylvania, West Virginia and eastern Ohio.

**It concluded that the natural faults and fractures in the Marcellus formation, exacerbated by the effects of hydraulic fracturing, could allow chemicals to reach surface aquifers in as little as "just a few years"**

Mr. Myers' study was conducted using computer modeling rather than direct observations. It concluded that the natural faults and fractures in the Marcellus formation, exacerbated by the effects of hydraulic fracturing, could allow chemicals to reach surface aquifers in as little as "just a few years." This is in contrast to the existing knowledge that it might take 1,000 years or more for fluids to migrate large distances within these shale reservoirs. The implication is that the Marcellus shale is being pulverized by all the fracturing activity designed to release the trapped natural gas, so that the formation's permeability increases sufficiently to allow contaminated water to migrate thousands of feet upwards to reach the ground water reservoirs that provide the region's drinking water.

**"There is substantial geologic evidence that natural vertical flow drives contaminants, mostly brine, to near the surface from deep evaporite sources"**

According to the description of the study posted on the National Ground Water Association web site: "Hydraulic fracturing of deep shale beds to develop natural gas has caused concern regarding the potential for various forms of water pollution. Two potential pathways—advective transport through bulk media and preferential flow through fractures—could allow the transport of contaminants from the fractured shale to aquifers. There is substantial geologic evidence that natural vertical flow drives contaminants, mostly brine, to near the surface from deep evaporite sources. Interpretative modeling shows that advective transport could require up to tens of thousands of years to move contaminants to the surface, but also that fracking the shale could reduce that transport time to tens or hundreds of years. Conductive faults or fracture zones, as found throughout the Marcellus shale region, could reduce the travel time further. Injection of up to 15,000,000 L [liters] of fluid into the shale generates high pressure at the well, which decreases with distance

**“The overall system requires from 3 to 6 years to reach a new equilibrium reflecting the significant changes caused by fracking the shale”**

from the well and with time after injection as the fluid advects through the shale. The advection displaces native fluids, mostly brine, and fractures the bulk media widening existing fractures. Simulated pressure returns to pre-injection levels in about 300 days. The overall system requires from 3 to 6 years to reach a new equilibrium reflecting the significant changes caused by fracking the shale, which could allow advective transport to aquifers in less than 10 years. The rapid expansion of hydraulic fracturing requires that monitoring systems be employed to track the movement of contaminants and that gas wells have a reasonable offset from faults.”

**Dr. Myers has now reviewed and opined on the EPA study of possible water contamination in wells in Pavillion, Wyoming due to shale drilling and fracturing**

We are not sure whether this computer modeling of the movement of fluids in the shale formation is correct, but the study will draw interest and support among proponents for blocking the use of hydraulic fracturing of shale formations such as the groups who sponsored the research. One of the leading students of the Marcellus shale and a proponent of using hydraulic fracturing, Dr. Terry Englander, a professor of geology at Penn State University and acknowledged as the “father of the Marcellus shale,” questioned the study’s results because it goes against everything known about the geological structure and rock mechanics of the formation. But the more interesting point is that Dr. Myers has now reviewed and opined on the Environmental Protection Agency’s (EPA) study of possible water contamination in wells in Pavillion, Wyoming due to shale drilling and fracturing. That study’s conclusions, which have been questioned due to the sampling techniques of the EPA, have been verified according to Dr. Myers. On the blog for the Center for American Progress Action Fund, a leftist organization opposed to fracking, Dr. Myers was quoted as writing in his review of the test results that “After consideration of the evidence presented in the EPA report and in URS (2009 and 2010), it is clear that **‘hydraulic fracturing’** (fracking [Kramer 2011]) **‘has caused pollution of the Wind River formation and aquifer...’** **The EPA’s conclusion is sound.**” [Emphasis theirs]

**Opponents of hydraulic fracturing will rally around these two reports**

According to the blog, Dr. Myers goes on to detail the geology of the Pavillion area and the waterways in which the polluting chemicals could have migrated into the groundwater. The blog did note that Dr. Myers wrote, “The situation at Pavillion is **‘not an analogue’** for other gas plays because the geology and regulatory framework may be different.” [Emphasis theirs] Opponents of hydraulic fracturing will rally around these two reports because they end the recent string of EPA reversals in its claims about water pollution due to shale-related drilling and fracking.

We initially heard four or five years ago from a geologist friend active in the Marcellus of this theory concerning the migration of fracturing fluids upward via natural faults to possible ground water sources, which is what underlies Dr. Myers analysis. It was suggested by our friend that the likelihood of this transmission happening was minimal,

**The best defense to prevent this scenario from occurring would be for the industry to employ more seismic analysis and especially the use of microseismic for monitoring the hydraulic fracturing of wells**

but always a remote possibility. Our friend, who is active in the application of 3-D seismic for developing shale drilling prospects, suggested that the best defense to prevent this scenario from occurring would be for the industry to employ more seismic analysis and especially the use of microseismic for monitoring the hydraulic fracturing of wells. He also thought it would help improve the output from the fracturing operations and possibly reduce the cost of the applications, too. That recommendation is not surprising given our friend's background, but if the industry adopted them, while it would add both cost and time to the development of shale wells, it would certainly provide substantial comfort to citizens, petroleum companies and regulators that the possibility of new well development activity polluting drinking water would be kept to an absolute minimum.

**We believe the petroleum industry, and much of the American population, understands that the attacks on horizontal drilling and hydraulic fracturing of shale formations are more about an attack on fossil fuels and not about the technology**

Will the petroleum industry adopt such a strategy? In an era of extremely low natural gas prices, and possibly significantly uneconomic drilling efforts, we are not sure producers will voluntarily adopt such a program. On the other hand, adopting it could sharply reduce the power of the anti-fracturing movement's arguments against the technology, although it would be naive to expect them to end their criticisms entirely. At the end of the day, however, we believe the petroleum industry, and much of the American population, understands that the attacks on horizontal drilling and hydraulic fracturing of shale formations are more about an attack on fossil fuels and not about the technology. Their focus on the technology is due to its success in helping the industry tap unconventional oil and gas resources, which has contributed to the glut of natural gas and its low price that has undercut the economics of clean alternative fuel sources. In the case of natural gas, one needs to remember that at one time this fuel was embraced by clean energy proponents because it represented the cleanest of the fossil fuels, but importantly it was selling at double-digit prices that provided a cost umbrella for expensive wind and solar power. This battle between cheaper, cleaner fossil fuels and more expensive clean energy alternatives will continue to be waged. The petroleum industry needs to seize the initiative for providing greater assurances to the American public that its technology is safe and that its use will benefit society through cleaner energy and positive economic contributions.

## **Chaos In Chesapeake's Energy Board Room Raises Questions**

**The drama unfolding at the Chesapeake Energy campus has raised shareholder ire (lawsuits)**

For the past few weeks, energy investors have been treated to a spectacle involving corporate governance of the second largest natural gas producer in the nation and a controversial and once a high-flying stock. The drama unfolding at the Chesapeake Energy Corp. (CHK-NYSE) campus in Oklahoma City has raised shareholder ire (lawsuits), forced the company's founder to yield both his role as board chairman and his participation in a special drilling arrangement with the company, and attracted investigations



**Energy corporate scandals hurt the image of the energy industry much like the downfall of Enron tarred the industry for a number of years**

by the Securities and Exchange Commission and the Internal Revenue Service. As a director of three publicly-traded companies and the chairman of the governance committee of two and a member of a third, we have been troubled by the corporate governance revelations and the circus underway at Chesapeake.

We do not enjoy criticizing companies and their managements, but there are situations where the criticism is warranted due to the fallout from the events underway on the image of all other energy companies. Such a situation now exists in our view. The industry is being attacked for many fundamental issues – the risk of deepwater drilling, the pollution from horizontal drilling and hydraulic fracturing, making record profits while not paying a fair share of corporate taxes, and manipulation of commodity markets. Energy corporate scandals hurt the image of the energy industry much like the downfall of Enron tarred the industry for a number of years.

Having to rely solely on public regulatory filings and media reports, we admit to having limited information regarding the dealings that led to the scandal. This means we take to heart Chesapeake CEO Aubrey McClendon's admonish on last week's earnings report conference call that "Your mother told you not to believe everything you read or hear for good reason, and that's certainly been the case for the past two weeks." That said, however, the events and disclosures over the past several weeks and the history of Mr. McClendon and his board of directors raise serious questions about corporate governance at Chesapeake.

**While this situation may not be illegal, the propriety of the dealings is in serious question when it was revealed that Mr. McClendon's loans totaled over \$1 billion**

The current furor stems from recent disclosure that Mr. McClendon, who has a nice executive perk of being able to personally invest in all the wells his company drills, had extensive personal loans based on the value of his interests in these Chesapeake wells. He has pledged those interests to the financial institutions extending the loans. Additionally, the company had dealings with several of those financial entities that were providing the personal loans to Mr. McClendon. While this situation may not be illegal, the propriety of the dealings is in serious question when it was revealed that Mr. McClendon's loans totaled over \$1 billion. The Founder Well Participation Program (FWPP), the special arrangement allowing Mr. McClendon to invest in the drilling of these wells, was begun in 1993. The program was approved by the shareholders in 2005 and was scheduled to run for 10 years, but clearly not all the details surrounding Mr. McClendon's personal finances related to the program had been disclosed either to shareholders, or, it appears, fully to the board of directors. We don't know whether any of his financial arrangements were disclosed to the members of the board's compensation committee that is responsible for supervising the FWPP program, but we doubt it based on the series of press releases claiming the board knew about the details and then backtracking on that statement.

**A key question left unanswered is whether taking shareholders' money to pay Mr. McClendon, which then enabled the chairman and CEO of the company to earn this interest in the company's wells, was in the best interest of the shareholders?**

The FWPP in which Mr. McClendon was able to invest in 2.5% of all the wells drilled by Chesapeake was in the limelight at the end of 2008 when the board of directors awarded him a \$75 million bonus to enable him to fund his share of the drilling program after his shareholdings were wiped out by a margin call during the stock market collapse during the financial crisis. The board determined that this bonus was an incentive to both keep Mr. McClendon and align his interests with the shareholders. A key question left unanswered is whether taking shareholders' money to pay Mr. McClendon, which then enabled the chairman and CEO of the company to earn this interest in the company's wells, was in the best interest of the shareholders? Had Mr. McClendon not been able to fund his drilling participation, presumably that 2.5% interest would have accrued to the shareholders. Would the present value of the reserves developed by that 2.5% interest been worth more to the shareholders than the \$75 million payment? Remember, this sequence occurred in the early phase of the great gas shale revolution, something Chesapeake was leading and that led to the company's premium value in those years. On the other hand, one could ask whether it was likely that had Mr. McClendon not received his bonus he would have left the company. These are all questions we would have hoped the board members were asking themselves when they deliberated on granting the bonus, but based on the latest developments and revelations, we wonder whether those questions were ever raised.

**Did the board ask about other financial dealings Mr. McClendon may have been engaged in that might raise issues of conflicts of interest?**

Because Mr. McClendon's shareholdings were wiped out by the margin call, the company has instituted a policy prohibiting the use of derivative and speculative transactions involving company stock. This is a policy that virtually all publicly-traded companies have had for quite a while, so Chesapeake was behind the curve, but we are glad they have caught up. Importantly, as we understand, the board did not know about the hedged stock until the margin call triggered the sale of the shares. Did the board ask about other financial dealings Mr. McClendon may have been engaged in that might raise issues of conflicts of interest? It appears they didn't or they might have learned about the borrowings related to the FWPP. Or they also might have learned about Mr. McClendon's ongoing personal involvement in a hedge fund trading oil and gas commodities, the company's primary business, while using the corporate address as its office address. Again, this is probably not illegal, but certainly questionable for the chairman and CEO of an important oil and gas company to be participating in, especially when his fiduciary duty is to devote full time and attention to the affairs of Chesapeake for the benefit of its shareholders.

The history of Chesapeake and Mr. McClendon is one of bold moves and brash attitudes. The company has been nearly bankrupted by this approach to running the business, but it has also been wildly successful at times. In other words, Chesapeake is not your typical "widows and orphans" stock. The company's past successes cannot

**That means many Chesapeake directors are reported in the company's proxy statement to have received approximately \$585,000 in total compensation in 2011**

be ignored, but on the other hand, how they were achieved has raised many eyebrows. If one looks at the compensation of the members of the board of directors, the cash and stock component provided approximately \$385,000 (\$153,000 in cash and \$232,000 in restricted shares; these are approximate since each director earned slightly different amounts) of compensation last year. Directors also are provided the use of an executive jet, which resulted in about \$200,000 being credited to each director's total compensation last year. That means many Chesapeake directors are reported in the company's proxy statement to have received approximately \$585,000 in total compensation in 2011. We find this pay level eye-catching as Exxon Mobil Corp. (XOM-NYSE), one of this nation's largest corporations, directors received \$100,000 in cash plus 2,500 restricted shares, worth \$185,000, for a total of \$285,000 in total compensation last year. Each ExxonMobil director was also credited with \$420 of compensation representing his pro rata share of a travel accident insurance policy.

**We're happy to see Chesapeake improving its corporate governance, but the furor has given the energy industry a black eye at a time when it doesn't need one**

There are other issues involving the corporate governance structure and policies at Chesapeake that have evolved from these various issues. Separating the roles of chairman and CEO is consistent with best practices for corporate governance, but there are strong arguments for not splitting the roles. The company has proposed for shareholder approval at the June annual meeting a resolution mandating majority voting for each director candidate, although the company retains its staggered board structure. We're happy to see Chesapeake improving its corporate governance, but the furor has given the energy industry a black eye at a time when it doesn't need one. There are enough critical issues about energy policy that need to be decided without such a distraction.

**Two Harvard Law School academics found last year that during the last decade the previous link between corporate governance and share price performance broke down**

A column in the *Financial Times* discussing the Chesapeake governance issues tied it to the performance of the stock. The column pointed out that two Harvard Law School academics found last year that during the last decade the previous link between corporate governance and share price performance broke down. Their view was that this was due to the fact people understood the importance of good corporate governance so it was already priced into share prices. Other studies still point to the fact that there is a difference: better run companies have less volatile shares, which fit with the view that good governance reduces corporate risk.

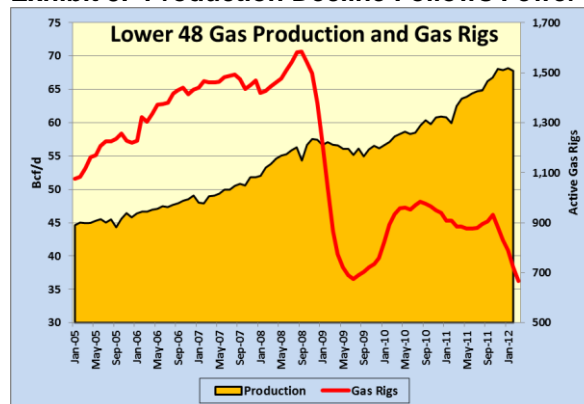
At the beginning of the Chesapeake preliminary proxy filed with the SEC on April 20, 2012, there is the following statement: "I am honored to represent Chesapeake's shareholders. Your Board is committed to advancing shareholder interests and maintaining strong corporate governance." - Kathleen Eisbrenner - Director since 2010. We wonder how Ms. Eisbrenner feels about this statement now after the events of the last two weeks.

## Is Rational Thinking Returning To The Natural Gas Market?

**Four months later we have seen the first signs of a slowdown in the growth rate for onshore natural gas output**

At the beginning of this year, we wrote a *Musings* article dealing with the oversupply of natural gas and the need for the E&P industry to rein in its drilling activity. We titled the article, “Are E&P Companies Coming To Their Senses About Gas?” Four months later we have seen the first signs of a slowdown in the growth rate for onshore natural gas output, even though the data lags by two months. The rapidly deteriorating price of natural gas since the beginning of 2012 has finally crimped companies’ cash flows. More importantly, the fuel’s supply and demand fundamentals have diminished the outlook for higher prices any time soon.

**Exhibit 5. Production Decline Follows Fewer Rigs**



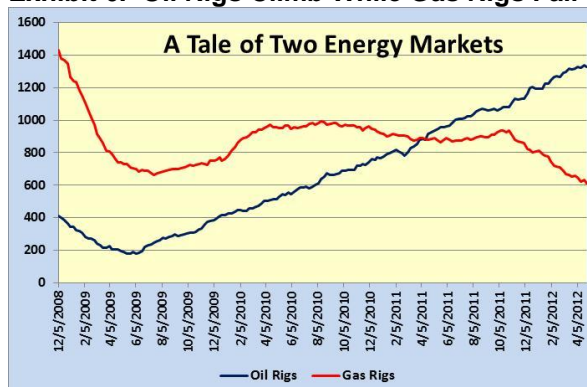
Source: EIA, PPHB

**This shift in drilling focus will eventually reduce gas supply, but it will not happen as quickly as the industry initially anticipated**

What we have been witnessing since last year is a concerted effort by the E&P industry to shift its drilling efforts in the United States away from dry natural gas and in favor of liquids-rich gas and crude oil plays. This makes immense economic sense with crude oil prices in excess of \$100 per barrel and a correspondingly high price for natural gas liquids at the same time natural gas prices hover in the low \$2 per thousand cubic feet (Mcf) range. As we have commented on numerous times, this shift in drilling focus will eventually reduce gas supply, but it will not happen as quickly as the industry initially anticipated since we seem to have forgotten that these new plays produce a meaningful amount of natural gas along with their liquids flow.

**There was a shift in drilling focus that began in June 2009, but it was not completely obvious for some time**

When we look at the recent history of drilling rig activity, it becomes clear that there was a shift in drilling focus that began in June 2009, but it was not completely obvious for some time. If one examines the chart in Exhibit 6, both the rigs drilling for natural gas and for crude oil turned up in mid-2009, but by spring 2010 the gas rig count advance stopped while the oil rig count continued to climb. Between spring 2010 and late fall, the gas rig count remained essentially flat before starting to slide in response to falling natural gas prices. In the early fall of 2011, expectations were that the U.S. economic

**Exhibit 6. Oil Rigs Climb While Gas Rigs Fall**

Source: Baker Hughes, PPHB

**The rise in global oil prices since late last year resulted from the talk by many western developed countries about the need to impose tougher sanctions against Iran for its defiant actions in continuing to develop a nuclear power industry**

recovery was accelerating, but that strength appeared somewhat ephemeral and with a warmer than expected winter, natural gas prices dropped sharply, touching the \$2/Mcf level, a decade low. During this whole period, crude oil prices remained very strong, helped by the premium built into global oil prices for the potential of a military confrontation in the Middle East with the possibility it could result in the loss of a significant volume of world crude oil output. The rise in global oil prices since late last year resulted from the talk by many western developed countries about the need to impose tougher sanctions against Iran for its defiant actions in continuing to develop a nuclear power industry. One of the sanctions being imposed is the banning of Iranian crude oil from these developed countries. When the sanctions go into effect later this summer, western countries, if they have not been granted prior relief, will have to stop importing Iranian oil and replace that volume from other sources. Whether the consumption of Iranian oil falls as much as suggested by the historical statistics remains to be seen, especially as we expect Iran will offer attractively priced oil that may entice countries to seek ways around the sanctions. As a result, oil prices continue to be elevated while natural gas prices remain extremely depressed.

**There has been a steady rise in the number of drilling rigs in the Eagle Ford formation, attracted there by high oil and natural gas liquids prices**

One sign of the impact of the E&P industry's shift toward liquids-rich gas and crude oil plays was the sharp uptick in the number of new wells drilled in the South Texas Eagle Ford formation during February and March. As we show in Exhibit 10 (page 16), there has been a steady rise in the number of drilling rigs in the Eagle Ford formation, attracted there by high oil and natural gas liquids prices. The challenge for the pace of future development activity in the trend is the estimated 60% annual decline rate in production and escalating cost of wells. While many economic analysis of the profitability of the formation suggest that well costs are in the \$7 million to \$9 million range, we have recently heard that well costs may now have moved up into the \$10 million to \$13 million range. This cost increase has come while crude oil prices remain high, even though they are not rising. Natural gas prices, on the other



hand, are lowest they have been in recent years. Is it possible that the economics for this play are eroding before our eyes?

**Exhibit 7. Liquids-rich And Oil Wells Climb**

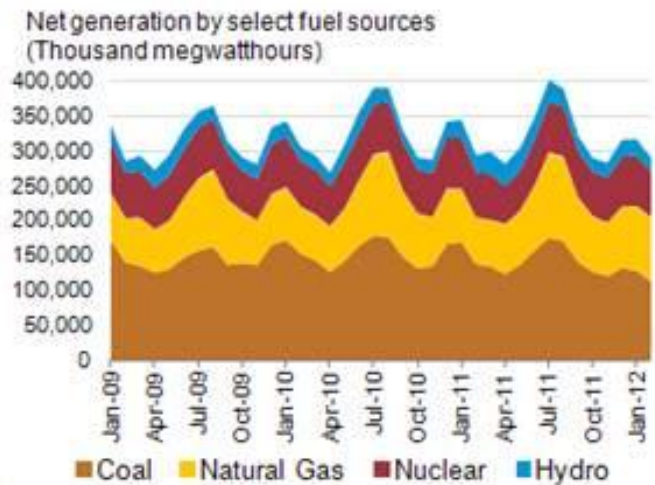


Source: EIA

**The greatest positive for the natural gas industry is the increased demand emanating from the electric power generation market**

The challenge the natural gas industry faces now is what happens to gas demand if gas prices remain historically low? At the present time, we are in the “shoulder” months of the year when natural gas demand is traditionally low due to the lack of heating or air conditioning loads as temperatures are moderate. The economic recovery remains sluggish so the natural gas market is getting little help from increased industrial use of gas, despite very low prices. The greatest positive for the natural gas industry is the increased demand emanating from the electric power generation market, which is coming at the expense of coal consumption. There are various estimates about how much incremental natural gas is being consumed as a result of this price advantage. The best estimates we have seen suggest that the demand increase centers around 5-6 billion cubic feet per day (Bcf/d). That volume represents approximately 7% to 9% of the 67.78 Bcf/d of natural gas produced in February in the Lower 48 States as reported by the EIA.

**Exhibit 8. Gas Gaining Share Of Electric Market**



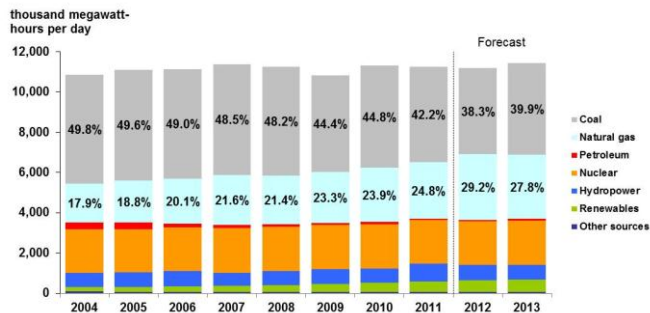
Source: EIA

**Until then, low coal and natural gas prices will continue to battle, with gas being helped by the recently tightened EPA rules on emissions from coal-fired power plants**

Last year, natural gas accounted for nearly 25% of the nation's electric generation versus just over 42% for coal. When we examine the latest monthly data, it is clear the natural gas is still gaining market share at the expense of coal. That gain can be seen in the chart of the latest monthly data in Exhibit 8 (Prior page).

Expectations are that natural gas will continue to gain market share in electricity generation this year merely because its price is so low. Coal prices have been undercut by low gas prices but eventually we expect coal will win back some of the lost demand, especially when the economic recovery accelerates. Until then, low coal and natural gas prices will continue to battle, with gas being helped by the recently tightened Environmental Protection Agency (EPA) rules on emissions from coal-fired power plants. We attended a presentation by an energy consultant who worked for many years for American Electric Power (AEP-NYSE) that is the nation's largest operator of coal-fired power plants. As one would expect, many of these plants are old, although they continue to function well. Most of the focus on the new EPA emission rules dealt with their application to new generation sources, meaning they are applied to newly constructed plants. However, when existing plants experience equipment-related downtime, the repairs and modifications can cause the plant to become subject to "new source" reviews and thus, these "new source" emission standards. According to the presenter, his former AEP colleagues suggested to him that they had established a \$5 million threshold for capital investments that would determine whether the plant would be shut down rather than repaired. The presenter commented that he could not think of any significant part of a coal-fired power plant that wouldn't exceed this threshold when, and if, critical equipment broke. In his view, America will experience faster erosion in coal-fired power generation capacity than expected by either regulators or company managements. For that reason, he was positive about the longer term outlook for natural gas demand, meaning he also sees higher gas prices down the road.

**Exhibit 9. Gas To Supply More Electricity**  
U.S. Electricity Generation by Fuel, All Sectors



Note: Labels show percentage share of total generation provided by coal and natural gas.

Source: Short-Term Energy Outlook, April 2012

Source: EIA



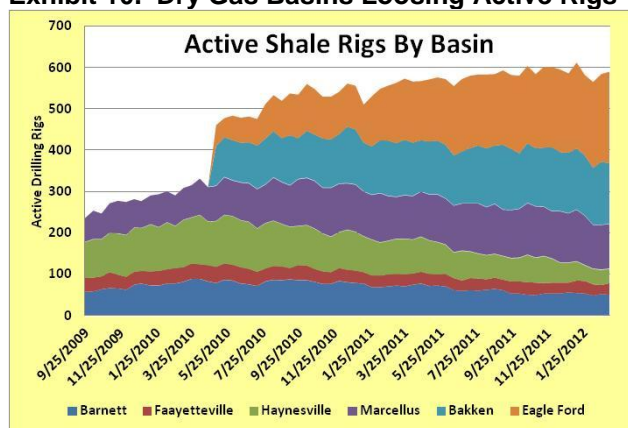
**While the anecdote doesn't suggest exactly when these older power plants might be retired, what we know is that old equipment does break down, and it is likely there will be plants shut down that were not projected to be closed within the next 12-36 months**

**We are inclined to believe that voluntary cutbacks are the primary reason for the production decline**

The EIA's Short Term Outlook projects a continuation of share gain in electric power generation by natural gas through 2013, although the increased share in 2012 will likely be eroded the following year due to coal prices becoming more competitive with natural gas. We believe, however, this forecasted coal recovery may be optimistic if the anecdote about how American Electric Power plans to handle new capital investment in existing coal-fired power plants proves accurate and plant breakdowns develop. While the anecdote doesn't suggest exactly when these older power plants might be retired, since it is impossible to forecast when equipment may break, even though there is much effort being expended at trying to predict machinery life, what we know is that old equipment does break down, and it is likely there will be plants shut down that were not projected to be closed within the next 12-36 months. What this means is that AEP must be prepared to replace these soon-to-be-retired plants with new capacity, and it will likely be powered by natural gas.

In the latest natural gas production data reported for February by the EIA, we witnessed a decline in Lower 48 output. A critical question about the decline is how much of it was driven by natural production declines and lower drilling activity versus arbitrary company decisions to shut-in production because of low gas prices? We know companies such as EnCana (ECA-NYSE) and Chesapeake Energy (CHK-NYSE), along with a handful of other producers, have elected to close producing wells to help alleviate the gas oversupply situation. While it is impossible to know the relative importance of these different actions, we are inclined to believe that voluntary cutbacks are the primary reason for the production decline. We are encouraged that the continued cutback in dry natural gas drilling and the decline curve phenomenon will bring actual production down in the next several months. This should begin to reverse the trend in natural gas prices. As the old saying in the oil business goes – the cure for low prices is low prices!

**Exhibit 10. Dry Gas Basins Losing Active Rigs**



Source: *Land Rig Newsletter*, PPHB

**If the E&P industry holds to its newly discovered discipline, the reservoir decline curve will begin to overwhelm newly added production leading to a reduction in the natural gas oversupply condition**

The one offset to a natural decline in production due to less drilling is whether we will see drilling cutbacks in the basins adding new gas production. Here is what has been happening in the key shale basins. The Eagle Ford and Bakken have been increasing their rig counts primarily at the expense of the Barnett and Haynesville with an early decline beginning to emerge in the Marcellus. The key to the impact of these basin trends can be seen by looking at the total number of active rigs in Exhibit 10. After hitting 600 during the fall of 2011, we are now consistently below that number now. If the E&P industry holds to its newly discovered discipline, the reservoir decline curve will begin to overwhelm newly added production leading to a reduction in the natural gas oversupply condition. That should begin the natural gas price healing process and boost prospects for higher prices in the future. The near-term problem is that pricing could get worse before it gets better, but that dip in prices could accelerate the recovery if companies are forced to exercise greater capital spending discipline.

## **Must We Now Fear Global Warming From Wind Turbines?**

**Wind farms of a certain scale, while producing clean, renewable energy, do have a long-term warming effect on the immediate environment**

The nation is being treated to another battle over what researchers actually showed in their study and how the mainstream media has reported it. A new peer-reviewed study was recently published in the journal *Nature Climate Change* showing that wind farms of a certain scale, while producing clean, renewable energy, do have a long-term warming effect on the immediate environment. The study's results were interpreted to suggest that wind turbines cause global warming. The major news agency that reported the story this way was Reuters followed by Fox News, which headlined its reporting as "New Research Shows Wind Farms Cause Global Warming." Some other media and blogs picked up the Fox story and ran with it.

**So there you have it – no global warming from large wind farms. But what did they really say?**

Immediately, the American Wind Energy Association (AWEA), as well as *The Washington Post*, was on its blog refuting the media coverage. *MediaMatters* quizzed the lead author of the study about the news stories and reported the following: "The researchers, led by Liming Zhou, said it is "[v]ery likely" that "wind turbines do not create a net warming of the air and instead only re-distribute the air's heat near the surface, which is fundamentally different from the large-scale warming effect caused by increasing atmospheric concentrations of greenhouse gases." So there you have it – no global warming from large wind farms. But what did they really say?

Here is the extract published on the journal's web site announcing the study. "The wind industry in the United States has experienced a remarkably rapid expansion of capacity in recent years and this fast growth is expected to continue in the future 1, 2, 3. While converting wind's kinetic energy into electricity, wind turbines modify surface-atmosphere exchanges and the transfer of energy, momentum, mass and moisture within the atmosphere 4, 5, 6.

**“Our results show a significant warming trend of up to 0.72 °C per decade, particularly at night-time, over wind farms relative to nearby non-wind-farm regions”**

**The lead author is claiming that all the wind turbine is doing is mixing up the layers of warm and cool air and the net result at the ground level is this warming trend they observed**

**The last we checked, according to Al Gore, a 2° C increase in global temperatures in the future was going to lead to catastrophic changes to the world’s climate and the existence of mankind**

**These changes, if spatially large enough, may have noticeable impacts on local to regional weather and climate.** Here we present observational evidence for such impacts based on analyses of satellite data for the period of 2003–2011 over a region in west-central Texas, where four of the world’s largest wind farms are located. **Our results show a significant warming trend of up to 0.72 °C per decade, particularly at night-time, over wind farms relative to nearby non-wind-farm regions.** We attribute this warming primarily to wind farms as its spatial pattern and magnitude couples very well with the geographic distribution of wind turbines.” (Emphasis added)

That extract sounds slightly more ominous than the quote given to MediaMatters. In the quote, the lead author is claiming that all the wind turbine is doing is mixing up the layers of warm and cool air and the net result at the ground level is this warming trend they observed over the nine-years-worth of satellite temperature observations. *The Wall Street Journal* published a story on the research report along with quotes from both the lead author and another contributor. The impact of the direct measurement the research team discovered was summed up by Baidya Roy, a contributor, this way. “The turbine pulls warm air down and takes cooler air underneath and pushes it up. That creates a warming effect near the surface.” Just how much warming is an interesting question, and seems to depend on your view of the outcome of the study. According to the abstract, it is 0.72° C per decade. *The Wall Street Journal* says the temperature rise was over nine years, which coincides with the growth of the turbines in the wind farms in central Texas from a few dozen in 2003 to more than 2,350 by 2011. The view of the lead author of the study, Mr. Zhou, was that “The temperature change is small” so there is no big problem. This conclusion is interesting since we are not aware of wind farm temperatures being an issue. We can only speculate what was behind the research. Is it an attempt to show that wind farms are benign or is it to try to refute possible research that they do heat the environment?

What are the implications of this warming? If we assume the decade analysis number is correct, then as long as we continue to add wind turbines to wind farms the rate of temperature increase will continue and we will get a 7.2° C increase over the next century. The last we checked, according to Al Gore, a 2° C increase in global temperatures in the future was going to lead to catastrophic changes to the world’s climate and the existence of mankind. As Mr. Roy put it, “The warming is going to level off when you stop adding more turbines.” But that is not what the AWEA or the Obama administration wants to do. They want more wind turbines.

The big question is what impact this surface warming might have on the climate. Mr. Zhou observed, “We don’t know whether there is a change in weather due to the temperature change.” But as wind



**We would point out that just as the long-term is made up of many short-terms, the global climate is made up of many regional climates**

**So won't more "heat islands" as these wind farms are going to become contribute to a permanent warming of nighttime temperatures?**

farms become more widespread he acknowledged they "might have noticeable impact on local-to-regional weather and climate."

AWEA's Michael Goggin wrote on the organization's blog, "Much of the popular reporting on this topic has confused the issue of climate change, which is a major global phenomenon driven by greenhouse gases actually warming the earth by altering the earth's energy balance, and a speculative, small, short-lived, localized impact on the weather that could possibly be caused by wind plants slightly altering how air mixes around wind plants." That sounds like we shouldn't worry about all these wind farms and the plans to add many more wind turbines – how else are we going to get to where clean energy alternatives supplant fossil fuels for our energy supply – but we would point out that just as the long-term is made up of many short-terms, the global climate is made up of many regional climates.

If we accept Mr. Goggin's belief that we shouldn't worry about "short-lived localized impact on weather" caused by wind farms, then what about tornadoes and hurricanes? He also fails to consider the impact on regional temperatures because the heating associated with the wind turbines occurs primarily at night or early in the morning. From what we know about the Texas heat wave of last year, one of the key differences from earlier hot periods was that temperatures didn't cool off at night, which helps mitigate temperature highs the following day. So won't more "heat islands" as these wind farms are going to become contribute to a permanent warming of nighttime temperatures? Might that make daytime temperatures much warmer than normal on an extended basis? The answer to the question about the impact on the weather from wind farm warming, according to Mr. Zhou, is more research. Follow the dollars to understand global warming.

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