

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*

Here We Go Again – EPA Slams State Dept. Keystone EIS

The EPA concluded that the DSEIS would be rated as EO-2 or “Environmental Objections – Insufficient Information”

A week ago Monday was another one of those “gotcha” moments as the Environmental Protection Agency (EPA) released a copy of a letter, signed by Cynthia Giles, assistant administrator for enforcement and compliance assurance, sent to the Department of State. The EPA’s letter was to inform the State Department that it had reviewed the draft Supplemental Environmental Impact Statement (DSEIS) for a Presidential Permit application by TransCanada Keystone Pipeline, LP (TRP-NYSE) to operate the Keystone XL Project in accordance with the EPA’s authorities under the National Environmental Policy Act (NEPA). The EPA concluded that the DSEIS would be rated as EO-2 or “Environmental Objections – Insufficient Information.”

The EPA had objected to the two prior Environmental Impact Statements prepared by the State Department

It was New York Yankee baseball great Yogi Berra who said, “It’s déjà vu all over again,” a sentiment we agreed with. The EPA had objected to the two prior Environmental Impact Statements (EISs) prepared by the State Department as part of the earlier application process for securing a permit to construct the pipeline, which was ultimately terminated by President Barack Obama in January 2012. He determined there was insufficient time for the State Department to complete its review of the proposed revised pipeline route to avoid crossing the environmentally-sensitive Sand Hills Region of Nebraska given a Congressionally-mandated deadline for approving the construction permit. Following the application denial, TransCanada negotiated a revised pipeline route through Nebraska that avoided the Sand Hills Region but still crossed over a portion of the Ogallala Aquifer.

The EPA letter was interesting in that it praised the State Department for how it had improved its prior analysis of the environmental issues surrounding Keystone, yet pointed out how

The EPA said that despite two lengthy EISs, the State Department had not done sufficient analysis of the pipeline's impact on the environment

some of the issues are examined in an insufficient manner. In 2011, the EPA was mostly focused on the risk of pipeline oil spills on drinking water in Nebraska and the sensitive ecosystems of the Sand Hills and Ogallala regions. The EPA also voiced concerns about the effect of the pipeline's product on greenhouse gas emissions in the United States and globally. At the end of the day, the EPA said that despite two lengthy EISs, the State Department had not done sufficient analysis of the pipeline's impact on the environment. The EPA's letter to this effect urged the State Department to conduct a more thorough analysis of oil spill risks and alternative pipeline routes. It concluded that until those concerns were addressed, the EPA would rate the project EO-2 as "environmental objections – insufficient information."

At some point, and we don't know when that date is, the northern section of the Keystone XL pipeline project may not be needed as the industry develops other transportation options

This time, the EPA seems to have some additional concerns about the adequacy of the State Department's DSEIS, but it assigned it the same rating. Our reading of the EPA's objections suggest that the additional investigations may extend the permit application approval process into 2014, with the possibility that even then the EPA may not be satisfied necessitating further delays. At some point, and we don't know when that date is, the northern section of the Keystone XL pipeline project may not be needed as the industry develops other transportation options for the increased oil sands output. Alternatively, TransCanada is developing a proposal to convert an unused natural gas pipeline running from Alberta to Ontario and building an additional pipeline across Quebec, for which the company already owns the pipeline right-of-way, to connect with pipelines to enable the oil to reach Canadian East Coast refineries and ports.

The EPA also questions the State Department's analysis that whether Keystone is built or not that oil sands output will not be impacted

The EPA's objections fall under three main topics with multiple concerns in some cases. Under its concerns about greenhouse gas emissions (GHG) the EPA believes more analysis needs to be conducted on the "monetized estimates of the social cost of GHG emissions from a barrel of oil sands crude compared to the average U.S. crude." The EPA also questions the State Department's analysis that whether Keystone is built or not that oil sands output will not be impacted as there are alternative ways to ship the oil to the U.S. market. The EPA recommends "the Final EIS provide a more careful review of the market analysis and rail transport options." The EPA believes this means an updated energy-economic modeling effort. The EPA also wants a discussion about ways in which the U.S. might work with Canada to promote further efforts to reduce GHG emissions including a joint focus on carbon capture and storage projects along with ways to improve the energy efficiency of the bitumen extraction technology. Carbon capture technology has been talked about, but has not been perfected.

The recent oil pipeline spill in Arkansas, in addition to the 2010 Enbridge (ENB-NYSE) spill in Michigan, has raised concerns about the risks associated with an oil sands oil spill. Because the bitumen

The EPA also thought the DSEIS had not done a sufficient job in examining alternative pipeline routes in Nebraska

involved in the Enbridge spill eventually sank to the river bed, the EPA determined it will have to be dredged up for removal in order to protect the public health and welfare and the environment. As a result, the EPA wants the Final EIS to “include means to address the additional risks of releases that may be greater for spills of dilbit [diluted bitumen] than other crudes.”

The EPA also thought the DSEIS had not done a sufficient job in examining alternative pipeline routes in Nebraska that would completely avoid both the Sand Hills and the Ogallala regions. The EPA cited the I-90 Corridor Alternative, which follows the path of existing pipelines. This route would parallel the existing Keystone pipeline and reduce the length of pipeline crossing the Northern High Plains Aquifer system that includes the Ogallala formation. Thus, the EPA said the Final EIS should “provide more detailed information as to why these alternatives were not considered reasonable or analyze these alternatives in more detail.”

The longer the recovery goes, the less important is the “job creation” justification for approving Keystone

It remains our belief that the wheels of environmental objection are at work. We have always maintained that on the basis of facts and economic arguments alone, approving the Keystone XL construction permit was/is a “no brainer.” The approval of this application, however, is really all about politics – the current president needs to offer something to his long-standing and long-suffering Democratic environmental supporters. The longer the recovery goes, the less important is the “job creation” justification for approving Keystone. As domestic oil and gas production continues growing, the idea that we need more imported oil, especially the “dirty” oil from Canada fades, even though the oil sands output would displace the heavy oil from Venezuela and Mexico. We have to believe the EPA criticism sets the stage for an extended delay in the approval process that might take President Obama off the hook for having to make a decision, but if he does, the odds in our view are slowing building against approval of Keystone. TransCanada has now delayed the proposed start-up of Keystone to late 2015 and has increased the project cost.

It’s Not Urban, But It Is How Energy Legends Are Created

That Monday was also the date for the Boston Marathon, the oldest organized sporting event in the state

April 15th is a day most Americans dread since it is the deadline for filing one’s income tax return. This year that date assumed a special and horrific mantle as that was the day selected by Massachusetts to celebrate Patriot Day, the day the first battle in the War of Independence was fought in 1776. That Monday was also the date for the Boston Marathon, the oldest organized sporting event in the state, and the day when two bombs were exploded killing three spectators. Those bombs led to a massive manhunt for the perpetrators who, later in the week, engaged in another killing, a carjacking and a massive gun fight resulting in one of the perpetrators being killed and the other wounded, which ultimately led

The authors go on to cite that four large Utica shale landowners have put up all or part of their acreage for sale

to his capture the following evening. With America, and the world riveted to the ongoing events in Boston, an energy article written by two reporters moved across the Bloomberg newswire. The article dealt with the Utica shale formation in Ohio and how, in the estimation of the article's authors, this heavily promoted shale play was beginning to prove to be a disappointment.

The article contained a drumbeat of negativity regarding prospects for the Utica formation beginning with its very first sentence: "U.S. drillers that set up rigs amid the rolling farmland of eastern Ohio on projections underground shale held \$500 billion of oil are packing up." The authors go on to cite that four large Utica shale landowners have put up all or part of their acreage for sale and that prices for acreage in the area have fallen by up to a third in some cases.

They also reflect the reality of shale development – not all shale formations are alike and even within a shale formation the quality of the rock can vary significantly

From Ohio, the authors extrapolate the challenge of unlocking the secrets of the Utica shale formation to the world citing difficulties explorers have encountered in California, Poland and China. The article highlights problems Occidental Petroleum Corp. (OXY-NYSE) has encountered in dealing with the heavily faulted Monterey Shale in California. We're not sure they have abandoned efforts to produce this formation, but clearly they need to do more research. The same is true in China where the initial efforts of Chinese oil companies Cnooc Ltd. (CEO-NYSE) and China Petrochemical Corp. (SNP-NYSE) proved unsuccessful and sent the companies looking for ventures in North America where they could gain greater understanding of the technical challenges of producing shale formations. The only example where an oil company has truly given up on a shale formation is ExxonMobil's (XOM-NYSE) abandonment of its exploration efforts in Poland. While these examples represent cases where the anticipated successes proved disappointing, they also reflect the reality of shale development – not all shale formations are alike and even within a shale formation the quality of the rock can vary significantly.

The emphasis from explorers was on the wet natural gas potential within the formation

We found it interesting when researching this article that there was a reference back to an October 2012 article written by one of the authors that seemed to be making the exact same point about disappointing results from Utica wells. In the end, we take issue with two points central to the article. First, the Utica was never established as a dry natural gas play nor was it deemed exclusively as an oil play. Rather, the emphasis from explorers was on the wet natural gas potential within the formation. However, the article virtually ignored this aspect of the Utica, and the fact that natural gas liquids (the "wet" aspect of natural gas) prices have declined making the economics of wet gas plays somewhat less attractive. The authors acknowledge the wet potential, but dismiss any discussion by stating that "only a minority of companies are positioned to benefit." For us, the article would have been more insightful had the authors explored why there is only a minority of companies poised to benefit and whether this was the result of a deliberate strategy when

The authors based their analysis on one slide from a presentation made in March 2011 at the annual meeting of the Ohio Oil & Gas Association

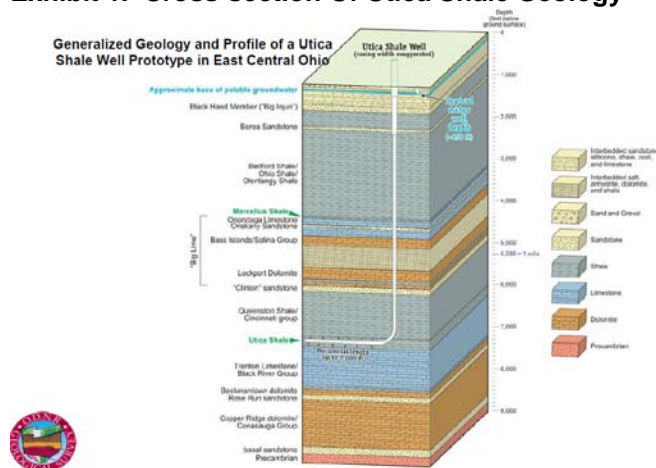
Because we believe the use of the 5.5 billion barrel estimate is misleading, we are revisiting the topic

the companies were engaged in the “great land grab” in Ohio, or whether it was the result of luck in selecting acreage.

The second issue we take with the article was its use of an estimate of the potential oil contained in the Utica formation. The article references an estimate by the Ohio Department of Natural Resources made in 2011 that the Utica formation contained 5.5 billion barrels of recoverable oil reserves, a volume that is more than twice the proven crude oil resources of Yemen and based on the current oil price, valued at roughly \$500 billion. These are claims that lead to the creation of energy myths. How does this happen? The authors based their analysis on one slide from a presentation made in March 2011 at the annual meeting of the Ohio Oil & Gas Association by Larry Wickstrom, then the chief of the Geological Survey arm of the Ohio Department of Natural Resources. The presentation was based on the work of Mr. Wickstrom and his associates, Chris Perry, Matt Erenpreiss and Ron Riley. The authors also give credit to the work of the U.S. Geological Survey and the Ohio Geological Society.

We attended this presentation as we were delivering a keynote speech immediately following it. We also wrote a *Musings* article about the presentation, making it part of a longer article dealing with shale resource estimates in general. Because we believe the use of the 5.5 billion barrel estimate is misleading, we are revisiting the topic. The presentation was made when exploration of the Utica was in its infancy. Mr. Wickstrom began by presenting a cross section of the geology of Ohio showing where the Utica shale was located within all the rock formations underlying the state. The presentation was also done to show the relationship of the Utica to where groundwater is typically located, which at the time was of concern to people opposed to drilling and developing shale resources.

Exhibit 1. Cross-section Of Utica Shale Geology



Source: Ohio Dept. of Natural Resources

The conventional well will generate \$2 million in gross revenues while the shale well produces \$16 million, an 8-1 advantage

Mr. Wickstrom then moved on to show why oil and gas companies, and citizens of Ohio, are interested in the potential of the Utica. What he showed was that a conventional gas well in the Appalachian Basin will produce 100,000-500,000 cubic feet of natural gas per day and 200-500 million cubic feet (MMCF) over its producing life. In contrast, a Marcellus well, and possibly a Utica well, should produce 2-10 MMCF per day, or four billion cubic feet of natural gas over its lifetime. Using an average gas price of \$4 per thousand cubic feet, the conventional well will generate \$2 million in gross revenues while the shale well produces \$16 million, an 8-1 advantage. There is an offset to this revenue superiority, which is the increased cost for drilling and completing a Marcellus or Utica well, but the revenue ratio is a powerful incentive.

Exhibit 2. Why The Utica Shale Is Important

So, why is this a big deal?

- A "typical" conventional gas well in the Appalachian Basin produces 100–500,000 CF of gas per day and 200–500 MMCF in its life. (500 MMCF x \$4/MCF* = \$2M gross revenue.)
- Horizontal Marcellus (or Utica?) well may produce around 2–10 MMCF of gas per day and are projected to average around 4 BCF of gas over their life, per well. (4 BCF x \$4/MCF* = \$16M gross revenue.)
- These large gas production increases lessen our purchases of imported energy, create jobs & retain wealth locally.

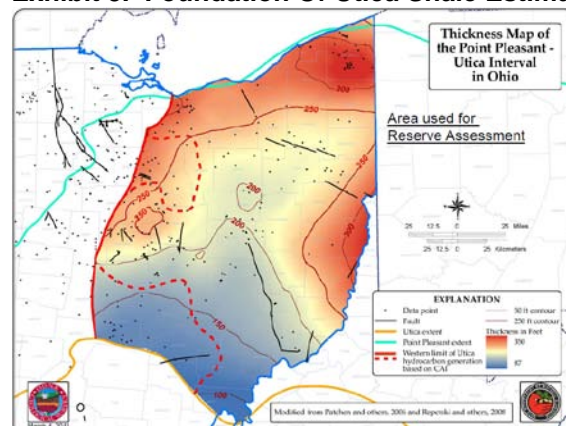
*Calculations show total gas sales for life of typical example wells assuming sale price of \$4 per MCF. Gas presently sells for \$10.00/MCF (10/28/10). Note that a typical horizontal well costs \$3–5 million, and there are other significant costs to produce and transport gas to market.

KEY M = million MMCF = million cubic feet (or 1,000 MCF)
MCF = thousand cubic feet BCF = billion cubic feet

Source: Ohio Dept. of Natural Resources

After demonstrating the economic significance of shale wells, the presentation moved on to a discussion of the geology of the Utica and the area of the formation utilized in developing an estimate of reserves in place.

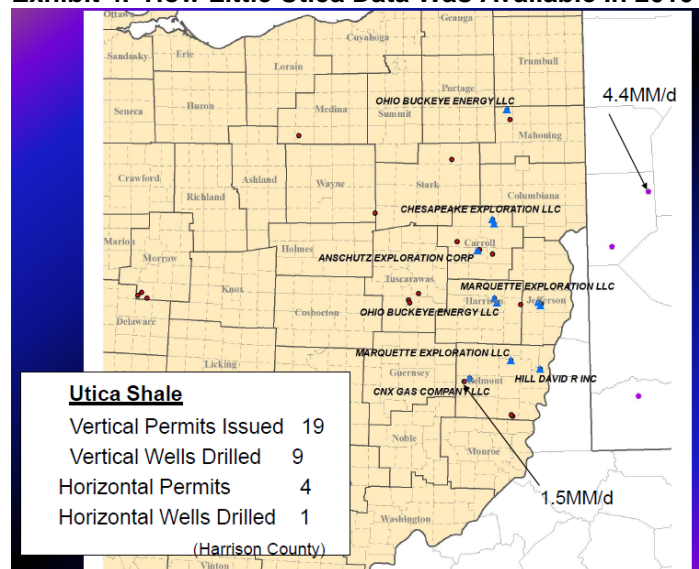
Exhibit 3. Foundation Of Utica Shale Estimate



Source: Ohio Dept. of Natural Resources

The presentation then showed how little drilling activity had taken place, at least in one prospective Ohio county.

Exhibit 4. How Little Utica Data Was Available In 2010



Source: Ohio Dept. of Natural Resources

While the formula appears straightforward, it actually requires estimating five important variables

From that point, the presentation shifted into the actual estimation of the possible reserves in place. It began with a discussion of the formula for calculating the Utica resource potential developed by two geologists in 1989. While the formula appears straightforward, it actually requires estimating five important variables. To project the volume of hydrocarbons contained in the field, it becomes necessary to estimate the volume of rock that could contain oil and gas, the density of the rock, the amount of carbon content in the rock, the percent of carbon converted into hydrocarbons and the percent of the reservoir space containing the hydrocarbons. By drilling core samples and analyzing the formation's rock composition, it is possible to make educated estimates. By correlating the rocks from the Utica with those from other similar basins, the accuracy of the estimates can be improved. But in the end, the estimates may be subject to wide degrees of error. Trying to estimate the degree of error may be a function of which side of the debate one is on. We liken it to the old beer commercial – “less filling” versus “tastes great” – both positive qualities but impossible to quantify.

Exhibit 5. How To Estimate Resource Potential**Method for Calculating Utica Oil Resource Assessment**

(Wallace and Roen, 1989)

$$Q_t = V \times D \times \text{TOC} \times C \times \%R$$

 Q_t = Quantity of hydrocarbons trapped (metric tons) V = Volume of rock (cubic meters) D = Rock density (kg /m) TOC = Total organic content (percent) C = Hydrocarbon conversion ratio (percent) $\%R$ = Reservoir space with hydrocarbons (percent)

(Recoverable % from shale as reservoir)

1 metric ton = 7.1475 barrels

Source: Ohio Dept. of Natural Resources

Remember that shale formations are the source of conventional oil and gas that migrates into a basin's various conventional traps

To help the audience understand the challenge of estimating the potential size of the Utica formation in Ohio, Mr. Wickstrom presented data from a study of the entire Appalachian Basin's Utica/Point Pleasant formation prepared in 1989. That study concluded the formation had migrated 13.26 billion barrels of crude oil to conventional reservoirs in the basin. Remember that shale formations are the source of conventional oil and gas that migrates into a basin's various conventional traps.

Exhibit 6. Base Case Assumptions For Utica Estimate**Resource Assessment for the Utica/Point Pleasant in the Entire Appalachian Basin (Wallace and Roen, 1989)** $D = 2.65 \times 10^3 \text{ kg /m}$ $\text{TOC} = 1.34 \text{ percent}$ $C = 10 \text{ percent}$ $\%R = 3 \text{ percent}$ $Q_t = 13.26 \text{ billion barrels of oil migrated to conventional reservoirs}$

Source: Ohio Dept. of Natural Resources

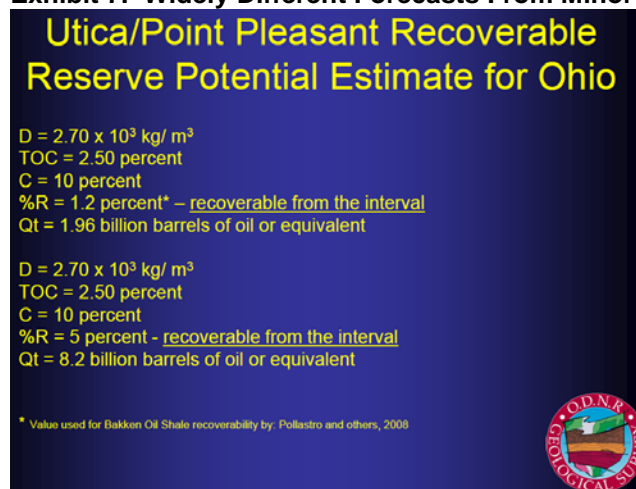
He undertook this exercise with the intent that the audience would have some "fun"

It was at this point that Mr. Wickstrom engaged the audience in an exercise to "manufacture" an estimate of the Utica's potential. He undertook this exercise with the intent that the audience would have some "fun." He started with the variables used in the 1989 study of the Utica formation for the entire Appalachian Basin. He suggested that based on more recent knowledge, we could increase the total organic content to 2.50% from the prior estimate of 1.34%. Then

What should be the percent of reservoir space containing hydrocarbons that can be recovered?

came the fun part. What should be the percent of reservoir space containing hydrocarbons that can be recovered? Mr. Wickstrom suggested we should start with the percentage figure used in the various studies of the Bakken formation – 1.2%. Plugging that number into the equation produced an estimate of 1.96 billion barrels of oil or its equivalent for the Utica formation.

Exhibit 7. Widely Different Forecasts From Minor Change

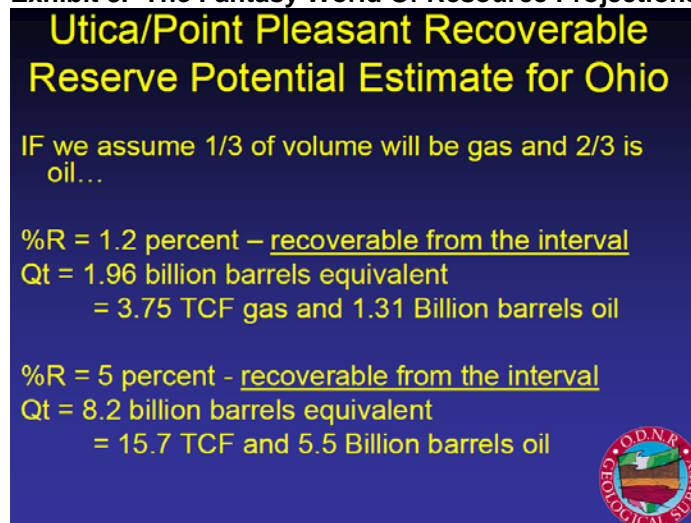


Source: Ohio Dept. of Natural Resources

That recovery estimate change produces a more than fourfold increase in total estimated reserves

But what happens if you change the recovery factor from the formation? Mr. Wickstrom boosted that number to 5%, and suddenly the Utica may contain upwards of 8.2 billion barrels of oil or its equivalent. That recovery estimate change produces a more than fourfold increase in total estimated reserves. What might that mean for crude oil and natural gas reserve estimates?

Exhibit 8. The Fantasy World Of Resource Projections



Source: Ohio Dept. of Natural Resources

Based on these estimates, the Utica reserves are either half the size of the Bakken field or more than one and a half times its size!

If you assume that the volume of hydrocarbons is split 1/3rd natural gas and 2/3rds crude oil, then we have a basin containing either 3.75 trillion cubic feet (TCF) of natural gas and 1.31 billion barrels of oil on the low side to potentially 15.7 TCF of gas and 5.5 billion barrels of oil on the high side. Based on these estimates, the Utica reserves are either half the size of the Bakken field or more than one and a half times its size! For natural gas, the estimated Utica shale resource represents either four-tenths of one percent of the nation's potential shale gas resources as estimated in the 2012 Potential Gas Committee report or it accounts for 1.5%, a significant difference.

The results of drilling would seem to not support the very optimistic estimate created by Mr. Wickstrom

The point of Mr. Wickstrom's presentation was to demonstrate that the Utica shale represented a significant opportunity for the oil and gas industry in Ohio. At the same time, however, one needed to be cautious about hyping the potential of the formation because there simply was not sufficient drilling and production history as of early 2011 to make reliable estimates. His "fun" exercise with the audience was designed to show how, using reasonable assumptions about the nature of the Utica shale formation and its recovery factor based on the performance of other shale plays in the U.S., one could create estimates of the potential oil and gas resources present ranging from highly conservative to overly optimistic. We are now two years later, and Mr. Wickstrom would have more data than available at the time of his presentation. Although Ohio only reports well production data annually, we certainly know more than we did two years ago. The results of drilling would seem to not support the very optimistic estimate created by Mr. Wickstrom. Therefore, the *Bloomberg* reporters, by using this most optimistic estimate, are helping to create and perpetuate an energy myth.

The only way to develop a model with greater confidence is to have wells drilled and producing, providing the data necessary to turn assumptions from highly speculative to solidly based

Having been in attendance during Mr. Wickstrom's presentation, we believe the audience understood that the two Utica shale resource estimates presented were just that – estimates. The audience had a much clearer understanding of how easy it was to manipulate an estimate by using "reasonable" assumptions from other shale plays that, when run through the model, yields an answer the model's operator desires. The only way to develop a model with greater confidence is to have wells drilled and producing, providing the data necessary to turn assumptions from highly speculative to solidly based. Energy myths may help make media articles about energy topics more sensational and attract greater readership, but they do little to promote fact-based conclusions.

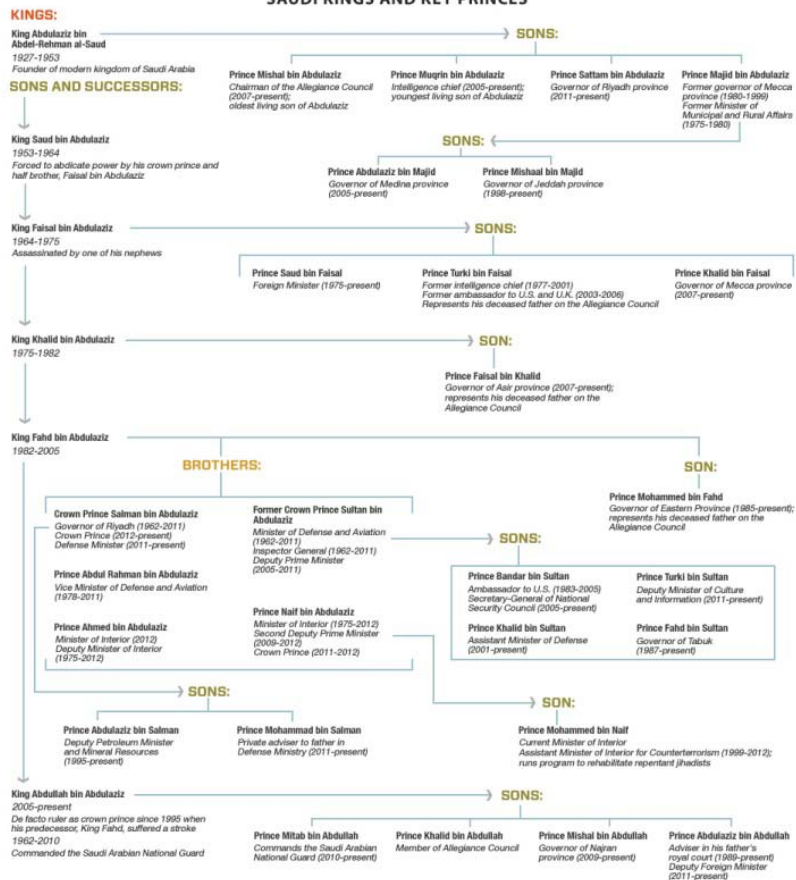
Announcement Of Saudi Government Change Ignored

A week ago, there was a very small item in the *Financial Times* about a move by Saudi Arabia King Abdullah to relieve the deputy defense minister, HRH Prince Khalid bin Sultan, of his duties. According to the report, the move came after the King considered a memorandum submitted by the crown prince and minister of

Prince Khalid is reportedly in the pool of future candidates for king, but we wonder about his status now

defense. A Saudi observer close to the royal family was quoted saying that there were several observations and complaints about his performance recently and the King wanted to send a strong message and set an example for others. Prince Khalid is reportedly in the pool of future candidates for king, but we wonder about his status now.

Exhibit 9. Saudi Royal Family Succession SAUDI KINGS AND KEY PRINCES



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Source: Stratfor

The royal family is on the brink of a generational change and the history of these changes in Saudi Arabia is not encouraging

We have written about the royal succession issue before because, even though it appears to be settled for the moment, the royal family is on the brink of a generational change and the history of these changes in Saudi Arabia is not encouraging. At the moment, the Kingdom is ruled by King Abdullah bin Abdulaziz who assumed the position following the death of his brother King Fahd bin Abdulaziz in 2005, but he had been the de facto ruler since 1995 when his brother suffered a stroke. There are two princes positioned under the King in the formal succession line with one of them destined to assume the leadership upon Abdullah's death. They are Crown Prince Salman bin Abdulaziz and Prince Muqrin bin Abdulaziz, the King's half-brother.

The problem is that they are old, ill and few in number

The key to understanding the significance of the impending leadership transition is tied to the history of succession in Saudi Arabia and the potential powder keg the royal family is sitting on. Since the death of the founder of the modern state of Saudi Arabia, King ibn Saud, in 1953, succession has moved only among his sons. The problem is that they are old, ill and few in number. At some point, possibly sooner than later, the succession will need to involve grandsons of ibn Saud, and there is no agreed formula other than the possibility that the last son will choose among his sons for that successor. When that happens, the House of Saud will enter a new world without the legitimacy that its leaders have enjoyed for nearly a century.

The two earlier ones collapsed due to external pressures and divisions within the family over succession questions

The current Saudi state is the third such state since 1745 created by the House of Saud. The two earlier ones collapsed due to external pressures and divisions within the family over succession questions. Importantly, the Saudi states have all been based on a unique partnership between the Saudi royal family and the conservative clerical establishment begun by Muhammad ibn Abd al Wahhab, one of the most important Islamic clerics since the earliest days of the faith. This partnership relationship extends beyond the borders of Saudi Arabia because the country is host to the two holiest cities of the Islamic religion meaning that any problems within this partnership will go global quickly.

The fragility of the state and clerical partnership is highlighted by the social and demographic issues bedeviling the Kingdom

The fragility of the state and clerical partnership is highlighted by the social and demographic issues bedeviling the Kingdom. Saudi Arabia's population is quite young – 60% of Saudis are 20 years old or younger. Their prospect for finding fulfilling jobs is not promising. Some 70% of Saudis cannot afford to own their own home. Approximately 40% of Saudis live below the poverty line. With 25,000 princes and princesses owning most of the valuable land in the Kingdom and all receiving a stipend and a share of the fortune, the income inequality is significant. Moreover, Saudi Arabia's economy depends on foreign labor to function. There are 19 million Saudis and 8.5 million guest workers, suggesting they could become a significant force in any period of social unrest depending on the reason.

The Saudi-Wahhabi relationship has been, and remains crucial to the stability of Saudi Arabia

Another disruptive social trend is the fact that 60% of Saudi college graduates are women but they only represent 12% of the work force. These young, educated women are demanding greater rights such as the right to drive a car. As these social pressures increasingly clash with the conservative Wahhabi Islamist religious dictates, the King has been forced to seek policies that keep the various pressures under control. The Saudi-Wahhabi relationship has been, and remains crucial to the stability of Saudi Arabia. That is why the King has spent in excess of \$130 billion on new stipends and projects to buy political and social peace in the country since the start of the Arab Spring.

What we do know, however, is that the succession change will usher in a new era for the House of Saud

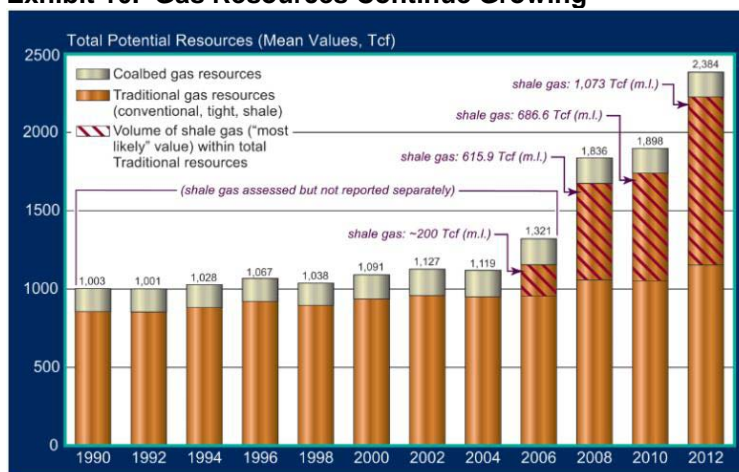
In the past there have been some very brief periods of instability within Saudi Arabia, but they have been resolved with only minor adjustments to the controlling power. There is not much known about the temperament or views of the Saud grandsons. When that transition occurs not only might the internal structure and society of Saudi Arabia change, but the role the country plays in the Middle East as an influencing political power and in the global petroleum industry as a moderating force may all change. In what ways may it change? We don't know, and doubt anyone else knows. What we do know, however, is that the succession change will usher in a new era for the House of Saud, and we should all be paying attention to any preliminary acts.

Gas, Gas And More Gas – Domestic Resource Base Expands

The PGC concluded there is a total technically recoverable resource base of 2,384 trillion cubic feet (Tcf) of gas

Earlier this month the Potential Gas Committee (PGC), an incorporated, nonprofit organization made up of knowledgeable and highly experienced volunteer members who work in the natural gas exploration, production, transportation and distribution industries and in the field and technical services and consulting sectors, delivered its latest assessment of the natural gas resource potential for the United States. The PGC concluded there is a total technically recoverable resource base of 2,384 trillion cubic feet (Tcf) of gas, including both natural gas and coalbed gas, but excluding proved dry-gas reserves, the highest evaluation in the 48-year history of assessments. The 2012 assessment exceeds by 486 Tcf, or 25.6%, the 2010 assessment, which was the prior peak and the increase reflects the analysis of recent drilling, well testing and production data. Importantly, the current assessment assumes neither a time schedule for the development of these resources nor a specific market price that would determine the relative attractiveness for producing the resource.

Exhibit 10. Gas Resources Continue Growing



Source: PGC

Of the 486.4 Tcf increase in traditional gas resources compared to the 2010 assessment, nearly 80% was attributable to the increased assessment for the Atlantic region

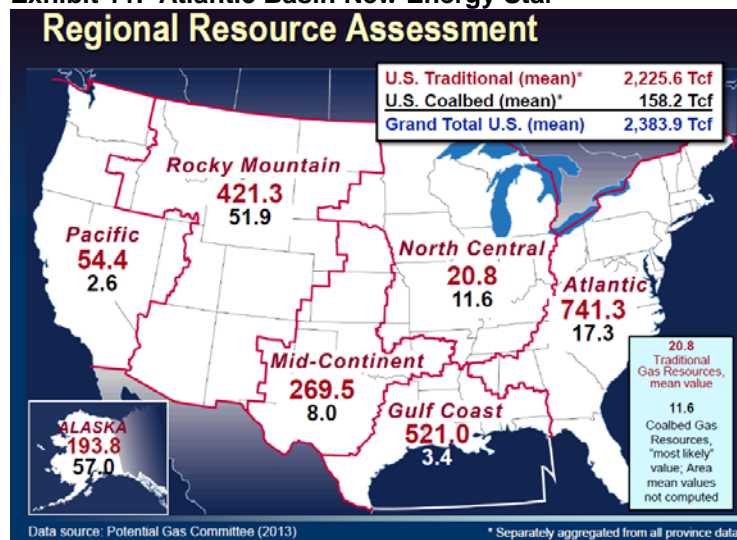
About 3% of the total increase in the total assessment came from the Gulf Coast region including the Gulf of Mexico

The increased assessment was driven principally by new evaluations of shale gas resources in the Atlantic, Rocky Mountain and Gulf Coast areas. Shale gas resources were estimated at 1,073 Tcf for 2012 and represents 48% of the country's total traditional potential resource. Of the 486.4 Tcf increase in traditional gas resources (both conventional and shale gas) compared to the 2010 assessment, nearly 80% was attributable to the increased assessment for the Atlantic region. This increase was related to the greater volume assigned to the Marcellus formation, but also increases for other Devonian shales and the Utica formation, which collectively accounted for 335 Tcf of the region's total increase of 388 Tcf, or 86% of the total.

Nearly 16% of the total resource increase came from a new assessment of the Rocky Mountain region, primarily in the Greater Green River basin and the San Juan basin, in each case more than double the province's total potential gas assessment for 2010. The Niobrara formation in the Denver basin was reassessed to a record volume of 7.5 Tcf, an increase of nearly 3.5 Tcf. About 3% of the total increase in the total assessment came from the Gulf Coast region including the Gulf of Mexico. The increase was almost totally due to a 21.6 Tcf increase in the assessment of the potential resource in the Eagle Ford shale in South Texas.

The coalbed resource estimate reflected a decline of 0.4 Tcf from 2010's assessment. It is also interesting to note that the Department of Energy's estimate of dry-gas reserves of 304.6 Tcf has not been updated from the year-end 2010 estimate. That means that when the DOE updates its estimate to a more recent date, the total potential gas estimate may change, although it is not likely to change materially.

Exhibit 11. Atlantic Basin New Energy Star



Source: PGC

The largest growth (264.6 Tcf) occurred in the possible category, which grew in significance by 3.5 percentage points

Another interesting breakdown of the resource assessment is the distribution and changes by category – probable, possible and speculative. Between 2010 and 2012, the primary shift in resource classification was between possible and speculative, with the former increasing in importance and the latter declining as shown in Exhibit 12. That shift is further confirmed when one examines the resource growth by classification between the two surveys and the percentage change. The largest growth (264.6 Tcf) occurred in the possible category, which grew in significance by 3.5 percentage points, while the smallest growth was in the speculative (40.4 Tcf) category. We have to assume that the reason for the disproportionate growth is a function of shale resources that are treated as having little exploration risk. As a result, since a higher proportion of wells are productive (not necessarily profitable), the ability of the scientists to ascribe resources to the well and its surrounding area is greater, helping to expand the probable and possible categories.

Exhibit 12. Category Of Gas Resource Growth

(Mean Values, Tcf)	Tcf	Pct. Of	Tcf	Pct. Of	Change	
	2012	Total	2010	Total	Tcf	Pct.
Traditional Gas Resources:						
Probable resources (current fields)	708.5	31.8	536.6	30.9	171.9	32.0
Possible resources (new fields)	952.3	42.8	687.7	39.5	264.6	38.5
Speculative resources (frontier)	558.7	25.1	518.3	29.8	40.4	7.8
Total Traditional Gas Resources*	2225.6		1739.2		486.4	28.0
* not additive						

Source: PGS, PPHB

Current natural gas prices, while having doubled from a year ago, still remain well below the levels they were at when the shale gas revolution commenced and at a level that raises issues of profitability

The PGC report didn't receive much media attention. That is probably due to the fact that shale plays dominate the industry news and discussion, so telling the industry, and the world, that there is a substantial resource base is nothing new. Dr. John B. Curtis, Professor of Geology and Geological Engineering at the Colorado School of Mines and Director of the Potential Gas Agency there, which provides guidance and technical assistance to the PGC commented about the growing knowledge about the geological endowment of the nation. Although questions about the recovery of this potential resource remain unanswered, current natural gas prices, while having doubled from a year ago, still remain well below the levels they were at when the shale gas revolution commenced and at a level that raises issues of profitability. Since the PGC does not deal with gas prices, and subsequently the profitability of natural gas development in this country, Dr. Curtis' optimistic statement cannot really be challenged. He was quoted in the PGC press release stating, "Consequently, our present assessment, strengthened by robust domestic production levels, demonstrates an exceptionally strong and optimistic gas supply picture for the nation." What remains open for debate is the "strong and optimistic gas supply picture" assessment. On the surface, the figures would support that conclusion. Below the surface (pardon the pun), the foundation of this shale gas revolution may not be as sound.

Oil Industry On Alert – Active Hurricane Season Forecast

The forecasters “anticipate an above-average probability for major hurricanes making landfall along the United States coastline and in the Caribbean”

These higher than historic probabilities will have the U.S. petroleum industry on alert during the upcoming season

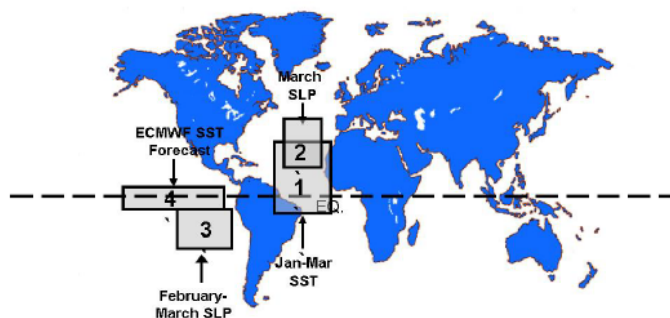
The forecasters say that this model correctly predicted above- or below-average seasons in 22 out of 31 hindcast years, a 71% average

Earlier this month, the tropical storm forecasting team of Philip J. Klotzbach and William M. Gray, professors in the Department of Atmospheric Science at Colorado State University (CSU), released their first forecast for the upcoming hurricane season. They are calling for the season to experience “enhanced activity compared with the 1981-2010 climatology,” meaning it will be an active storm season. Furthermore, the forecasters “anticipate an above-average probability for major hurricanes making landfall along the United States coastline and in the Caribbean.” In other words, be prepared.

Based on the work the tropical storm forecasting team has done in conjunction with the GeoGraphics Laboratory at Bridgewater State University in Massachusetts, the model predicts that there is a 72% probability of a major hurricane making landfall along the entire U.S. coastline compared to a 52% average for the past century. For the U.S. East Coast including the Florida Peninsula, the probability of landfall is 48% versus a 31% historic record. For the Gulf Coast from the Florida Peninsula to Brownsville, Texas, the probability is 47% compared to a 30% record. The model also estimates that the Caribbean has a 61% probability versus 42% historically of experiencing a major hurricane landfall. These higher than historic probabilities will have the U.S. petroleum industry on alert during the upcoming season although even with a very low probability it only takes one storm to create serious disruption and economic hardship.

The CSU forecasters are using a relatively new April forecasting model that employs four predictors they have found to have an above-average predictive value. This is the third year the forecasters have used this model, which is built on data from 1982-2010. The model incorporates the most recent and reliable data available, which the forecasters believe helps improve the model's predictive ability. They said these four predictors helped the model to correlate with the Net Tropical Cyclone Activity (NTC) at 0.79 when all years studied are included. A drop-one cross-validation analysis yields a correlation with the NTC of 0.68. This is a more realistic view of the skill the model will have in future years. The forecasters say that this model correctly predicted above- or below-average seasons in 22 out of 31 hindcast years, a 71% average. The model's predictions have had a smaller error than climatology in 19 of 31 years for a 61% average.

The predictors used in the model include the average sea surface temperature (SST) in the Atlantic basin in the January to March period, the sea level pressure (SLP) for March in the central Atlantic Basin and the February to March SLP in the Pacific Ocean region off South America, and the European Centre for Medium-Range Weather Forecast (ECMWF) of the SLP in the Pacific Ocean along the Equator.

Exhibit 13. Predictors Used In Hurricane Model**New April Forecast Predictors**

Source: CSU

The CSU forecast calls for 18 named tropical storms during the season with nine hurricanes and four of them becoming intense hurricanes

The CSU forecast calls for 18 named tropical storms during the season with nine hurricanes and four of them becoming intense (major) hurricanes, meaning they are storms in the intensity range of 3-4-5. They believe that 2013's activity will be similar to the 2011, 2010 and 2009 years with the exception of the number of intense hurricanes last year. This year's activity would also compare with 2008, but not as intense as 2005 when there were 26 named storms and seven intense ones and 2004 with 14 named storms and six intense hurricanes. The comparison of the April forecast with the most recent six years is displayed in Exhibit 14.

Exhibit 14. Storm Forecast Calls For Active Year In 2013

Forecast Parameter and 1950-2010 Climatology (in parentheses)	Forecast 10-Apr-13	2012	2011	2010	2009	2008	2007
Named Storms (12)	18	19	19	19	9	16	15
Named Storm Days (60.1)	95.00	99.50	89.75	88.25	30.00	84.75	34.5
Hurricanes (6.5)	9	10	7	12	3	8	6
Hurricane Days (21.3)	40.00	26.00	26.00	37.50	12.00	29.50	11.25
Intense Hurricanes (2.0)	4	1	4	5	2	5	2
Intense Hurricane Days (3.9)	9.00	0.25	4.50	11.00	3.50	8.50	5.75

Source: CSU, PPHB

None of the analog years had a significant El Niño during the peak of the hurricane season, which is the condition anticipated this year

The reason for the above-average forecast this season for tropical storms, hurricanes and intense hurricanes is because the meteorological projections call for the combination of an anomalously warm tropical Atlantic basin and a relatively low likelihood of the formation of an El Niño. To modify the forecast from the output of the model, the forecasters look to analog years. In selecting the analog years, the forecasters look for those years with similar meteorological conditions as projected for this season. None of the analog years had a significant El Niño during the peak of the hurricane season, which is the condition anticipated this year. The forecasters are anticipating that 2013 will have more activity than the average of the five analog years selected – 1915, 1952, 1966, 1996 and 2004.

Exhibit 15. Analog Years For 2013 Storm Forecast

Year	NS	NSD	H	HD	MH	MHD	ACE	NTC
1915	6	48.25	5	30.50	3	13.75	127	129
1952	7	39.75	6	22.75	3	7.00	87	103
1966	11	64.00	7	41.75	3	8.75	145	140
1996	13	79.00	9	45.00	6	13.00	166	192
2004	15	93.00	9	45.50	6	22.25	227	232
Avg.	10.4	64.80	7.2	37.10	4.2	13.00	151	159
Forecast								
4/10/13	18	95.00	9	40.00	4	9.00	165	175

Source: CSU, PPHB

The development of El Niño could alter the forecast meaningfully

The next forecast update will be produced at the beginning of June and it will be interesting to see what modifications are made. The development of El Niño could alter the forecast meaningfully, but the likelihood is that this year will be more active – consistent with the more active tropical storm phase for the Atlantic basin. If the CSU forecast on landfall potential proves correct, the energy industry will need to be vigilant and is likely to have several episodes when offshore operations will need to be shut down and crews evacuated. That will mean the Gulf will produce less oil and gas this summer than potentially anticipated now by operators and forecasters. All of these possibilities need to be considered when making projections about how the domestic energy business will play out in 2013.

Economic Outlook Continues To Weigh On Energy Markets

The analysis concluded that the country's GDP grew at an annual rate of 2.5%, well below the consensus estimate of business economists who anticipated a 3.2% growth rate

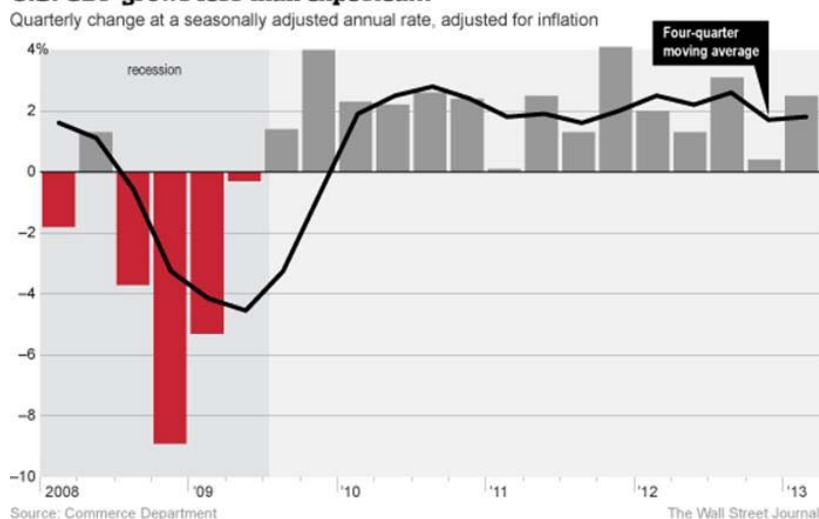
Last Friday, the first look at the performance of the U.S. economy in the first quarter of 2013 was released by the federal government. The analysis concluded that the country's Gross Domestic Product (GDP) grew at an annual rate of 2.5%, well below the consensus estimate of business economists who anticipated a 3.2% growth rate. Earlier in the week, the weekly initial unemployment claims data was positive with a 16,000 drop to 339,000. While this figure was praised, some observers suggested that the improved weekly claims data, the best weekly performance in nearly five years, was more a reflection of the cessation of job layoffs and the exhaustion of unemployment insurance benefits for many workers who have been unemployed for a long time. If that observation is correct, it may signal help with the April unemployment report due out this week. The drop in the unemployment rate in recent months has occurred not because the job market has improved, but rather because more people were dropping out of the labor market and giving up on seeking a job, so they are not included in the unemployment rate calculation.

The problem for the U.S. economy is its inability to accelerate the pace of growth. Compounding the problem is that policy makers and economic and financial advisors have been unable to determine which government policies are holding the economy back and which

The latest battle in this policy debate is the uproar over a 2010 research paper on the relationship between the level of national debt and a country's growth rate

ones might accelerate its growth. The latest battle in this policy debate is the uproar over a 2010 research paper on the relationship between the level of national debt and a country's growth rate authored by Harvard professors Carmen Reinhart and Kenneth Rogoff. For that paper they provided their spreadsheet to a team of researchers from the University of Massachusetts Amherst who found a mathematical mistake that when corrected minimized the magnitude of the countries' growth reduction due to their high debt-to-GDP ratios. One issue is that this was a slightly different academic paper written after the publication of their breakthrough book, This Time Is Different, and that the error was in the research for the paper and not for the book. Because politicians had referenced this work to push austerity measures in countries where the growth of their debt was out of control, the error is being used by economists and politicians who wish to ramp up government spending regardless of their current debt level as a tonic for stimulating economic growth. The problem is that substantial stimulus has been tried by our current administration with little positive impact.

**Exhibit 16. 1st Quarter GDP Up But Still Disappoints
U.S. GDP grows less than expected...**



Prospects are that the growth won't improve until possibly 2014

While the U.S. economy grew faster in 2013's first quarter than in the fourth quarter of last year, full year 2013 growth estimates continue to lag the pace of historical recoveries since 1970. As seen in Exhibit 17, the current recovery from the recession of 2008-09 is the lowest of any of the prior five economic recoveries. Prospects are that the growth won't improve until possibly 2014, but that may prove optimistic as that is the year the full extent of the Affordable Care Act (a.k.a. Obamacare) with its tax and penalties takes effect. In addition, Congress is working on a revision of the U.S. tax code and possibly higher taxes and reduced entitlement benefits, all of which would impact consumer spending and business investment.

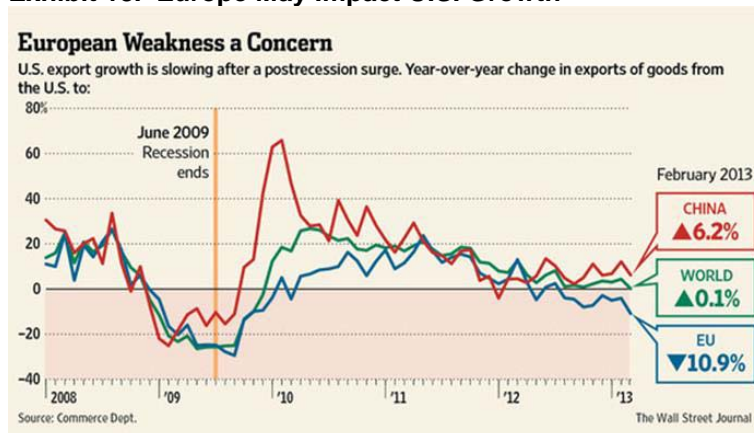
Exhibit 17. Slowest Economic Recovery Since '70s

Average Annual GDP Growth in Expansions	
2009 - 2013	2.0%
2001 - 2007	2.6%
1991 - 2000	3.7%
1982 - 1990	3.8%
1980 - 1981	4.4%
1975 - 1980	4.3%

Source: *The Wall Street Journal*, PPHB

The very precarious condition of the Eurozone economies – they are officially in a recession – means they are not helping boost the U.S. growth rate

One of the concerns about the health of the U.S. economy and the pace of its growth is its relationship to important overseas economies. As shown in Exhibit 18, the U.S. economy depends on exports to various countries, and in particular, European countries for a component of its growth. The very precarious condition of the Eurozone economies – they are officially in a recession – means they are not helping boost the U.S. growth rate. If they were, it could help drive meaningful growth for the world economy.

Exhibit 18. Europe May Impact U.S. Growth

Source: *The Wall Street Journal*

The IMF has also reduced its 2014 growth rates for economies, although the reductions appear very modest

In addition to the reductions in growth for the United States economy, growth rates for economies around the world are being ratcheted down by researchers such as the International Monetary Fund (IMF). Their latest cuts are shown in Exhibit 19. The IMF has also reduced its 2014 growth rates for economies, although the reductions appear very modest (Exhibit 20, next page.). One might speculate that the 2014 estimates are not receiving close attention because the events of 2013 may have a much greater impact on those future estimates than anything else.

Exhibit 19. 2013 Not Unfolding As Originally Expected**Gloomy outlook: IMF's 2013 forecasts**

Annual % change in GDP

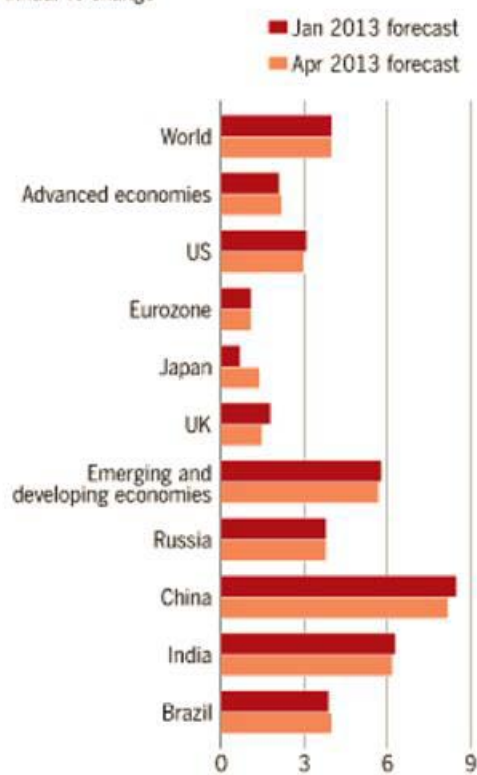


Source: IMF

Source: Financial Times

Exhibit 20. 2014 Growth Estimates Reduced**IMF forecasts for GDP growth in 2014**

Annual % change



Source: IMF

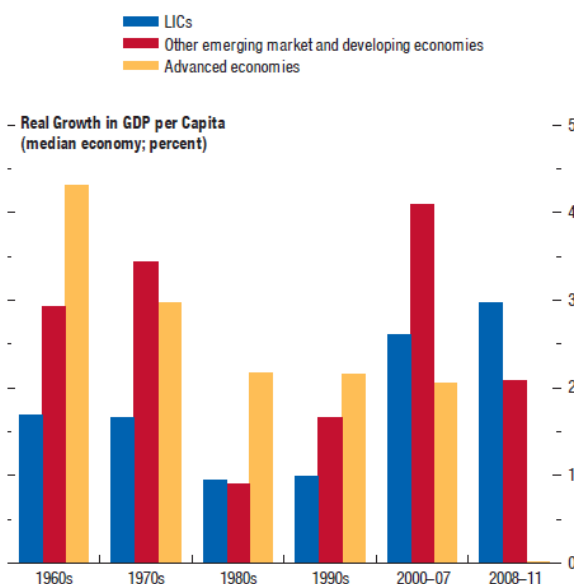
Source: Financial Times

Low-income emerging countries are now performing better than other emerging economies and developing economies and they are performing much better than advanced economies

The slowing economic growth is not a good omen for global energy demand. On the other hand, we found the following chart on economic performance for different classes of countries quite interesting, and part of the explanation why the oil and gas business can look forward to growth, albeit not like the growth of the post-World War II era. The chart in Exhibit 21 shows that low-income emerging countries are now performing better than other emerging economies and developing economies and they are performing much better than advanced economies.

Exhibit 21. Low Income Economies Show Best Growth

Low-income countries (LICs) have seen a major improvement in their economic performance since the 1990s. Growth in output per capita for the median LIC has increased since the 1990s. It is now higher than median growth in other economy groups.



Sources: IMF, World Economic Outlook database (October 2012); Penn World Table 7.1; World Bank, World Development Indicators database; and IMF staff calculations.
Note: Economy groups and indicators are defined in Appendix 4.1. Real GDP per capita is in purchasing-power-parity terms. The 2008–11 median of real GDP per capita growth of advanced economies is near zero (0.02 percentage point).

Source: The Wall Street Journal

There are seeds of energy growth being sowed as demonstrated by the better performance of low income emerging economies

We believe it is going to be hard for energy demand to grow in the current economic and political environment. That said, there are seeds of energy growth being sowed as demonstrated by the better performance of low income emerging economies, which are larger energy consumers. Hopefully the world's economies will begin to recover and grow as that will be the easiest way to ensure that social unrest and civil disobedience do not become the primary way people deal with the lack of jobs and food, which can be the long-term outcome of a subpar growing economy.

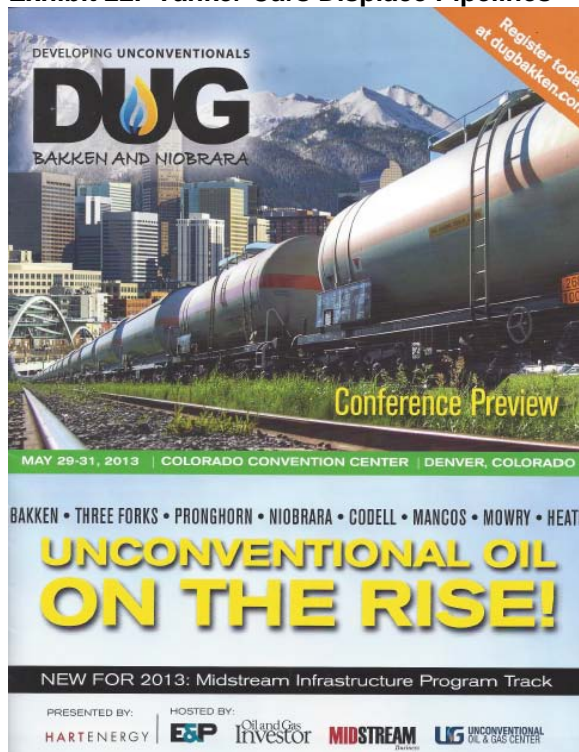
Random Energy Thoughts

It wasn't that long ago when rail was never considered an option for hauling crude oil around the country

Unconventional And Rail – How Unconventional Is That?

We were surprised when we received a brochure in the mail advertising Hart Energy's conference in Denver on developing unconventional crude oils – the Bakken and Niobrara formations – to see railroad tanker cars featured prominently. It wasn't that long ago when rail was never considered an option for hauling crude oil around the country, but the explosion of shale and tight oil output from areas lacking substantial pipeline infrastructure has forced the oil industry to seek unconventional transportation options.

Exhibit 22. Tanker Cars Displace Pipelines



Source: **Hart Publications**

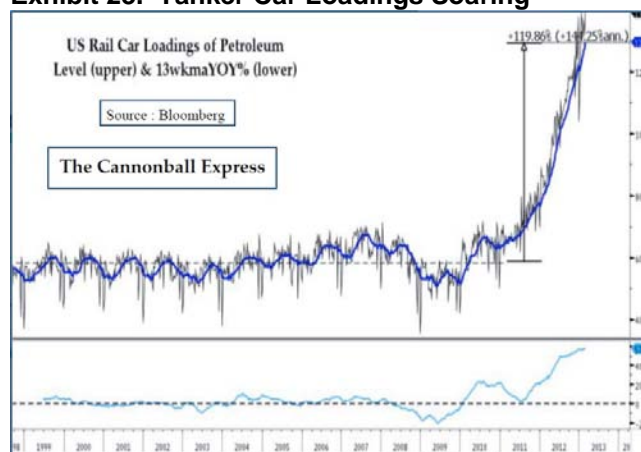
Tank cars accounted for more than 30 percent of the rail cars built in 2012 and they will account for closer to 50 percent this year

The increase in oil volumes being shipped by rail has been dramatic in recent years. Prospects are that rail shipments of petroleum products - crude oil, bitumen, natural gas liquids and even refined petroleum products - will continue to climb over the next few years based on the number of tanker cars on order and the industry's increased investment in unit-train loading and unloading facilities. Tank cars accounted for more than 30 percent of the rail cars built in 2012 and they will account for closer to 50 percent this year. In 2012, more than 17,000 tank cars, most destined to move crude oil from the Bakken formation in North Dakota and Montana, were

Producers are enjoying the flexibility of being able to ship their crude oil and natural gas liquids output to the highest bidder anywhere in the country

delivered. In 2013, the total should exceed 20,000 as the backlog of unfilled orders is currently in excess of 46,000 cars and represents more than two year's production. Producers are enjoying the flexibility of being able to ship their crude oil and natural gas liquids output to the highest bidder anywhere in the country. Likewise, refiners and petrochemical processors are welcoming the ability to purchase their raw material supplies from more sources than if they were completely dependent on a single pipeline from a single basin. This purchasing flexibility may become increasingly more important in a market with relatively flat demand growth but rising raw material costs.

Exhibit 23. Tanker Car Loadings Soaring



Source: zerohedge.com

As more shale plays are developed, they are likely to be smaller in extent and produce less volume, factors that favor the most flexible transportation systems

As more shale plays are developed, they are likely to be smaller in extent and produce less volume, factors that favor the most flexible transportation systems. While pipelines will not be made obsolete, the increased challenges for gaining rights-of-way and permits for the construction of new lines will give rail a near-term competitive advantage. Those of us used to always assuming pipelines were the preferred method of transportation will need to adjust our thinking. That's not a bad thing.

Barron's Spring 2013 Big Money Poll Likes Energy

Those managers look for technology, energy and financial stocks to lead the market over the next 12 months

Last week, the financial newspaper, *Barron's*, conducted its semi-annual survey of 135 institutional money managers ranging from small firms to some of the largest asset managers in America. Those managers look for technology, energy and financial stocks to lead the market over the next 12 months. Nearly three-quarters of the managers are bullish or very bullish, maybe not the best sign about the future. However, since over half of them expect the economy to grow in the 2.0-2.5% range for the next 12 months, and most don't expect the Federal Reserve to raise interest rates before 2014, inflation won't be a serious issue, although 60% expect it will be higher than it has been in the past 12 months.

On the other hand, no energy stocks were listed as overvalued

Consistent with this view of moderate growth, continued low interest rates and modestly higher inflation, the money managers are calling for crude oil prices to average \$91.87 a barrel this year and \$94.56 in 2014. While energy is the second most favored investment sector, in response to the question "Name your favorite stock for the next six to 12 months," only National Oilwell Varco (NOV-NYSE) was cited. On the other hand, no energy stocks were listed as overvalued. Where there has been a significant shift among investors has to do with underperforming energy companies that have been attracting activist investors. If the Big Money Poll is correct, many energy company activist shareholders will be going home with handsome profits in 2014. On the other hand, if the poll results are wrong, look for more activist shareholders to target energy companies later this year. Investors may like that outcome, but we doubt the energy company managements will be quite as happy.

LNG And U.S. Railroads

Operators of truck fleets or buses that leave and return to the same facility each day are considering, and in some case committing to, natural gas fuel

The U.S. natural gas industry covets a portion of the domestic transportation market to solve its oversupply problem. Compressed natural gas (CNG) for the automobile market is one target and liquefied natural gas (LNG) for the over-the-road trucking industry is another. Operators of truck fleets or buses that leave and return to the same facility each day are considering, and in some case committing to, natural gas fuel. Another transportation market targeted by LNG is the railroad industry. With the enthusiastic support of BNSF, the nation's second-largest rail network owned by Berkshire Hathaway (BRK.B-NYSE) and run by the iconic Warren Buffet, General Electric (GE-NYSE) and Caterpillar (CAT-NYSE) are cooperating in trials of the new technology due to start later this year. Locomotives will be built to run on LNG and the super-cooled fuel will either be kept within the locomotive or in an adapted freight car. GE Transportation, one of the two large locomotive builders says it is developing LNG-powered engines that should produce at least the same power as existing locomotives fueled by diesel.

Since there is no proof yet that LNG-fueled engines can generate the same power as a diesel-fueled one, railroads may be reluctant to jump on this strategy

The head of BNSF says that his line could convert to LNG on its own. However, the heads of Union Pacific (UNP-NYSE), Norfolk Southern (NSC-NYSE) and CSX Corp. (CSX-NYSE) say that it is feasible to convert, but if others do not make the switch at the same time, the efficiency of the existing railroad system could suffer when differently-powered engines must travel on the tracks of other railroads. Since there is no proof yet that LNG-fueled engines can generate the same power as a diesel-fueled one, railroads may be reluctant to jump on this strategy, even though the economics of operating LNG-engines appear to work. It is evident other railroad CEOs don't share the same enthusiasm for switching to LNG as does Matt Rose, the CEO of BNSF, who said, "We don't change a lot in our industry. There was a big change from steam to diesel. This is that kind of change." We will see.

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