
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

Could The U.S. LNG Market Be Derailed Before It Starts?

Takeaways from the presenters often become discussion and data points

Early in the morning on Halloween, we joined a few hundred other energy professionals in the ballroom of the Westin Galleria to eat breakfast and hear from a panel of industry experts about the future of the oil and gas business. The occasion was another of Decision Strategies' Oilfield Breakfast Forums, held twice a year since the forum was founded in 1994. Having been a participant on a number of these panels in the past, we understood the significance of the session as the takeaways from the presenters often become discussion and data points that resonate throughout the industry for at least the next several days and possibly even for weeks afterward.

Dr. Tinker has also been the lead investigator in a series of studies conducted by the BEG to examine the major shale basins around the country to ascertain estimates of their reserves and future production potential

The panel of experts included Reagan (R.T.) Dukes, senior analyst with the London-based oil and gas consulting firm Wood Mackenzie, April Sharr, business development manager for the water management business of Baker Hughes Corp. (BHI-NYSE), Robert N. Erlich, Senior Vice President, Exploration and New Ventures for PanAtlantic Exploration Company, and Dr. Scott Tinker, professor of geology at the Jackson School of Geology at the University of Texas at Austin and the director of the Texas Bureau of Economic Geology (BEG). Dr. Tinker has also been the lead investigator in a series of studies conducted by the BEG to examine the major shale basins around the country to ascertain estimates of their reserves and future production potential. The bureau has already completed and released the results of three basin studies – the Barnett, Haynesville and Fayetteville – and has completed a fourth – the Marcellus - but the results have not been officially released.

It was Dr. Tinker's presence on the panel that prompted us to attend the early morning breakfast meeting. We had been introduced to Dr. Tinker earlier this year when he was a participant, along with two

Not only can we meet increased domestic gas demand but we can also create a meaningful liquefied natural gas (LNG) export business

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other industry experts, on a panel dealing with the shale revolution hosted by *Texas Monthly* magazine in conjunction with the James A. Baker III Institute for Public Policy at Rice University. One of the other participants at the Rice presentation was Dr. Ken Medlock, a professor of energy economics and the head of the Gas Institute at the Baker Institute, who played a role in Dr. Tinker's presentation.

In the course of the morning's presentations, the audience was treated to a bullish view of the impact of the shale revolution on the future of America's oil and natural gas production. We were assured that there is sufficient oil and gas reserves to not only grow the nation's petroleum production, but also to do so in a low-price environment. We were also assured that natural gas production could grow to meet expanding industrial demand coming from new and expanded petrochemical plants in this country, often being built by European and other international companies who find the cheap gas in America to be a key economic driver. Additionally, not only can we meet increased domestic gas demand but we can also create a meaningful liquefied natural gas (LNG) export business. All of this growth can be accomplished while natural gas prices remain in the \$4-\$5 per thousand cubic feet (Mcf) price range until well into the next decade. At the same time, America can look forward to its domestic oil output continuing to climb from its present 26-year high to nearly 10 million barrels per day, a level not seen since 1971.

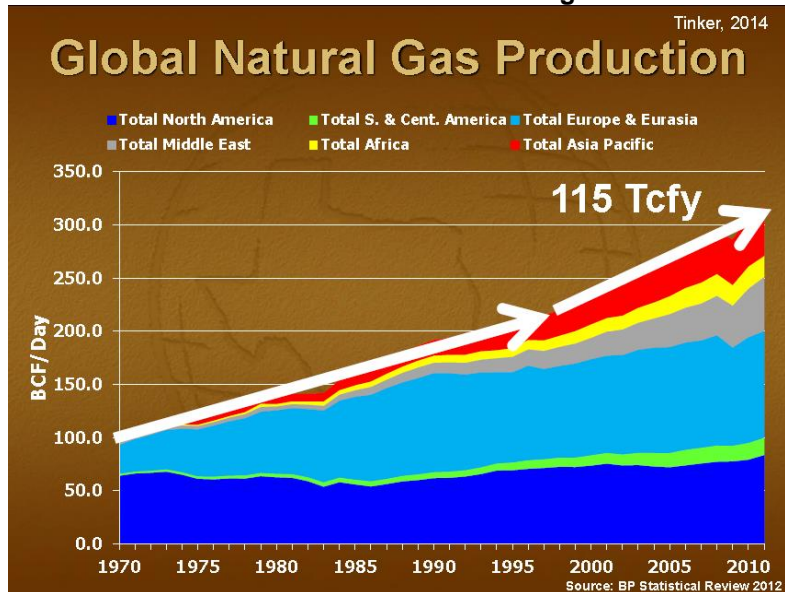
We were also educated about the challenge the nation faces with having adequate water resources to meet the needs of individuals along with those of the agriculture and energy sectors. We were shown how the oil and gas industry is working to reprocess produced and flowback water from hydraulic fracturing wells. Yes, the nation faces a challenge in managing its water resources, especially given the droughts that have plagued the western half of the country over the past few years. Importantly, with the steps the petroleum industry is undertaking to reuse water and consume less fresh water, this crisis should not be an insurmountable barrier to greater oilfield activity in the future.

Lastly, the roles of private equity and other financing sources for exploration and development activities were explored. Despite oil prices having only recently begun making the news due to their precipitous drop and natural gas prices continuing to be buffeted by the latest weather forecasts, this long-term, value-creating private equity money will likely remain committed to the oil and gas industry and continue to provide the necessary capital companies need to explore, develop and produce the abundance of shale resources believed to be present both here and abroad.

These three presentations set the stage for Dr. Tinker who began with a chart showing the history of global natural gas production growth and how it has accelerated over the past 15 years, largely as a result of the shale revolution in North America. Certainly,

increased gas output from the Middle East and Asia – mostly in the form of LNG – has helped boost global production, but North America has been the real driver recently.

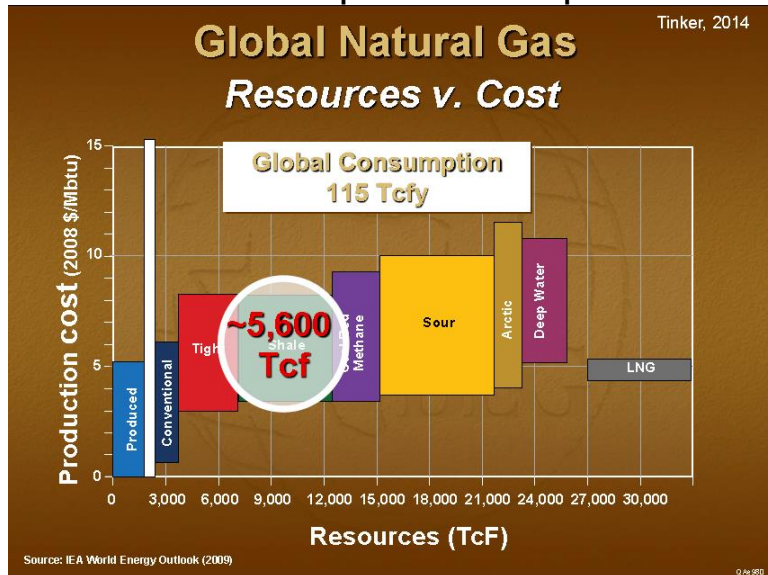
Exhibit 1. Global Gas Production Is Growing Market



Source: Tinker, BEG

Dr. Tinker followed with a slide utilizing data from the International Energy Agency (IEA) showing estimates of the global natural gas resource base by types of gas and estimates of the cost to produce them. As shown in Exhibit 2, the world has already consumed about

Exhibit 2. Shale Gas Is Expensive But Cheaper Than Others



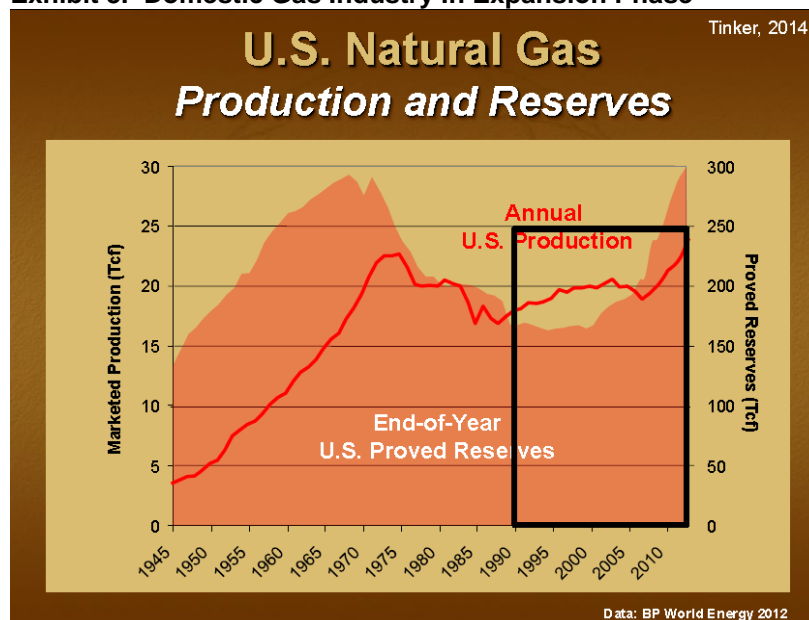
Source: Tinker, BEG

Natural gas reserves peaked in the late 1960s before beginning a nearly 30-year decline that bottomed around 1995

2,500 trillion cubic feet (Tcf) of gas, but that still leaves the world with an estimated 24,000 Tcf of gas resources. As the chart demonstrates, each category of gas can be measured not only for its relative contribution to the global resource base, but also for the cost range to produce it.

Dr. Tinker shifted from a global resource perspective to the United States. He presented a slide based on BP Ltd. (BP-NYSE) data covering America's natural gas reserves and production history beginning after World War II and through the glory years of the gas business until the early 1970s. As the chart shows, natural gas reserves peaked in the late 1960s before beginning a nearly 30-year decline that bottomed around 1995. Since then, natural gas reserves have climbed aided by the shale revolution. In fact, those shale resources have contributed to total domestic natural gas reserves now exceeding those at the industry's late 1960s' peak.

Exhibit 3. Domestic Gas Industry In Expansion Phase



Source: Tinker, BEG

The growth in gas reserves and production has contributed to the positive outlook for the business

As is often the case in the oil patch, production and reserve growth trends often do not match. This mismatch is similar to the pattern between the number of active drilling rigs and oil and gas prices. In that case, the trend in the rig count almost always lags a change in direction for commodity prices, either up or down. In the U.S., gas output fell for about a decade following the production peak in the mid 1970s before recovering and growing slowly for many years, a pace that has accelerated recently due to the shale revolution. The growth in gas reserves and production has contributed to the positive outlook for the business.

By answering these questions, it becomes possible to estimate the role these shale basins will play in the outlook for gas production

After discussing gas production growth and the emergence of the shale plays, Dr. Tinker discussed the shale gas integrated study of selected basins undertaken by the BEG. This effort, when it was unveiled several years ago, was hailed for its rigor and detailed well-by-well assessment of the four important gas shale basins. The BEG said it also planned to study the oil and liquids-rich shale plays.

As Dr. Tinker showed, the BEG study was designed to answer a series of important questions about the shale gas basins – what is the estimated total resource base in place; what proportion is technically recoverable; what portion is economically recoverable; and what is the long-term production outlook. By answering these questions, it becomes possible to estimate the role these shale basins will play in the outlook for gas production.

Exhibit 4. Critical Questions To Be Answered About Basins

Tinker, 2014

Bureau of Economic Geology
U.S. Shale Gas Integrated Study

- What is the **total** resource base in place?
- What portion is **technically** recoverable?
- What portion is **economically** recoverable?
- What is the long-term **production outlook**?

BEG Shale Reserves and Production Project

Source: Tinker, BEG

From those estimates, a range of total production distributions can be assembled that provides a centralized range of total production from the Barnett of between 35 Tcf and 56 Tcf of gas

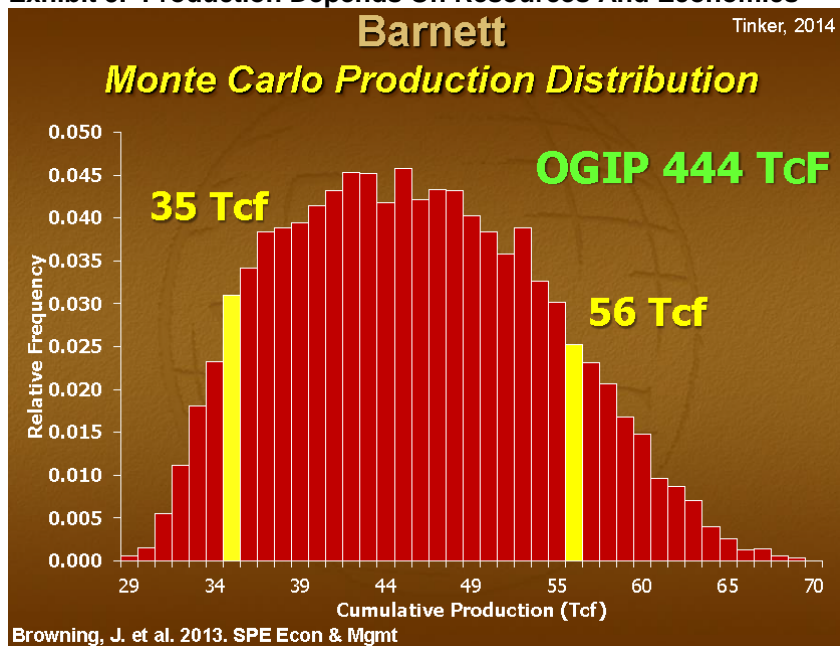
In the remainder of his presentation dealing with the shale gas outlook, Dr. Tinker presented slides showing Monte Carlo production distributions for each basin developed by the BEG. These distributions produce a Bell-shaped curve of production estimates with probabilities for each occurring. It is important that an estimate of the total volume of original gas in place is determined for each basin. For example, the Barnett is estimated to contain 444 trillion cubic feet (Tcf) of gas originally in place. From that figure, the BEG was able to simulate future production profiles based on their conclusions about what proportion of those reserves are technically and economically recoverable. From those estimates, a range of total production distributions can be assembled that provides a centralized range of total recovery from the Barnett of between 35 Tcf and 56 Tcf of gas.

The Haynesville, which was once hailed to be the nation's largest gas shale play, has an estimated original gas in place volume of 489 Tcf

For the Fayetteville formation, the original gas in place was estimated at 80 Tcf and a central production range of 13 Tcf to 23 Tcf of gas. The Haynesville, which was once hailed to be the nation's largest gas shale play, has an estimated original gas in place volume of 489 Tcf, with a centralized recovery range of 24 Tcf to 62 Tcf. We then moved to a series of Marcellus basin slides but with no numeric values since that study has not been released.

For us, the next few slides that Dr. Tinker showed were very interesting. His first Marcellus slide showed the distribution of production estimates such as shown in Exhibit 5 for the Barnett basin. The spread of the distributions was quite wide with relatively few small tails on either side of what would mark the central production range. There was no OGIP (original gas in place) estimate on the slide. (More on this later)

Exhibit 5. Production Depends On Resources And Economics



Dr. Tinker than displayed the Marcellus production distribution chart using a \$6/Mcf of gas price scenario

The Marcellus production chart was based on a \$4 per thousand cubic feet (Mcf) of gas price scenario. There was a normally rounded shape to the distribution of total production. Dr. Tinker than displayed the Marcellus production distribution chart using a \$6/Mcf of gas price scenario. As would be expected, there was an increase in the amount of gas that could be produced, but the upward bulge in production was concentrated largely in the center of the distribution range with the fall-off from the peak output point extending into larger estimated total recovery estimates. He put the Marcellus production distribution together with those for the other three basins to get a total estimated production profile through 2030.

Dr. Tinker's comment was that he had told Dr. Medlock that his LNG export estimates are too high, but they have agreed to disagree

What then proved interesting was that Dr. Tinker presented a chart containing the long-term production profile for gas from the Rice University gas model developed by Dr. Medlock and others and used extensively in modeling the impact on gas supplies and gas prices of different legislative actions. The model, which estimates gas output through 2040, has played a prominent role in the debate over approving more LNG export terminal facilities. The chart displayed, according to Dr. Tinker, facilitates LNG exports ranging from 8 billion cubic feet per day (Bcf/d) to 25 Bcf/d. Dr. Tinker's comment was that he had told Dr. Medlock that his LNG export estimates are too high, but they have agreed to disagree.

The EIA's estimates fall short of the Rice model's, which says that the federal government's view of shale output is not as optimistic as the Rice model

Dr. Tinker then showed two charts. The first showed the estimated natural gas production profile developed by the Energy Information Administration (EIA) through 2030 superimposed on the Rice gas model chart. The EIA's estimates fall short of the Rice model's, which says that the federal government's view of shale output is not as optimistic as the Rice model. This is important since federal government forecasts are used by energy regulators in assessing the impact of their policy decisions on the future gas market.

We were shocked that the BEG production forecast was below that of the EIA, meaning that this very detailed study of shale geology and well productivity is less optimistic than either the government's view or the highly optimistic Rice forecast

The second slide showed the BEG gas production forecast, using the \$4/Mcf base case pricing assumption, superimposed on the EIA and Rice gas model forecasts. We were shocked that the BEG production forecast was below that of the EIA, meaning that this very detailed study of shale geology and well productivity is less optimistic than either the government's view or the highly optimistic Rice forecast. Dr. Tinker even showed the respective production forecasts using the BEG's \$6/Mcf price scenario, which added more gas output to the forecast but did not change the relationship to the other more optimistic forecasts. We thought this chart was not only interesting but highly significant and we looked forward to studying it later once the panelists' slides were posted to the Decision Strategies web site, which is the standard procedure for presenters at the breakfast forum. This is when things got interesting.

Dr. Tinker told Decision Strategies' representatives that he needed to make some final edits before the presentation could be posted

The breakfast presentations are usually posted in the early afternoon following the forum. We went to the web site about mid-afternoon and encountered a message associated with Dr. Tinker saying that his presentation was coming soon. Intrigued by the fact that the Decision Strategies people only need to take the slides from the morning presentation and put them on its web site, we were surprised that Dr. Tinker's presentation wasn't posted. That prompted us to email Decision Strategies asking about the missing presentation. We were informed that Dr. Tinker told Decision Strategies' representatives that he needed to make some final edits before the presentation could be posted. By the following Monday, the presentation still wasn't posted, which caused us to send another email questioning why it was still missing. We received a response that Dr. Tinker had promised it the prior Friday as he was leaving the presentation, but he had not sent the slides. By

When we opened up the presentation, we were surprised to find that all the slides dealing with the Marcellus study had been removed

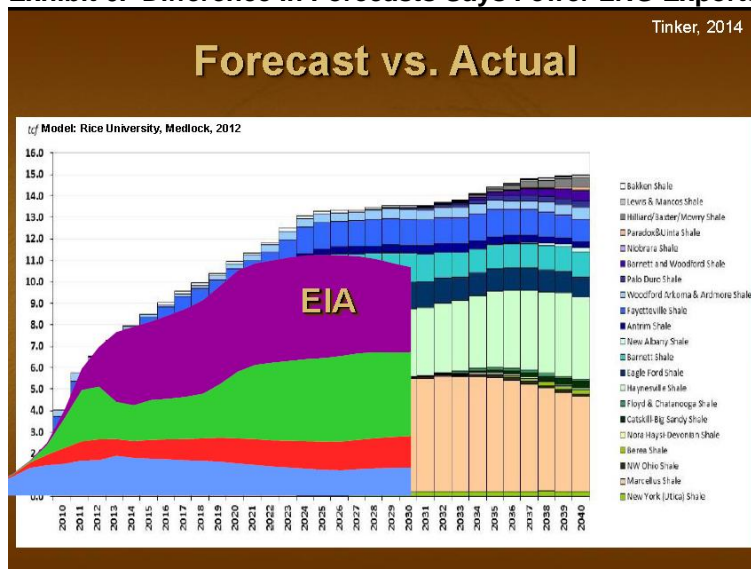
We wondered if he was concerned (or persuaded) that the conclusion to be drawn from his presentation was too negative relative to the optimistic story line of 100-years of gas supply that ensures not only sufficient gas to meet domestic demand but also to promote a large LNG export business

Tuesday, he responded to Decision Strategies that he hoped to have time that day to edit the presentation and send it. Late that afternoon, we received a copy of the presentation.

When we opened up the presentation, we were surprised to find that all the slides dealing with the Marcellus study had been removed. There was another group of slides Dr. Tinker presented that represented his comic criticism of the oilfield service industry's approach to new technology. That group of slides preceded Dr. Tinker's discussion of the new nanotechnology applications advancing production techniques. We assumed the removal of this group of slides may have been because Dr. Tinker didn't want to offend those in the audience, which tends to be heavily weighted to oilfield service executives, but they all laughed when they saw that during the presentation.

The removal of the Marcellus slides made us wonder whether people associated with the BEG were concerned that Dr. Tinker was disclosing too much information about the new study before it was officially released. On the other hand, we wondered if he was concerned (or persuaded) that the conclusion to be drawn from his presentation was too negative relative to the optimistic story line of 100-years of gas supply that ensures not only sufficient gas to meet domestic demand but also to promote a large LNG export business. (We remember Dr. Tinker stating that the Rice supply forecast was too optimistic about LNG exports.) What struck us about his presentation was that even with the BEG \$6/Mcf gas price scenario, the forecast failed to match the EIA supply model, which was well below the Rice gas study conclusion. The implication of Dr. Tinker's gas supply forecast was that either the LNG business would not

Exhibit 6. Difference In Forecasts Says Fewer LNG Exports



Source: Tinker, BEG

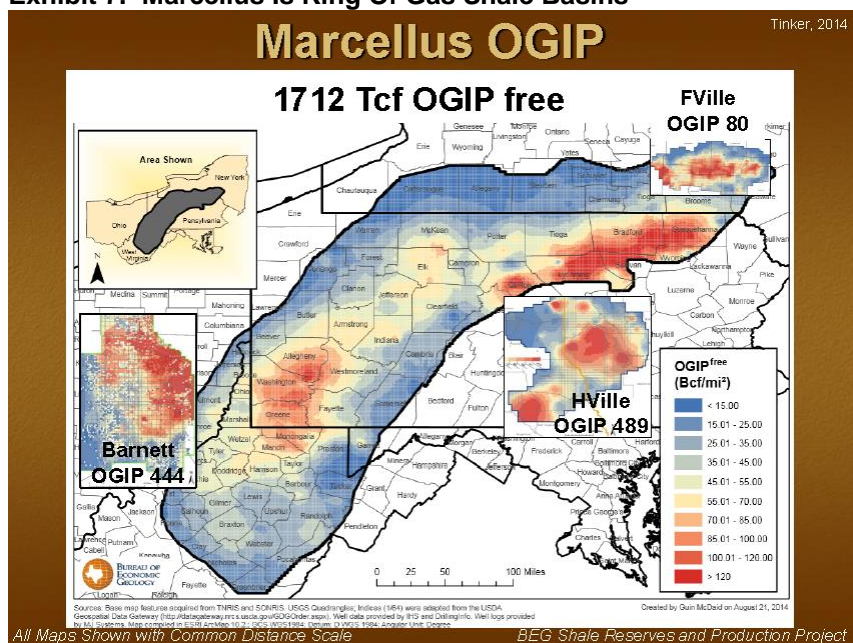
Neither conclusion will be popular with those supporting the conventional view of lots of gas supply at cheap prices for years

We found two earlier presentations made to company-sponsored sessions that contained variations of the slides

have sufficient supplies available or that natural gas prices had to go much higher than the gas market optimists are forecasting. Neither conclusion will be popular with those supporting the conventional view of lots of gas supply at cheap prices for years. We emailed Dr. Tinker looking for an explanation as to why the presentation was altered from the one he showed. Without an explanation, we are left with his final gas chart. (Exhibit 6, page 8)

As a result of our questioning as to why the presentation was changed, we began looking for other presentations made by Dr. Tinker to see if any of them contained the material he presented that was left on the cutting room floor following the Decision Strategies forum. We found two earlier presentations made to company-sponsored sessions that contained variations of the slides Dr. Tinker presented at the Decision Strategies forum. Both presentations had a map (Exhibit 7) showing the OGIP for the Marcellus compared to the estimates for the other three basins studied by the BEG.

Exhibit 7. Marcellus Is King Of Gas Shale Basins

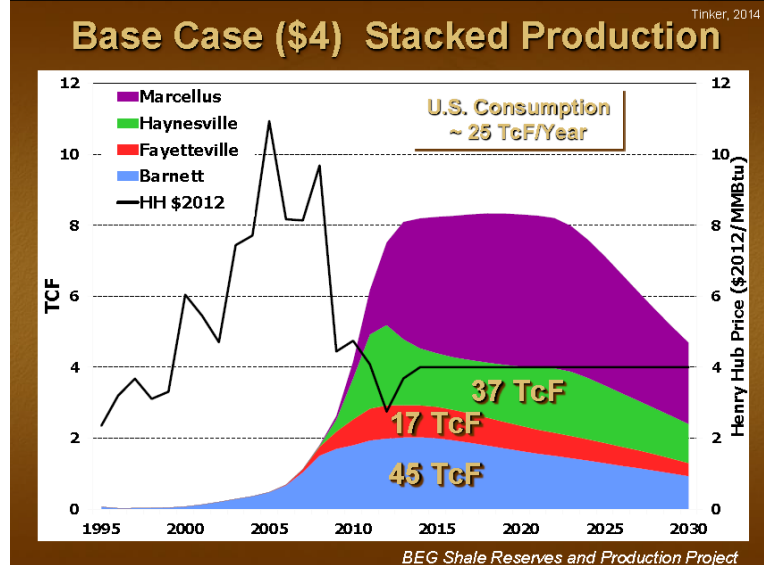


If we eyeball the Marcellus production profile from the slide, we guess the total recover estimate may be in the range of 60-65 Tcf of gas

While we didn't find the stand-alone Marcellus charts, we did find the charts showing the combined production outlook for the four shale basins studied by the BEG. The first chart (Exhibit 8) shows the production with the \$4/Mcf price scenario. In that chart, there are estimates for total production for the three basins for which the estimates have been publically released. Those estimates are all slightly below the mid-point of the central range of production distributions forecast for each basin. If we eyeball the Marcellus production profile from the slide, we guess the total recover estimate may be in the range of 60-65 Tcf of gas. The total annual

production under the base case scenario slightly exceeds 8 Tcf a year during 2012-2023. The implication of the chart is that Marcellus production at \$4/Mcf has already reached its maximum.

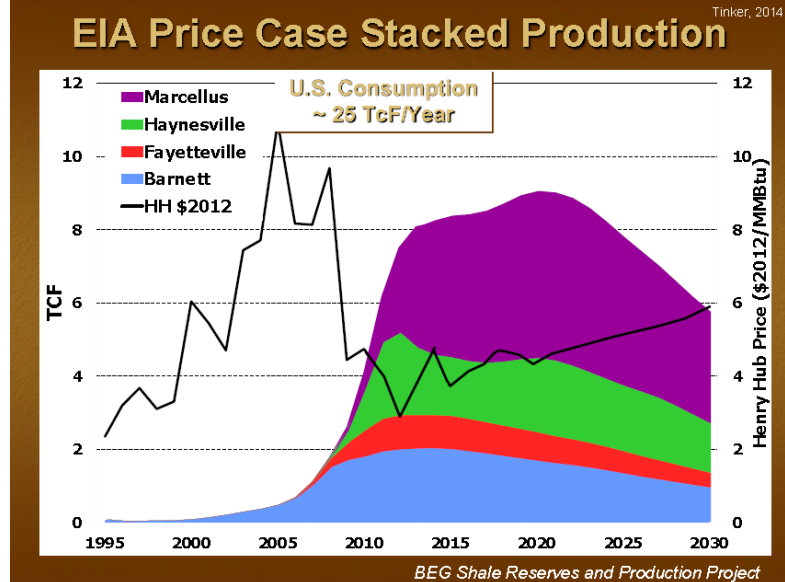
Exhibit 8. Production At Peak Output With \$4 Price Scenario



Source: Tinker, BEG

The next stacked gas shale production chart shows the outlook using the EIA's gas price forecast. Under that scenario, gas production climbs to about 9 Tcf by 2020 but then declines, although at a slower rate than shown in the base case scenario.

Exhibit 9. Escalating Prices Bring Forth More Gas Output

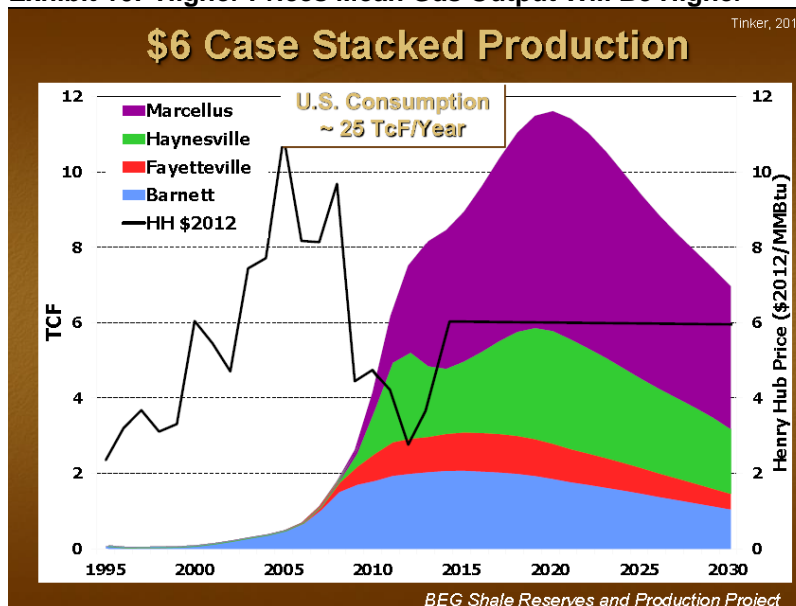


Source: Tinker, BEG

That causes gas output to rise sharply from slightly over 8 Tcf in 2012 to nearly 11.5 Tcf by 2020

The third production chart shows what happens under the \$6/Mcf price scenario. That causes gas output to rise sharply from slightly over 8 Tcf in 2012 to nearly 11.5 Tcf by 2020. Gas production then falls sharply to 7 Tcf by 2030. That level of output is considerably better than the 6 Tcf of production that results from the EIA-priced gas output scenario or the sub-5 Tcf volume associated with the \$4/Mcf price scenarios.

Exhibit 10. Higher Prices Mean Gas Output Will Be Higher



Source: Tinker, BEG

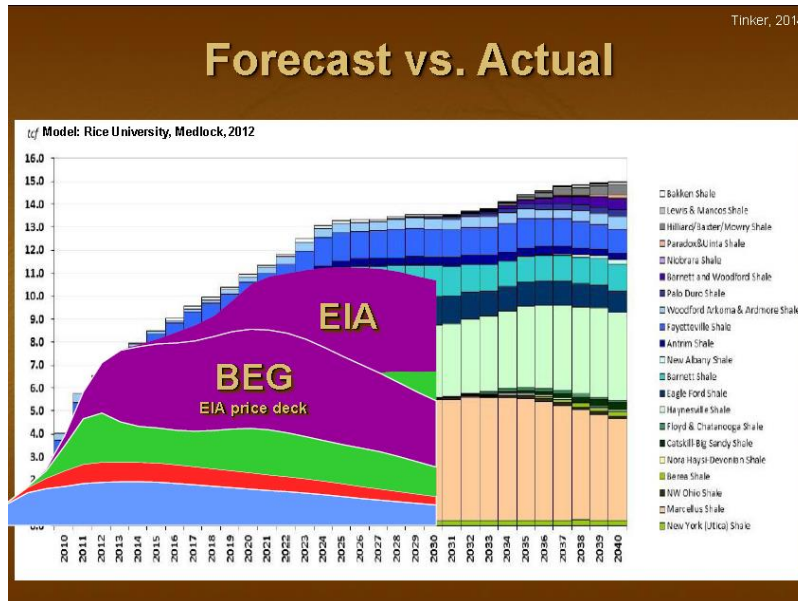
if the \$6/Mcf scenario is inadequate to meet demand forecasts, especially since they contain a large demand component associated with LNG exports, then we could be looking at returning to the double-digit gas prices of the early 2000s

The conclusion one draws from Dr. Tinker's Oilfield Breakfast Forum presentation is that natural gas prices have to go much higher than currently available in the gas futures market if the industry is to develop the supplies necessary to meet future demand. Just how high they will have to go is unclear, but if the \$6/Mcf scenario is inadequate to meet demand forecasts, especially since they contain a large demand component associated with LNG exports, then we could be looking at returning to the double-digit gas prices of the early 2000s. The final gas slide (Exhibit 11, page 12) in Dr. Tinker's breakfast presentation was similar to a slide he included in the earlier company talks we examined.

High gas prices will erode the anticipated arbitrage opportunities with Europe and Asia that LNG players are counting on

If the industry is indeed heading back to very high natural gas prices, one has to question whether the rash of new LNG export terminals currently approved and commencing construction may become white elephants, much as the earlier wave of LNG import terminals became when gas supplies grew. High gas prices will erode the anticipated arbitrage opportunities with Europe and Asia that LNG players are counting on. High gas prices will also make some of the planned petrochemical plant expansions and greenfield projects uneconomic, unless worldwide gas prices head much higher.

Exhibit 11. These Forecasts Mean Gas Prices Must Rise Soon



Source: Tinker, BEG

We have been skeptical of the potential volume of gas that would be available for export in the form of LNG

We are anxiously awaiting the official release of the BEG Marcellus gas study so we can fill in the missing production numbers from Dr. Tinker's presentation. We have been skeptical of the potential volume of gas that would be available for export in the form of LNG, so we have watched the rush to gain approval for new terminals as a little bit of the Charge of the Light Brigade into the Valley of Death. We may be wrong, but we are starting to believe more firmly that natural gas prices are headed higher, and substantially higher sooner than most analysts think. At every step-change in commodity prices, there will be winners and losers, and many unintended consequences. Thinking about that future, we believe, is time well spent.

Morality Has Now Become Ground Zero For Climate Change

One only has to open the pages of a newspaper, turn on the television, or follow commentary on social media to understand that the issue of climate change has now become a moral issue

There was a time in the 14th and 15th Centuries when the public was treated to morality plays to help promote the tenants of Christianity. The plays and their characters were simple, making them easy to understand. The lessons learned were simple as they usually focused on good versus evil, and how to deal with the seven deadly sins - pride, lust, greed, envy, wrath, sloth and gluttony. In other cases, a play's theme was based on showing how when a person gives in to temptation, repentance and redemption are still possible. In an era when life was difficult and life expectancy was short, providing hope for a better future was a positive motivating factor. Today, one only has to open the pages of a newspaper, turn on the television, or follow commentary on social media to understand that the issue of climate change has now become a moral issue.

Mr. Mandery is shocked at the statements by administrators opposed to acting in response to the student and faculty pressure

Recently, *The New York Times* carried an op-ed from Evan Mandery, a professor at John Jay College of Criminal Justice and an author of a book on capital punishment in America, decrying the lack of debate on campuses over climate change. Mr. Mandery opened his op-ed with the following statement: “Climate change is our era’s defining challenge, but most of America’s universities are planning to sit this one out.” He goes on to cite how students and faculty members at more than 400 colleges have called for administrators to divest their fossil-fuel investments, but fewer than 20 have actually committed to doing so. Mr. Mandery is shocked at the statements by administrators opposed to acting in response to the student and faculty pressure. He quotes Drew Gilpin Faust, president of Harvard, who said, “The endowment is a resource, not an instrument to impel social or political change.” David Skorton, Cornell University’s president, stated, “We must resist, in almost all cases, the temptation to manage these precious funds to further social or political causes, no matter how worthy.” From the leaders of two of the nation’s most prestigious universities and recognized bastions of liberal thinking, these thoughts are offside with the view that only divestment of fossil fuel investments is acceptable when it comes to climate change.

He says that universities taking sides in the Israeli-Palestinian conflict would “undermine universities’ role as a forum of open debate,” but that seems to be his only concession to administrators

Mr. Mandery points out that research, much of which is done at universities, overwhelmingly has concluded that global warming is caused by humans. He wonders how these university leaders can support their positions by saying they have an obligation not to consider morality when investing? He points to past divestment efforts to boycott companies doing business in South Africa with its apartheid policies, while others divested from tobacco companies and those doing business in the Sudan. He points out that students are protesting against investments in prison companies, and Chinese and Israeli companies. He says that universities taking sides in the Israeli-Palestinian conflict would “undermine universities’ role as a forum of open debate,” but that seems to be his only concession to administrators. That assumes colleges and universities actually practice ‘open debate.’ Given the number of recent faculty rejections of graduation speakers and the bans and disruptions of campus talks by social conservatives or those supporting non-conventional international groups raises a question about ‘open debate.’

“If this debate included more voices, one can’t help but imagine that our universities might construe their obligation more broadly”

The op-ed concludes with the following paragraph: “Of course, global warming is at bottom a dilemma about the nature of fiduciary duty – about whether that duty is solely to make money or whether we also owe an ethical obligation to endangered species, the inhabitants of low-lying islands and our children. If this debate included more voices, one can’t help but imagine that our universities might construe their obligation more broadly.”

This argument is supplemented by recent articles pointing to the conclusions from the recent synthesis report of the

Martin Wolf wrote of the indifference of today's generation to the fate of future generations condemned to live in a disaster environment due to this indifference

“The ethical response is that we are the beneficiaries of the efforts of our ancestors to leave a better world than the one they inherited”

The question is not: What have fossil fuels done to the planet, but rather what benefits have fossil fuels brought to the world's population?

He also explores the benefits from the successful use of cheap fossil fuels to improve the lives of humans

“The moral case for fossil fuels is not about fossil fuels”

Intergovernmental Panel on Climate Change (IPCC) about the planet's impending doom if we do not immediately take draconian actions to stop the burning of fossil fuels with their carbon emissions. One such article was authored by Martin Wolf, the economics editor of the *Financial Times*. He wrote a column called “An unethical bet in the climate casino” that discussed the IPCC report and the objections of deniers to the climate change science and the overall indifference of today's generation to the fate of future generations condemned to live in a disaster environment due to this indifference.

Mr. Wolf summarized his case and his frustration with the current attitude toward climate change when he wrote: “The ethical response is that we are the beneficiaries of the efforts of our ancestors to leave a better world than the one they inherited. We have the same obligation even if, in this case, the challenge is so complex. But, however strong such a moral argument may be, it is most unlikely to overcome the inertia we now see. Future generations, and even many of today's young, might curse our indifference. But we do not care, do we?”

These commentators raise interesting questions, but we wonder whether they have not built their case by focusing on the wrong question when it comes to climate change and fossil fuels. We were recently provided an advanced copy of a book by Alex Epstein of the Center for Industrial Progress entitled, [The Moral Case for Fossil Fuels](#). The book will be published later this month and we commend it to readers because it represents, in our view, the most balanced discussion of the issue of fossil fuels and their future. Mr. Epstein frames the moral debate differently than the climate change proponents. In his view, the question is not: What have fossil fuels done to the planet, but rather what benefits have fossil fuels brought to the world's population?

This 200+ page book is chocked full of graphs, charts and tables with data that outlines the positive benefits from fossil fuels. Mr. Epstein reviews the claims about fossil fuels and global warming and climate change. He also explores the benefits from the successful use of cheap fossil fuels to improve the lives of humans. He summarizes his view/conclusion in the following two paragraphs:

“Fossil fuel technology transforms nature to improve human life on an epic scale. It is the only energy technology that can currently meet the energy needs of all 7+ billion people on this planet. While there are some truly exciting supplemental technologies that may rise to dominance in some distant decade, that does not diminish the greatness or immense value of fossil fuel technology.

“Ultimately, the moral case for fossil fuels is not about fossil fuels; it's the moral case for using cheap, plentiful, reliable energy to amplify our abilities to make the world a better place – a better place *for human beings*.”

Fossil fuels that when combined with human ingenuity “gives us the ability to transform the world around us into a place that is far safer from any health hazards (man-made or natural), far safer from any climate change (man-made or natural), and far richer in resources now and in the future”

T
he climate-change solutions dictated by the few will condemn the many to lifetimes of deprivation and suffering when an alternative and better future is within their reach

As Mr. Epstein demonstrates throughout the book, it is the cheap, plentiful, reliable energy we get from fossil fuels that when combined with human ingenuity “gives us the ability to transform the world around us into a place that is far safer from any health hazards (man-made or natural), far safer from any climate change (man-made or natural), and far richer in resources now and in the future.” Mr. Epstein shows through World Bank data that more fossil fuel use in China and India between 1970 and 2011 has coincided with dramatic increases in life expectancy – from 63 to 75 years in China and 49 to 65 years in India. Life expectancy has also benefited from declines in infant mortality. In addition, there have been significant increases in income per capita in both countries over this time period. He also shows that emissions data in the U.S. highlights the decline in pollution since 1970 despite a dramatic increase in energy consumption. On a global basis, improved water sources have come despite an increase in fossil fuel use, and there are fewer climate-related deaths worldwide since the early years of the 20th Century. He acknowledges that there is a smog problem in China, but as in other large cities around the world, air quality can be improved without sacrificing the social benefits gained from increased energy use.

After reading Mr. Epstein’s book, we are left with the understanding that what is crucial in the moral debate over climate change is to focus on asking the right question. It is easy to focus on the bad scenarios that may emerge from the flawed climate models because they support the climate change proponents’ case. However, if one ignores balancing all the benefits from cheap fossil fuels against all the costs for all the people on this planet, we are left with the view that the climate-change solutions dictated by the few will condemn the many to lifetimes of deprivation and suffering when an alternative and better future is within their reach. Mr. Epstein concludes: “Here, in a sentence, is the moral case for fossil fuels, the single thought that can empower us to empower the world: Mankind’s use of fossil fuels is supremely virtuous — because human life is the standard of value, and because using fossil fuels transforms our environment to make it wonderful for human life.”

Oil Price Volatility Magnifies Mystery Of Saudi Oil Strategy

One analysis we read focused on the similarity of current oil market conditions to those that existed in the mid-1980s when oil prices collapsed in response to Saudi Arabia’s actions

Like a bouncing ball, oil prices have been going up and down daily depending on the latest crude oil traders’ assessment of oil market trends and their guesses about if and when OPEC, led by Saudi Arabia, acts to erase the current global oil oversupply. One analysis we read focused on the similarity of current oil market conditions to those that existed in the mid-1980s when oil prices collapsed in response to Saudi Arabia’s actions to regain control over the oil market, slow down new oil developments, discipline its OPEC fellow members and rebuild global oil demand. The author of the analysis suggested it was foolhardy to think that Saudi was targeting Iran,

He pleaded for Saudi Arabia to provide greater transparency into its oil market thinking and actions

Russia or American shale producers in its current oil pricing moves. The author blamed the oil price decline on a lack of clarity as to Saudi's oil pricing strategy. He pleaded for Saudi Arabia to provide greater transparency into its oil market thinking and actions, which he believes would make all market players more rational, thus reducing price volatility associated with shifts between over- or under-supplied market conditions.

We concluded Saudi was essentially attempting to do what it did in the 1980s

As we wrote several issues ago, when discussing Saudi's declaration that it could live with oil prices in the \$80-\$90 per barrel range for up to two years, there were numerous theories about who the country was targeting. After examining five of those supposed targets, we concluded Saudi was essentially attempting to do what it did in the 1980s – stimulate economic activity, especially in Europe, while heading off new Canadian oil sands output from carving out a share of Europe's future demand at OPEC's expense.

The Saudi government does have significant cash reserves to support its deficit spending

Recently, analysts have become concerned about growing internal and external threats to Saudi Arabia's stability and the role those threats may play in the kingdom's oil strategy. Part of the analysis involves considering how long the kingdom can/will tolerate deficit spending due to low oil prices, given that it ramped up social payments several years ago in an attempt to buy domestic peace following the outbreak of the Arab Spring. The Saudi government does have significant cash reserves to support its deficit spending.

Exhibit 12. Saudi's Precarious Position Shapes Energy View



The Saudis were caught off-guard by the al-Houthi surge in Yemen, a country beholden to Riyadh for decades

Saudi Arabia has been battling Iran for years over its support of Shiite factions that are battling Sunnis throughout the Middle East for dominance of the Islamic leadership of the region. The most recent external threat emerged in Yemen, a country south of Saudi Arabia, where the Iranian-backed al-Houthi movement, once thought to be merely a rebel subset of the Zaidi sect has now become a mainstream terrorist player. It seized the Yemeni capital city of Sanaa in mid-September and continues to expand. The Saudis were caught off-guard by the al-Houthi surge in Yemen, a country beholden to Riyadh for decades. It happened because the Saudis lost their influence with the Yemeni tribes and because the old ruling elite in Sanaa had become badly fragmented. While the Saudis were negotiating with Iran over the Syrian war, Iran was backing al-Houthi's rise to power.

About 15% of Saudi's population is Shia, but it dominates the population of the Eastern Province where the majority of the kingdom's oil facilities are located making relations with this minority extremely sensitive

Internally, Saudi Arabia's problem with its Shia minority population may have changed dramatically following the Nov. 3rd attack by unidentified gunmen, presumed to be Salafist (Sunni) extremists, who opened fire at a Shia mosque in al-Ahsa, a district in the oil-rich Eastern Province, killing seven people and wounding 12 others. The attacks came about a month after a Saudi court delivered a death sentence to Nimr al-Nimr, a radical Shiite cleric who was arrested in 2012. About 15% of Saudi's population is Shia, but it dominates the population of the Eastern Province where the majority of the kingdom's oil facilities are located making relations with this minority extremely sensitive.

It is possible that jihadists, affiliated with either al Qaeda or the Islamic State, are behind the attacks because they may upset the kingdom's stability

The parties responsible for the Nov. 3rd attack understand that their actions complicate the kingdom's strategy for dealing with its Shia minority. It is possible that jihadists, affiliated with either al Qaeda or the Islamic State, are behind the attacks because they may upset the kingdom's stability. If either of these groups is behind the attacks, then the Nov. 3rd event suggests they have expanded the scope of their terrorist activities in the region. Military analysts, however, suggest that the tactics used in the attack imply that Salafist tribesmen with close ties to the religious establishment in the country may have been the attackers. If true, then the attack is more consequential since the Saudi government cannot fight jihadists if elements from its tribal and religious establishments are involved in unsanctioned acts of violence.

For Saudi Arabia, a Salafist state, it must now fight extremist Salafists at home and abroad in order to contain its domestic and regional Shia adversaries further complicating the kingdom's political strategy

This outbreak of domestic terrorism complicates the kingdom's regional political balancing act. Saudi Arabia's Shia population is the government's true adversary, but the kingdom must maintain a peaceful relationship with the group to better its relationship with Iran. Attacks by non-state Salafists put this peace with the Shia at risk. For Saudi Arabia, a Salafist state, it must now fight extremist Salafists at home and abroad in order to contain its domestic and regional Shia adversaries further complicating the kingdom's political strategy.

The Saudis are always thinking about oil markets in terms of decades, not days

While Saudi Arabia struggles with these new internal and external threats, it still must consider its oil strategy and its potential impact on the country's adversaries and friends. It is important to not lose sight of the fact that Saudi's oil strategy is always based on long-term market trends. The Saudis are always thinking about oil markets in terms of decades, not days. Therefore, the Saudis know that the crucial challenge for the long-term health of the oil market is a lack of global oil demand. Lowering oil prices is the only action the Saudis and OPEC can take to try to boost global oil demand. Starting and sustaining that demand is paramount in Saudi's thinking, and they now must deal with the additional variable of renewables in the demand equation, besides their internal and external political problems.

The renewables variable is something the kingdom has little influence over except that low oil prices could make them uneconomic

The renewables variable is something the kingdom has little influence over except that low oil prices could make them uneconomic. Since renewables continue to be heavily subsidized in many markets, the longer they remain uneconomic the greater the pressure citizens will exert on their political leaders to cut those subsidies, especially if oil prices remain low. If the current oil price correction is a repeat of the 1980s, note that it took much lower oil prices and a decade to restore global demand to 1981's level.

Keystone Saga Makes Another Twist – Approval Coming?

As expected, neither Senator Mary Landrieu (D-LA) nor Representative Bill Cassidy (R-LA) secured a majority of the vote in Louisiana so they are locked in a run-off race to be settled December 6th

The midterm elections provided some interesting momentum. The Republicans won a smashing victory. One of the more interesting developments was that all the talk about how critical the Louisiana race would be for determining the fate of Democratic control of the Senate was washed away by the Republican election wave. As expected, neither Senator Mary Landrieu (D-LA) nor Representative Bill Cassidy (R-LA) secured a majority of the vote in Louisiana so they are locked in a run-off race to be settled December 6th. Sen. Landrieu, a recognized friend of oil, came out swinging in the run-off campaign. Last Wednesday, the first day back for Congress following its campaign hiatus, Sen. Landrieu delivered a speech on the Senate floor urging a vote to approve the Keystone XL pipeline - the long-stalled, high-profile project to haul oil sands bitumen output from Alberta, Canada to the U.S. Gulf Coast where it can be shipped abroad or refined with the resulting petroleum products either consumed domestically or shipped to international markets.

The thinking is that the Democrats are prepared to sacrifice their opposition to the pipeline in order to help Sen. Landrieu in her re-election bid

Political watchers were intrigued that Senate Majority Leader Harry Reid (D-NV) along with Sen. Barbara Boxer (D-CA) and Bernie Sanders (I-VT), all leading opponents of Keystone, were on the floor of the Senate during the speech but did not object to Sen. Landrieu's "unanimous consent" request for a vote. The thinking is that the Democrats are prepared to sacrifice their opposition to the pipeline in order to help Sen. Landrieu in her re-election bid. Media reports are that a vote in the Senate could occur today. The media also reports that it appears there may be close to a 60-vote majority in

At the moment, Rep. Cassidy is polling well ahead of Sen. Landrieu

But possibly more telling for the fate of Keystone is the impact of the climate change treaty the U.S. and China agreed to last week

Assuming he vetoes the bill and then has it over-ridden by Congress, we expect he would encourage his governmental agencies, and even possibly the State Department, to sue to block the legislation because of “defects” in the environmental impact statement review and/or failure to comply with other environmental regulations

the Senate for Keystone that would assure a veto-proof bill. However, the opposition is targeting those senators who are on the fence in hopes of preventing a veto over-ride vote.

At the same time Sen. Landrieu was making her case for a vote, the Republican leadership in the House of Representatives was moving forward with a bill to approve Keystone sponsored by Rep. Cassidy, Sen. Landrieu’s opponent. The House voted last Thursday to approve Rep. Cassidy’s bill. At the moment, Rep. Cassidy is polling well ahead of Sen. Landrieu. Senator Mitch McConnell (R-KY), the Senate Majority Leader-elect, has announced that Rep. Cassidy, should he win the senate seat from Louisiana will be given a seat on the Energy and Natural Resource Committee, replacing Sen. Landrieu and giving the state continued input to the Congressional oversight role on energy. So who wins in this battle of bills to approve Keystone?

The more interesting development is that the press secretary for President Barack Obama, traveling with him in Asia, reiterated the President’s position that he wants to wait for the State Department’s review process to be completed along with the determination of the appeal to the Nebraska Supreme Court of the district court case that ruled that the approval of the Keystone route through the state was conducted unconstitutionally before he decides. But possibly more telling for the fate of Keystone is the impact of the climate change treaty the U.S. and China agreed to last week. The two countries have supposedly agreed to reduce pollution more aggressively than previously announced by either country, setting the stage for a global deal in Paris in 2015 as the major hurdle of having China in agreement seems to have been resolved with this deal.

As President Obama has now made climate change a key initiative in his legacy-building effort, how would he justify approving legislation granting a permit for Keystone? Assuming he vetoes the bill and then has it over-ridden by Congress, we expect he would encourage his governmental agencies, and even possibly the State Department, to sue to block the legislation because of “defects” in the environmental impact statement review and/or failure to comply with other environmental regulations. Maybe that would appear to be a futile effort, but for a man with a clock running out on his time in office, delaying the pipeline approval might just be a successful endeavor. Remember, this is a president who is not adverse to selectively enforcing or defending the laws of the land depending on whether he likes or dislikes them. He clearly dislikes Keystone and is intent on making sure that his environmental supporters win in the battle over climate change and the necessity to change the world’s economy and our society.

Advice From *New York Times*: Don't Stand Under A Tree!

A new study published in the journal *Science* that estimates a 50% increase in the number of lightning strikes in the United States in the future due to global warming

Lightning provides the energy to form new chemical compounds in the air, including some pollutants

“This increase in lightning is an example of a fairly large change that you can get from what sounds like a relatively small global temperature increase.”

He pointed out that the researchers were only able to get the necessary data in order to test their equation for a single year, 2011

The environmental writer for *The New York Times* highlights a new study published in the journal *Science* that estimates a 50% increase in the number of lightning strikes in the United States in the future due to global warming. The study was conducted by David Romps, an atmospheric physicist at the University of California, Berkeley, his graduate student and two colleagues. It concluded that lightning strikes could be forecast by a simple equation that incorporates data for precipitation and storm energy. The study concluded that this forecasting technique tends to work over large geographic areas, whereby previous examinations may have missed that relationship due to looking at too small of an area.

Global warming, by definition, puts more energy into the atmosphere. Increased lightning is one possible consequence of such an increase, but the methods to measure its impact have been crude up until now. Lightning provides the energy to form new chemical compounds in the air, including some pollutants. The exact effects on atmospheric chemistry would depend on many factors, but one would be to increase the chemical that helps break down methane, a contributor to global warming, which in turn could boost the number of lightning strikes. The researchers looked at computerized models of future climate and deduced an increase in lightning strikes ranging from a low of 14% to a high of 90%.

The determination of the lightning strike increase was tied to an increase in global temperatures of 7° Fahrenheit. We were struck, as we also believe the *NYT* reporter was, by the comment from Dr. Romps that “This increase in lightning is an example of a fairly large change that you can get from what sounds like a relatively small global temperature increase.” One would have to question the idea that a 7° Fahrenheit temperature change is small. It is roughly twice the 2°C limit the UN’s Intergovernmental Panel for Climate Change said would trigger a climate disaster for the planet. As the *NYT* environmental writer put it, assuming a 7° temperature increase, “future generations are likely to have much bigger problems to worry about than lightning.”

The *NYT* writer interviewed Kevin Trenberth, a climate scientist at the National Center for Atmospheric Research who was not involved in the research, who said he found the conclusion of the study plausible. But he pointed out that the researchers were only able to get the necessary data in order to test their equation for a single year, 2011. He suggested that the method needs to be tested for other years to determine whether the assumption holds up. Having only one year’s data to confirm the theory is tantamount to forecasting global oil demand for every year in the future based on the increase experienced in 2004. That was the year when China’s oil demand exploded as it built out its infrastructure in anticipation of the upcoming Olympics. The International Energy Agency (IEA)

considerably underestimated global oil demand that year because its model was lacking adequate data. Now they claim their models are more accurate, but they seem to over-estimate demand every year rather than under-estimate it as they did in 2004. The lesson learned is to be careful of forecasts based on a single year's data.

Other Items Of Interest

While some analysts speculated the consolidation move was prompted by concern over the current decline in oil prices, we thought the deal was driven by strategic considerations

Halliburton announced it would submit a slate of directors, meaning that Baker shareholders would face a proxy battle unless the managements and boards could agree to a deal, which they did over the weekend

Temasek has joined with RRJ to purchase \$1 billion in convertible bonds to be issued by Cheniere Energy

Halliburton And Baker Hughes:

Late last week, the media broke the story that Halliburton (HAL-NYSE) was in discussions with Baker Hughes (BHI-NYSE) to acquire it. As expected, Baker's share price soared on the rumor of the talks, later confirmed to be happening, but Halliburton's share price also rose, suggesting investors saw a combination of the #2 and #3 oilfield service companies as a positive for both. While some analysts speculated the consolidation move was prompted by concern over the current decline in oil prices, we thought the deal was driven by strategic considerations. We suspected that Halliburton was waiting for Baker to report its third quarter financial results so it could complete its final assessment of the attractiveness of the deal and the price to offer before making its move. We now know that to be true.

Friday evening, word leaked out that deal talks had stalled over price and asset divestment terms necessary in order to win various government antitrust approvals. The significance of the announcement was highlighted by the significance of Friday being the last day possible for investors to propose an alternative slate of directors for Baker's annual meeting to be held next spring. That maneuver would set up a potential proxy fight over control of Baker. That evening, Halliburton announced it would submit a slate of directors, meaning that Baker shareholders would face a proxy battle unless the managements and boards could agree to a deal, which they did over the weekend. The \$34.6 billion cash and stock purchase of BHI with agreed-to divestments of businesses of the combined company generating \$7.5 billion in sales ends the threat of a proxy battle. There will be a lot to comment on in the future as the deal progresses as the divestments and competitor responses become catalysts for reshaping the oilfield service industry at the same time commodity fundamentals appear to be unraveling.

Asia Money And The U.S. LNG Business:

Temasek, Singapore's state investment company, has joined with RRJ, a private equity firm founded by Richard Ong, a Malaysian dealmaker, to purchase \$1 billion in convertible bonds to be issued by Cheniere Energy (LNG-NYSE) for financing the construction of its liquefied natural gas (LNG) export terminal. The bonds have a 6 ½ year maturity and carry an annual interest rate of 4.87% and will be convertible into Cheniere's common stock in a year's time. RRJ

We continue wondering whether the U.S. LNG export terminals will become white elephants just as the LNG import terminals did

already had an equity investment in Cheniere. This move comes at the same time Asian buyers appear less interested in buying U.S. LNG. We don't know why they are turning down what is supposed to be cheaper LNG, but we wonder whether they have less confidence that U.S. LNG supplies will be available in the volumes projected, and especially at the current low price that is projected to remain so for many years. It is also possible that Asian gas demand will not grow as much as projected due to slow growing economies, increased conservation and efficiency that trim demand growth, and other alternative gas supplies being available with long-term, fixed price terms that prove cheaper than U.S. gas volumes. We continue wondering whether the U.S. LNG export terminals will become white elephants just as the LNG import terminals did.

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