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## MUSINGS FROM THE OIL PATCH

April 19, 2016

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*Note: Musings from the Oil Patch reflects an eclectic collection of stories and analyses dealing with issues and developments within the energy industry that I feel have potentially significant implications for executives operating and planning for the future. The newsletter is published every two weeks, but periodically events and travel may alter that schedule. As always, I welcome your comments and observations. Allen Brooks*

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### Helping Explain The Enigma That Is Saudi Arabia's Oil Policy

**The stock market is also climbing, as investors are sensing higher oil prices will improve energy company profitability possibly to the point where there may actually be profits rather than losses!**

We are writing this article prior to last Sunday's meeting in Doha, Qatar involving the leading oil exporting countries of the world. While rumors are circulating that Saudi Arabia and Russia – the two leading oil exporters – have agreed to freeze their oil production at their January volumes regardless of whether Iran joins in the agreement or not, crude oil prices have jumped. As of last Tuesday afternoon, West Texas Intermediate traded over \$42 a barrel, up 4.5% for the day and the highest settlement price in 2016. For the prior week, WTI was up over 17%. From then through Friday afternoon, oil prices declined as concerns about the viability of an agreement at Doha. The stock market is also climbing, as investors are sensing higher oil prices will improve energy company profitability possibly to the point where there may actually be profits rather than losses! Equally important is the prospect that any sustained improvement in energy-company fortunes would almost immediately translate into reduced financial problems for commercial banks from bad energy loans. An improved outlook for two large sectors of corporate America should lead to a better stock market.

**We remain mired in a market where oil supply exceeds demand, adding to global oil inventories on a daily basis**

Will oil prices continue to march higher, or could we be disappointed by the outcome of Doha? We remain mired in a market where oil supply exceeds demand, adding to global oil inventories on a daily basis. Although the pace of the inventory build is slowing, most industry forecasts suggest it will not be until late 2016 or sometime in the first half of 2017 that supply and demand reach balance. After that point, assuming supply continues to shrink and consumption grows, global oil inventories, currently at record levels, will begin declining rapidly. At some point before that occurs, oil prices will respond to the structural change in the underlying industry fundamentals and begin climbing in anticipation that only substantially higher oil prices will stimulate supply growth. As a few

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**If the output freeze effort fails to produce a substantive agreement (forget cheating by all parties involved because that is a given), oil prices are likely to fall**

**Those growth expectations are 0.4% and 0.3% lower**

**Many industry experts believe Saudi Arabia has maxed out its production by pumping at 10.4 mmb/d**

forecasters are moving their estimate of the market balance point forward, they are encouraging higher oil prices sooner.

The timing of the scenario described above will be influenced by what happens in Doha. If the key oil exporters agree to freeze their output, the market will anticipate supply shrinking faster than currently anticipated meaning that oil prices are likely to climb faster and sooner. On the other hand, if the output freeze effort fails to produce a substantive agreement (forget cheating by all parties involved because that is a given), oil prices are likely to fall as expectations shift from shrinking supply to growing supply.

Another critical variable in these forecasts is what happens to global economic growth. Last week, the International Monetary Fund (IMF) reduced its forecast for global growth in 2016 for the fourth time. The IMF is now predicting that the global economy will grow by only 3.2% in 2016 and 3.5% in 2017. Those growth expectations are 0.4% and 0.3% lower, respectively, than the IMF's prior forecast. In the case of the United States, the new IMF growth estimates are 2.4% and 2.5% for 2016 and 2017. These forecasts represent reductions of 0.2% and 0.1%, respectively.

These new growth estimates are below what is considered the inherent growth rate for the global economy, which is estimated at 3.4%-3.5%. The weak performance, although the current 2016 estimate remains 0.1% higher than 2015, is a reason why the International Energy Agency (IEA) is predicting global oil demand growing only 1.2 million barrels a day (mmb/d) compared to the estimated 1.8 mmb/d demand growth experienced in 2015. (Some forecasters believe those demand estimates are too conservative.) The weak economic growth and low oil demand scenario is an issue for Saudi Arabia and the other major oil exporting countries. While Russia is primarily hoping for higher oil prices as its production may be at a maximum, it is not necessarily the case for Saudi Arabia, and certainly not the case for Iran. Many industry experts believe Saudi Arabia has maxed out its production by pumping at 10.4 mmb/d. Those same experts, however, were adamant a while ago that Saudi Arabia would not produce above 10 mmb/d, which had been a long-standing position of the country.

While the upcoming Doha meeting is dominating the oil market news and that of Saudi Arabia, there is other issues surfacing that may come to dominate the political news of the Kingdom. Those issues include the upcoming visit to Saudi Arabia by President Barack Obama to attend a summit of the leaders of the Gulf Cooperation Council and the debate in Washington over declassifying some 28 pages of the report from the "Joint Inquiry into Intelligence Community Activities before and after the Terrorist Attacks of September 11, 2001," otherwise known as the "9/11 Commission."

**The potentially more explosive issue is the 28 pages that reportedly detail Saudi Arabian support for the terrorists of 9/11**

President Obama will journey to Saudi Arabia to attempt to ease the concerns of the leaders of the Gulf countries that relations with the United States have not been altered by the recent U.S. and western powers nuclear agreement with Iran. The potentially more explosive issue is the 28 pages that reportedly detail Saudi Arabian support for the terrorists of 9/11 who commandeered planes that flew into the World Trade Center Towers and the Pentagon killing thousands of Americans. Analysts are parsing a sentence from the summary of the report that leaves open the possibility that lower level Saudi officials and non-government organizations provided support for the 15 Saudi nationals who entered the U.S. with limited language skills and documentation yet being able to enroll in pilot training schools. These two issues crystalize the tensions over the state of the relationship between the two long-standing allies – the U.S. and Saudi Arabia - in the Middle East, especially as it relates to the Syrian crisis and the war with the Islamist State.

**Prince Mohammad has given two extended interviews with global media organizations in which he unveiled significant changes in the thinking within Saudi Arabia**

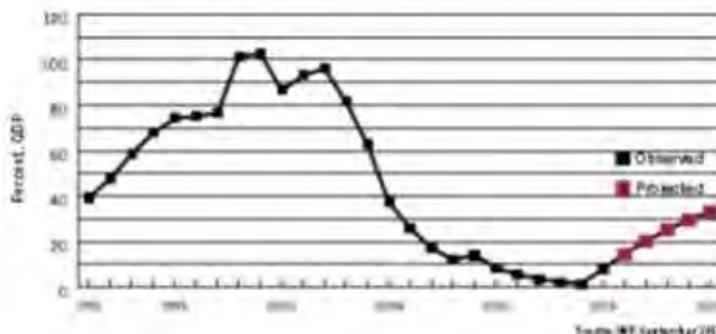
These events form part of a larger tapestry for the Middle East and Saudi Arabia. We are now nearing the 14-month anniversary of the reign of King Salman and the one-year anniversary of the realignment of Saudi Arabia's royal succession, important given its 80-year old leader. We have highlighted the significance of that succession alignment in previous articles and suggested it was important to watch the King's 30-ish year old son, Deputy Crown Prince Mohammad bin Salman. Prince Mohammad has given two extended interviews with global media organizations in which he unveiled significant changes in the thinking within Saudi Arabia. In the first interview, Prince Mohammad disclosed that the government was considering transitioning Saudi Aramco, the nation's oil company, into a publicly-traded company. The second interview disclosed the concept that the money raised from that initial public offering of Aramco would help fund a \$2 trillion Public Investment Fund that would help wean the country off crude oil as the source of its economic growth and eventually its government receipts.

**Over time, especially in a low oil price environment, the cost of buying this loyalty will continue rising and will cause a financial squeeze that could lead to actions that translate into political insolvency**

Two recent reports have highlighted conflicting views of how the future of Saudi Arabia may evolve. One is a screed against the kingdom based on the authors' assumptions that the country is not a legitimate country and will fail for one of two reasons. One idea is that Saudi Arabia is a "political enterprise with a clever but ultimately unsustainable business model," and the second that the country is so corrupt it can only be viewed as a "vertically and horizontally integrated criminal organization." The authors believe that the future for the country depends on the ability of the royal family to continue to buy political legitimacy through payments for loyalty. This means that over time, especially in a low oil price environment, the cost of buying this loyalty will continue rising and will cause a financial squeeze that could lead to actions that translate into political insolvency. Dealing with this issue could cause a significant revamp of the Saudi economy, including increasing its borrowings back to historical levels.

**Exhibit 1. Saudi Has Substantial Borrowing Capacity Left**

**Central Government Gross Domestic Debt  
as a percentage of GDP**



Source: Belfer Center

**The need for U.S. government officials to evaluate a range of alternative scenarios for the future of Saudi Arabia**

The authors' view about corruption within Saudi Arabia ultimately bringing the country to its knees is that the reaction will lead to either a factional struggle within the royal family, or another foreign war, or possibly a general insurrection within the country – either via a non-violent uprising or a jihadist insurgency. The purpose of this paper was to highlight the need for U.S. government officials to evaluate a range of alternative scenarios for the future of Saudi Arabia rather than to continue blindly following current government policies toward the country.

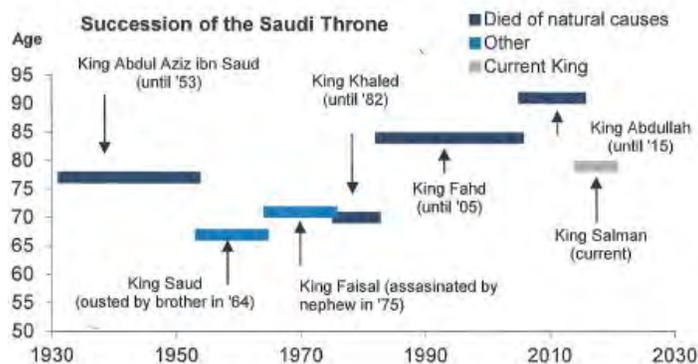
**The history of Saudi Arabia and its ruling family is important for understanding the significance of the succession moves during 2015 and the impact on the plans being proposed for future of the country**

The other paper attempts to tie current events and policy evolutions together within the historical context of Saudi Arabia. The author, Karen Elliott House, spent a month in the country and is a long-standing and well-respected reporter of Middle East and Saudi Arabian events. The history of Saudi Arabia and its ruling family is important for understanding the significance of the succession moves during 2015 and the impact on the plans being proposed for the future of the country. The key to these trends is explained in an early paragraph of the paper, in which the author writes:

**The royal family itself has put power in the hands of a new generation of leaders who are more self-confident and assertive**

“After more than two decades of domestic drift under geriatric rulers and over-dependence on U.S. protection in a dangerous region, the Kingdom of Saudi Arabia is starting to stand up to shape its own future. There are two major reasons for this change. The royal family itself has put power in the hands of a new generation of leaders who are more self-confident and assertive. In the meantime – in Riyadh’s view – the United States, long the Kingdom’s protector, has increasingly shied away from a leadership role in the Middle East under President Obama.” On this latter point, a question constantly asked of the reporter during her visit was whether Mr. Obama’s policies marked a new trend in America’s relations with the country or was it merely an interlude to be corrected by the next U.S. president?

**Exhibit 2. Ending The Aged Saudi Leadership**



Source: RBC

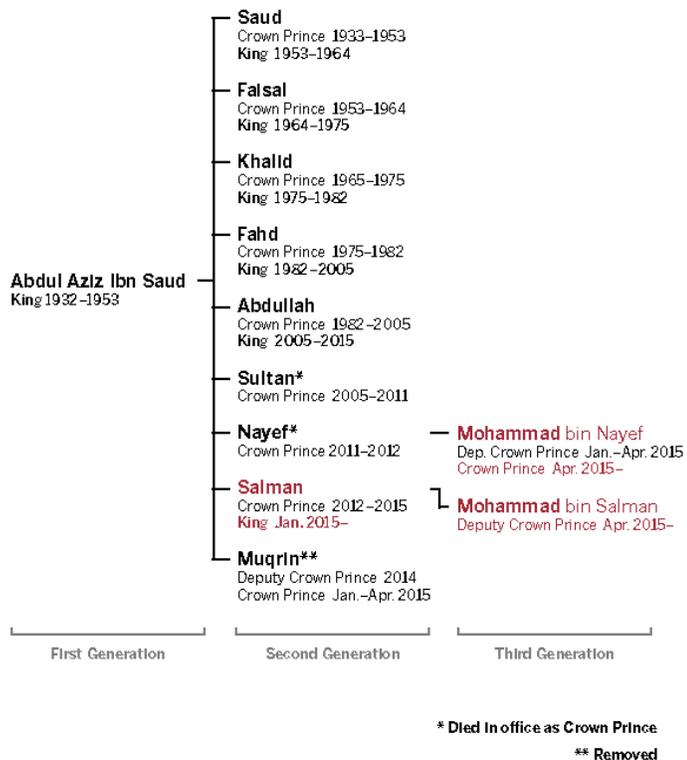
**He also believes there may be another change forthcoming that will set in place a British-style monarchy in which sons follow their father**

Understanding the first point is critical to being able to assess the various potential scenarios for how the future of Saudi Arabia may unfold. It is important to also appreciate why and how the new policies are being implemented and what that means for rethinking the playbook for anticipating Saudi Arabia’s actions. King Abdul Aziz ibn Saud founded the country. He sired 44 sons by 22 wives, and 36 sons lived to adulthood. Six of those sons have followed their father as kings of Saudi Arabia. A dozen sons, including the current King Salman, remain alive, but they are elderly. Most are infirm and none are seen as likely to ever sit on the throne. That doesn’t reduce the tension among the remaining brothers, especially after what King Salman did by firing his half-brother, Prince Muqrin, last April. One of King Salman’s half-brothers, Prince Talal bin Abdul Aziz, 85, a long-time critic of the Al Saud family, expressed to the author his distaste for the disenfranchisement of the remaining brothers. He also believes there may be another change forthcoming that will set in place a British-style monarchy in which sons follow their father. That could be an important event given that the 36 sons of Saudi’s founder have sired a “plethora of princes,” an estimated 7,000 strong.

**Exhibit 3. Transitioning To Third Generation Leaders**

**Modern Kings and Crown Princes of Saudi Arabia**

Since 1953, there have been six Kings of Saudi Arabia descending from **Abdulaziz ibn Abdul Rahman ibn Faisal ibn Turki ibn Abdullah ibn Muhammad Al Saud**. The reigning King since 2015 is **Salman bin Abdulaziz Al Saud**, and **Mohammad bin Nayef Al Saud** is the current Crown Prince. King Salman's son, **Mohammad bin Salman Al Saud**, is the current Deputy Crown Prince.



Source: Belfer Center

**The Crown Prince is unusual in the royal family as he only has daughters**

At the present time, the line of succession for King Salman is to Crown Prince Mohammad bin Nayef, nephew of the King, and then to Deputy Crown Prince Mohammad bin Salman, the King's son. This line of succession has cemented the leadership transition from the second generation of the family to the third generation. The possibility of this line of succession being changed to elevate the deputy crown prince is what Prince Talal is referencing. The Crown Prince is unusual in the royal family as he only has daughters, while the Deputy Crown Prince has sons who could succeed him and thus establish the monarchical pattern of succession.

**It is Prince Mahammad who has become the face of Saudi Arabia to the world via his interviews**

The Deputy Crown Prince has been installed as minister of defense, economic czar and the man in charge of Aramco. It is Prince Mohammad who has become the face of Saudi Arabia to the world via his interviews and attendance at official functions representing his father. And, it is Prince Mohammad who is leading the structural changes underway in the Kingdom. He was not,

**He is the first senior prince not to have been educated in the West**

however, the person behind the Saudi oil policy move in November 2014 that created the current industry downturn as that happened before he assumed his office. He is the first senior prince not to have been educated in the West. He is a lawyer trained at King Saud University. He said he was interested in business but abandoned plans to obtain a business degree in order to join the government as a minister of state running his father's royal court at age 26. Even though he didn't obtain an MBA, he now oversees the entire Saudi economy.

**It has been suggested that not since King Abdul Aziz, the prince's grandfather, has a prince his age wielded so much power**

It has been pointed out that the rise of the young Prince Mohammad has upset some of the other branches of the royal family. That is because in nearly every area he is shaking up the sclerotic Saudi system and along with it the somnolent Saudi society. It has been suggested that not since King Abdul Aziz, the prince's grandfather, has a prince his age wielded so much power. What is critically important is that it appears that the young Saudis are enthusiastic about Prince Mohammad. It is important because 70% of the country's population is 30 years old or younger. Nearly a third of the population is foreign workers, but a portion of them have gone home for lack of work.

**The young Saudis are happy with Deputy Crown Prince's willingness to take risks and his informality**

The young Saudis are happy with the Deputy Crown Prince's willingness to take risks and his informality. Mohammad bin Salman always appears in a long "thobe," the Saudi national dress that resembles a floor length long-sleeved dress shirt. He often is bareheaded and also shuns the royal "bisht," the gold-trimmed flowing floor length brown cape royals wear around their shoulders for formal meetings. These qualities about Prince Mohammad are important for the changes he envisions for the country's economy will have significant impact on the youth.

**The transformation will require Saudis to seek employment in the private sector where even after a decade of pressure to hire Saudis, about 84% of the workforce is composed of foreign workers**

The National Transformation Plan 2020 calls for moving the Saudi economy from one dependent on government jobs funded by oil to one led by private-sector growth. Oil has traditionally funded 90% of the government's spending, although that number is projected to fall to 73% in 2016. The transformation will require Saudis to seek employment in the private sector where even after a decade of pressure to hire Saudis, about 84% of the workforce is composed of foreign workers. Besides changing the social demographic of the country's labor force, there will be significant actions to close the current gap between government revenues and outlays. Gasoline prices were raised and other energy subsidies are being cut. Those subsidies cost the government \$61 billion in 2015. The plan is for Saudis to be paying market prices for energy by 2020. If that is achieved, there should be a meaningful impact on domestic energy consumption, a trend that recently prompted Citigroup (C-NYSE) to predict that without such a change the Kingdom might be importing oil by 2030.

**Because Saudi Arabia doesn't tax the income of its citizens, it needs to raise other taxes and tighten expenditures to offset the drag on government revenues from lower oil prices**

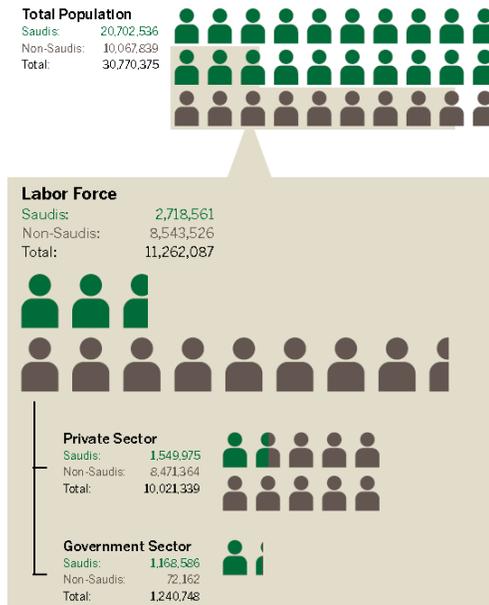
**An earlier attempt was made in 2000 following the late 1990s oil price downturn**

The government is also tightening up the scholarship money to send thousands of young Saudis abroad for education, a program begun by King Abdullah that has sent 200,000 Saudi students to the U.S. over the past decade. Mohammad bin Salman also has announced plans to impose taxes on undeveloped urban land, on cigarettes and soda and, more significantly, a value added tax is to be instituted later this year or in 2017. Because Saudi Arabia doesn't tax the income of its citizens, it needs to raise other taxes and tighten expenditures to offset the drag on government revenues from lower oil prices. Both of these actions will be unpopular with the citizens. But as one middle-aged Saudi businessman told the author, "No one wants to make hard decisions if he doesn't have to. We know structurally the price (of austerity) will be huge and it may destroy the country. When you have people in tents who believe they are entitled to a foreign maid, a lot of things would need to change that the government can't yet do."

In light of that view, a critical question is whether a real economic transformation can be performed. An earlier attempt was made in 2000 following the late 1990s oil price downturn and the expensive Saudi-financed war to oust Saddam Hussein's troops from neighboring Kuwait. The financial pain of that experience was washed away by the rebound in oil prices that ended that transition effort. That experience leads Saudis to expect something to bail them out from having to make hard economic and social decisions.

**Exhibit 4. Saudi's Labor Force Challenge**

Saudi Arabia's Labor Force Demographics



Source: IMF, September 2015

Source: Belfer Center

**By 2030, the youth group will add 4.5 million new Saudis to the labor force, nearly doubling its current size to 10 million workers**

Critical to this transition effort will be the mindset of the young Saudis who dominate the country's population. By 2030, the youth group will add 4.5 million new Saudis to the labor force, nearly doubling its current size to 10 million workers. If the female labor force participation rate increases the number could be larger. This population demographic will force the economy to have to create three times the number of jobs for Saudis than it did during the oil boom of 2003-2013, which seems highly unlikely to occur.

**Here is where modern technology is helping as Uber helps liberate some of these females**

There are a number of social impediments to making this transition occur, including Saudi reluctance to take blue-collar jobs that are thought to be menial. Saudi workers enjoy the slow pace and shorter working hours of government jobs. There is also a problem associated with tapping the young females in the country who are constrained by the social stigmas of not being able to drive and not earning enough to employ a car and driver. Here is where modern technology is helping as Uber helps liberate some of these females. More females are taking white-collar jobs in the private sector. Instead of becoming teachers, many are become lawyers and professionals. The challenge is that many of them are willing to trade down to government jobs with shorter hours when they have children. There are also social and employment issues involved with marriage when a woman's father prefers that a prospective husband have the security of a government job.

**The new social compact will demand greater self-reliance from the people in exchange for their prosperity**

Probably the greatest challenge for Saudi Arabia is that both the rulers and the ruled have been satisfied with the social compact that underlies the nation. The populace trades loyalty and obedience to the government in exchange for prosperity, which costs the government substantially. The new social compact will demand greater self-reliance from the people in exchange for their prosperity. Whether the populous understands how precarious their position is in continuing to depend on the government's continuing largess because of the current and future market for oil.

**The difference now versus the 2000 transition effort is that the next generation of leadership is directing this change**

The difference now versus the 2000 transition effort is that the next generation of leadership is directing this change. They have the enthusiastic support of the young Saudis, which the aged leaders of the past didn't possess. The new leadership understands that the country's economy is based on the nation being blessed with one of the world's largest deposits of crude oil reserves. But that blessing is slowly turning into a curse as Saudi's golden asset is under attack for the damage it causes to the planet's atmosphere. The urgency of transforming the country's economy has not been lost on the new leaders. The question is whether it can be done quickly and without tearing apart the social fabric of the country. If successful, Saudi Arabia will play a major role in the Middle East and the political balance of the world. If the transition fails, there is no way of knowing how volatile the Middle East might become and what impact that could have on the geopolitical balance of the world, let alone the global oil business. Will Saudi Arabia agree to a

production freeze or possibly a cut at Doha, or will it hold to its plan to force meaningful economic pain on high-cost, long-lived oil resources to ensure a longer term future for its lone resource as it races to transform its economy? Every country's playbook for oil and Saudi Arabia needs to be reconsidered because knowledge of past behaviors may not bear any resemblance to what the government may do in the future.

## Oilfield Labor Good News May Really Be Bad News

**Most industry workers, if asked, would probably answer that the oil industry downturn has claimed more than 20% of the workforce**

A headline in *The Houston Chronicle* two weekends ago claimed "1 in 5 oil jobs lost in U.S." For those involved in the energy business, that was not a surprise. The issue is that most industry workers, if asked, would probably answer that the oil industry downturn has claimed more than 20% of the workforce. That's because we don't have a good handle on the actual number of oil-related jobs that have been lost since oil price peaked in June 2014. Part of the accounting problem is that layoff announcements and company closures where jobs evaporate occur sporadically and the announcements usually cover past, present and future actions by the company, especially for the larger ones in the industry.

Several energy industry staffing firms have become the prime source for job loss estimates. All their pronouncements are couched with qualifiers that the numbers are best estimates based on the firms' contacts in the industry. This is not to denigrate the estimates, but rather to point out how difficult it is to get a handle on such an industry dynamic as employment changes in such a dynamic and global business as the oil and gas industry.

**Expansion or contraction of employment rolls is a measure of an economy's health**

The federal government struggles with this same issue every week and every month when it reports on the health of the U.S. labor market. Each week the government reports the number of new unemployment claims filed, with the ups and downs from week to week setting the tone as to whether the labor market is expanding and is healthy, or contracting and unhealthy. Expansion or contraction of employment rolls is a measure of an economy's health.

**Until a few months ago, our household was one of those surveyed**

Every month the government provides an estimate of the number of net new jobs created by businesses. At the same time, based on personal inquiry by government officials of representative households, the federal government estimates the dynamics of the labor force. From this "household survey," the government derives an estimate of the unemployment rate, and all the various measures of unemployment. Until a few months ago, our household was one of those surveyed. The designation comes after a selection of a specific house number and not a family, meaning that the government picked a few homes in our neighborhood and questioned the residents about our employment status.

**It makes one cautious about accepting the “absolute” conclusions forecasters make each week or month when the government’s statistics are released**

Each month during the week in which the 19<sup>th</sup> day fell, we would receive a phone call from the census bureau worker who would conduct the survey. We developed a rapport that led to a pattern of her calling us mid-afternoon on the Sunday of the survey week. Half of the survey consisted of the same set of questions about how many people by age categories lived at the house; whether each was employed or looking for work; how many hours a week those individuals worked; and other questions designed to characterize the labor force participation of each individual. The second half of the survey varied each month and focused on gaining information about specific activities of individual members of the household. What we learned by participating in this survey is that respondents can make up answers to the questions and there was no way the census taker can verify or challenge them. I’m sure lying to a census official is a federal crime, but proving whether one was watching television all the time or actively scanning the want ads and sending resumes when you claim to be unemployed but actively seeking employment would appear to be impossible to prove. None of this is to take away from the general value of the survey and the statistics produced, but it makes one cautious about accepting the “absolute” conclusions forecasters make each week or month when the government’s statistics are released.

**The big difference between now and then is that a second phase of the 1980s downturn claimed almost another one-third of the workforce, or an additional 52,000 workers, between 1984 and early 1987**

When we consider this data about the labor market and its submarkets, we understand that it’s best to view it in a broad context. Even in those terms, however, the news about oil industry job losses, while less than in the 1980s downturn, points to challenging trends for the industry. The article stated that according to the Federal Reserve Bank of Dallas, nearly 118,000 oil and gas jobs have been lost since the beginning of 2015. That figure includes the estimated 23,000 job losses announced for the first quarter of 2016. The challenge was to relate the current industry downturn to that of the 1980s. During the first phase of the downturn – early 1982 to mid-1983 – the industry shed 172,000 jobs. As a percentage of the initial oil and gas industry workforce in 1982 that was about 20%, or the same proportion as cut in the current downturn. The big difference between now and then is that a second phase of the 1980s downturn claimed almost another one-third of the workforce, or an additional 52,000 workers, between 1984 and early 1987. Therefore, over the entire 1982-1987 period, the oil and gas industry cut 224,000 jobs, which equates to a 26% decline in employment. We remind readers that when most analysts and media discuss past downturns, they usually only focus on the 1984-1987 era, so including the earlier phase was a surprise.

If the current industry downturn were to experience a similar percentage decline in jobs as experienced in the 1980s, there would be another 35,400 jobs lost over the next several years. Relative to the 118,000 jobs the Dallas Fed says have already been lost, that would be a significant further decline in oil and gas industry jobs.

**According to the Baker Hughes rig count for January 2, 1982, there were 4,467 rigs drilling for oil and gas in America**

Whenever we discuss an industry downturn, the easiest way is to focus on the decline in the number of active drilling rigs. When we compare these two downturns on that measure, we find some interesting statistics. According to the Baker Hughes (BHI-NYSE) rig count for January 2, 1982, there were 4,467 rigs drilling for oil and gas in America, a few rigs shy of the all-time high of 4,530 rigs. If the 172,000 lost jobs in the 1980s downturn equaled 20% of the labor force, then we can assume that domestic oil and gas employment totaled 860,000 workers. If we then divide the total work force number by the 4,467 active rigs, we find that each rig required 193 employees.

**The 1980s rig count decline claimed 105,150 workers, or 46.9% of the total oil and gas industry employment lost**

Going through the same analysis for this downturn, the estimated 590,000 industry employees were supporting 1,811 rigs working at the start of 2015. That means each working rig needed 326 industry workers, or 169% of the number of workers required in the 1980s.

**The economic harm from the downturn may eventually be greater this time than in the 1980s downturn**

How do we explain the significant difference between the 1982 and 2015 figures? If we measure the declines in rig counts over these two periods, the 1980s saw 3,505 fewer rigs working, while the 2015-2016 decline has claimed only 1,361 rigs. If we assume each drilling rig needs 30 workers to operate 24-hours a day, then the 1980s rig count decline claimed 105,150 workers, or 46.9% of the total oil and gas industry employment lost. In contrast, the current downturn has claimed an estimated 40,830 rig workers, or 34.6% of the industry's beginning employment. This analysis will become more important when we begin attempting to contemplate the employment needs of the industry when the oil cycle turns up.

The conclusion we draw from this analysis is that while there have been fewer oil and gas industry jobs lost in this downturn, according to the totals from the Dallas Fed, the economic impact may be greater if we simply assume that non-rig employees earn more than rig-workers. We know that is not completely accurate, but it points out that the economic harm from the downturn may eventually be greater this time than in the 1980s downturn. What we often forget about the 1980s oil and gas industry downturn, especially in Texas and Oklahoma, is that it coincided with the real estate bust that destroyed the savings & loan industry. For those of us who lived through the 1980s downturn, we remember the overgrown lawns of abandoned homes. Since we haven't seen that yet in this downturn, we don't think this economic hit has been as bad as in the 1980s, yet. Because most of the recent employment cuts have been home-office employees, the impact of the income reduction is just beginning, so this downturn may become worse. None of this analysis eases the pain of those oil and gas industry workers who have lost their jobs. Nor does it minimize the economic damage being done to communities heavily dependent on the oil and gas industry. And, it doesn't measure the impact that the downturn will have on the future trajectory of the oil and gas business. These are tough times. They certainly will end at some point. How many jobs

will be recreated in the next upturn remains a haunting fear at the moment. Some portion of the recently lost jobs may never return, and for some workers the recovery won't come soon enough for them given their age.

## Nutrition Study History, Free Speech Attack And The Climate

**Some 24 research laboratories testing over 2,000 subjects failed to replicate the “ego depletion” study despite it being cited over 3,000 times in the academic literature**

We have recently written about the problem of scientific research believers failing to question the paradigm when data and studies lead to contradictory conclusions. We wrote about how the assumptions underlying the psychology theory of “ego depletion” that suggest humans have a limited amount of willpower went unchallenged until a massive study questioned it. Some 24 research laboratories testing over 2,000 subjects failed to replicate the “ego depletion” study despite it being cited over 3,000 times in the academic literature. Now we have another scientific study failure based on a similar situation, only this time the potential impact could be much greater. The failed study dealt with the virtues of low-fat diets that underscores the official diet guidance published by the federal government.

Last week, an article in *The Washington Post* stated the following about the study.

“It was one of the largest, most rigorous experiments ever conducted on an important diet question: How do fatty foods affect our health? Yet it took more than 40 years — that is, until today — for a clear picture of the results to reach the public.

**“Patients who lowered their cholesterol, presumably because of the special diet, actually suffered more heart-related deaths than those who did not”**

“Today, the principles of that special diet — less saturated fat, more vegetable oils — are included in the Dietary Guidelines for Americans, the government’s official diet advice book. Yet the fuller accounting of the data indicates that the advice is, at best, unsupported by the massive trial. In fact, it appears to show just the opposite: Patients who lowered their cholesterol, presumably because of the special diet, actually suffered more heart-related deaths than those who did not.

“The new researchers, led by investigators from the National Institutes of Health and the University of North Carolina, conclude that the absence of the data over the past 40 years or so may have led to a misunderstanding of this key dietary issue.

“‘Incomplete publication has contributed to the overestimation of benefits and underestimation of potential risks’ of the special diet, they wrote.”

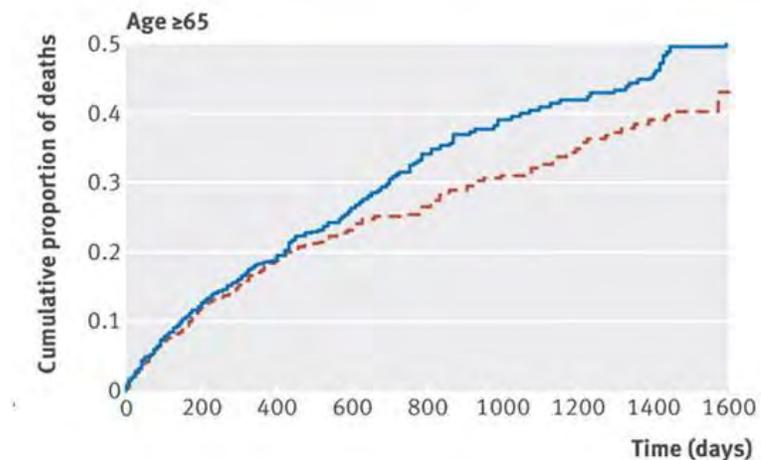
So one has to ask how that happened. The writer of the article interviewed various nutrition professors, most of whom suggested that this was not an earthshattering research conclusion, but the author also questioned Steven Broste, now a retired biostatistician,

**“The Minnesota investigators had a theory that they believed in — that reducing blood cholesterol would make people healthier”**

who was a student at the University of Minnesota at the time of the study and used the full set of data for his master’s thesis in 1981, which was never published. The author of the article wrote, “Broste suggested that at least part of the reason for the incomplete publication of the data might have been human nature. The Minnesota investigators had a theory that they believed in — that reducing blood cholesterol would make people healthier. Indeed, the idea was widespread and would soon be adopted by the federal government in the first dietary recommendations. So when the data they collected from the mental patients conflicted with this theory, the scientists may have been reluctant to believe what their experiment had turned up.”

“The results flew in the face of what people believed at the time,” said Broste. “Everyone thought cholesterol was the culprit. This theory was so widely held and so firmly believed — and then it wasn’t borne out by the data. The question then became: Was it a bad theory? Or was it bad data? My perception was they were hung up trying to understand the results.”

#### Exhibit 5. 40-Year Old Misunderstanding About Fat



Source: *The Washington Post*

As shown in Exhibit 5, the mortality of those patients on the special cholesterol-lowering diet (blue line) climbed above the mortality rate of patients on the conventional diet (dashed red line) over time. The take-away from the study was that those people on the special diet actually were dying at a higher rate, but it didn’t become completely clear until longer into the study.

**Once again we have a thesis that was supposedly supported by substantial research that happened to fit the popular scientific thesis at the time**

Once again we have a thesis that was supposedly supported by substantial research that happened to fit the popular scientific thesis at the time. Upon further examination, it appears that the data didn’t support the thesis. By failing to sufficiently question the conclusions of the study, and then for further studies not to examine the thesis in depth, we are left with a nutrition gospel that is likely not accurate.

**The strategy of the climate change promoters is to attempt to shut down the questioning of the thesis rather than to re-examine it**

But that seems to be the way it goes with current nutrition/health studies? What was bad for you in the past is now good, and vice versa.

With climate change, it seems the thesis is never questioned despite robust academic studies and analyses of the underlying temperature data questioning the basic premise. The strategy of the climate change promoters is to attempt to shut down the questioning of the thesis rather than to re-examine it. As we head toward the date when President Obama plans to sign the Paris climate change agreement of last November, the political attacks on the oil industry and research organizations speaking out about climate change is escalating. A rally of state attorneys general was held to back the investigation efforts of their fellow attorneys generals of New York, California and two other states who have launched inquiries into whether Exxon Mobil Corp. (XOM-NYSE) hid from the public its knowledge of the damage fossil fuels cause to the climate.

**ExxonMobil has no staff or operations in the Virgin Islands**

The latest development is a subpoena by the attorney general of the U.S. Virgin Islands seeking records to address the claims that the company was obtaining money under false pretenses and conspiring to do so. ExxonMobil has gone to court to have the subpoena dismissed because it was issued “without the reasonable suspicion required by law and based on an ulterior motive to silence those who express views on climate change with which they disagree.” ExxonMobil has no staff or operations in the Virgin Islands. The only law cited by the Virgin Island’s attorney general was the Racketeer Influenced and Corrupt Organizations Act (RICO) that would not apply due to its statute of limitations. The RICO law requires one provable act of fraud in the last five years and ExxonMobil has openly admitted climate change’s impact on the world for at least 10 years. Therefore, the company shouldn’t be targeted.

**The environmentalists set about on a campaign “to establish in public’s mind that Exxon is a corrupt institution that has pushed humanity (and all creation) toward climate chaos and grave harm”**

The battle over climate change has reached a tipping point, but largely due to the frustration of environmentalists at the perceived lack of potency of recent climate deals. Their effort, which was underscored by the *Wall Street Journals*’ reporting on a January meeting of key environmental leaders to develop a strategy to push their agenda, reflects this elevated campaign. Backed by funding from the Rockefeller Family Fund, the environmentalists set about on a campaign “to establish in public’s mind that Exxon is a corrupt institution that has pushed humanity (and all creation) toward climate chaos and grave harm.” That goal was listed on an agenda from the meeting that was seen by the *Wall Street Journal*, and reported by them. Note how the agenda language references biblical phraseology.

Not only has ExxonMobil become a target of the climate change activists but so has the Competitive Enterprise Institute (CEI), a think tank skeptical of global warming that has received funding from the oil company in the past. A subpoena was issued to CEI by the

**Mr. Reynolds questions whether the various attorneys general have ever read this law after their public relations rally to support those attorneys general investigating ExxonMobil and now CEI**

Virgin Islands' attorney general for all communications dealing with climate change research between CEI and ExxonMobil over the past 10 years. CEI has moved to have the subpoena dismissed on the basis of it being a violation of free speech.

With respect to free speech, University of Tennessee constitutional law professor Glenn Harlan Reynolds wrote an op-ed in *USA Today* pointing out that Title 18, U.S.C., Section 241 makes it a felony "for two or more persons to agree to injure, threaten, or intimidate a person in any state, territory or district in the free exercise or enjoyment of any right or privilege secured to him/her by the Constitution or the laws of the United States." The language is taken directly from the Department of Justice Civil Rights Section web site. Mr. Reynolds questions whether the various attorneys general have ever read this law after their public relations rally to support those attorneys general investigating ExxonMobil and now CEI.

**If almost every one of the nearly 4,100 members surveyed believe in climate change but one-third of them believe humans are not the primary cause, then arguing that climate science is settled is foolish**

As the battle lines are drawn between the environmentalists and their legal supporters and the fossil fuel companies and independent research organizations, the issue of free speech will not disappear. The fact that the latest survey of members of the American Meteorological Society showed that more than nine out of ten believe that climate change is occurring, but that only 67% believe it is caused largely or mostly by humans, highlights the skepticism. It is an important point. If almost every one of the nearly 4,100 members surveyed believe in climate change but one-third of them believe humans are not the primary cause, then arguing that climate science is settled is foolish. Rest assured that given the support of the mainstream media, the environmental movement will keep its claims about climate change and the "fraud" of ExxonMobil, representative of the entire fossil fuel industry, alive. We are in the early innings of this ballgame, which could certainly go extra-innings.

## Gasoline Relief As Self-driving Cars Face Limitations

**The Jetson-world view of personal transportation envisioned by the early adaptors of autonomous vehicle technology may not be happening as quickly as proponents wish**

The rush to put self-driving vehicles on the public highways may have been slowed as issues with the technology emerged during the first of two National Highway Traffic Safety Administration (NHTSA) hearings about establishing guidance and regulations for how it would be deployed. The Jetson-world view of personal transportation envisioned by the early adaptors of autonomous vehicle technology may not be happening as quickly as proponents wish. That does not ignore the fact that some of the basic technology for self-driving vehicles is already being incorporated into current vehicle models – such as lane-steering and automatic emergency braking.

The NHTSA has been pushed aggressively to issue guidance for deploying self-driving cars within six months. These hearings are designed to help push that agenda. The reality of the limitations of

**Thousands of “disengagements” in road tests of self-driving cars have been reported, according to Consumer Watchdog**

the technology, especially given the existence of 253 million vehicles in the United States as of 2013, may slow its implementation. According to the NHTSA, issuing new regulations has taken an average of eight years. Guidance, on the other hand, can be issued faster, but regulations are legally enforceable whereas guidance is usually more general and open to interpretation.

During the hearing, General Motors (GM-NYSE) said it expects to deploy self-driving cars within a few years through a partnership with ride-sharing service Lyft. Google (GOOG-Nasdaq), one of the early innovators in the self-driving vehicle space, has been pushing for expedited permission to sell cars without steering wheels or pedals. In the early tests, the California Department of Public Service has mandated that test vehicles must have both steering wheels and brake pedals to allow humans to take control of the vehicle from computers in certain situations. Therein lies a problem for self-driving vehicles. Thousands of “disengagements” in road tests of self-driving cars have been reported, according to Consumer Watchdog.

Issues with the self-driving technology that need to be addressed include: poorly marked pavement, including parking lots and driveways, where clear lane markings are not present; bad weather that could interfere with the sensors; the inability for self-driving cars to take orders from a policeman; and inconsistent traffic control devices such as horizontal rather than vertical traffic lights.

**The solution to overcome this technological shortcoming would be to require greater control over pedestrian crossings**

Additional issues with self-driving vehicle technology reflect that in the busiest places such as the centers of cities there are too many pedestrians. If a self-driving car is programmed to recognize a human and avoid hitting it, there is the possibility these cars could never make it through the city during busy times due to sensory overload. As a result, the solution to overcome this technological shortcoming would be to require greater control over pedestrian crossings. Think about the chaos of pedestrians in midtown Manhattan at lunch time versus the more orderly street crossings in London. Old timers in Houston may remember the jaywalking police in downtown during the 1970s when you crossed only at intersections and then only when traffic allowed.

**The passenger might merely exit the vehicle and allow it to navigate around town until the person wishes to be picked up again**

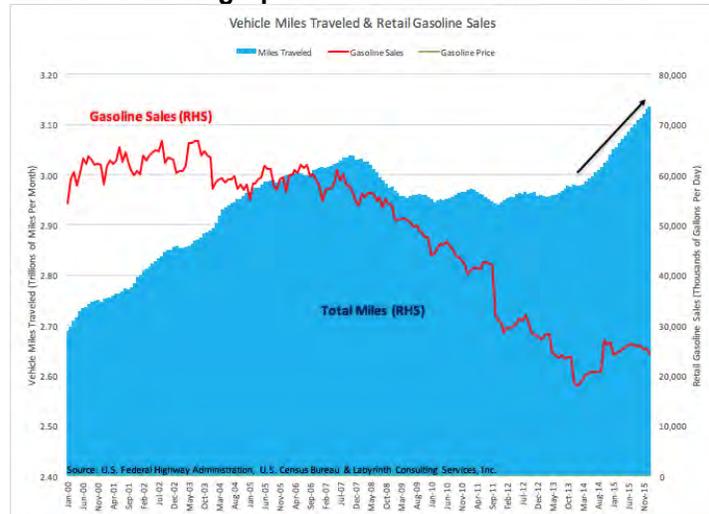
Another problem in central cities is that if a driverless vehicle cannot find a parking space, the passenger might merely exit the vehicle and allow it to navigate around town until the person wishes to be picked up again. That will add to a city’s congestion rather than alleviate it. Also, there is the issue of people sending their driverless vehicle home after commuting to work and doubling the number of trips per day, further adding to congestion.

There are other issues that derive from the self-driving vehicle’s design. Visibility from the inside out may not be a priority, especially if riders are not facing the windshield. How will drivers of other cars

**Driverless vehicles will no longer need headlamps because there is “nothing necessary to see” when driving at night**

who are used to visually engaging other drivers be able to gauge what a driverless car will do in a given situation? Driverless vehicles will no longer need headlamps because there is “nothing necessary to see” when driving at night. Self-driving cars will only need marker lamps for others to see it, but that will necessitate a recalibration by drivers of conventional cars as to what to expect to see when navigating at night.

**Exhibit 6. Driving Up But Gasoline Volumes Lower**



Source: Art Berman

**Based on electric vehicle sales for 2010-2014, the estimated annual sales growth rate was 23%**

As it becomes clear that evolving the current American vehicle fleet into a self-driving one will not be either easy or quick, the petroleum industry will breathe a sigh of relief. They have been worried that these autonomous vehicles will all be electric cars rather than possessing internal combustion engines. A report issued late last year by the Electric Vehicle Transportation Center showed that as of August 2015, the U.S. possessed the largest electric vehicle fleet in the world with 358,000 units in operation. Based on electric vehicle sales for 2010-2014, the estimated annual sales growth rate was 23%. The sharp decline in gasoline prices last year significantly hurt the electric vehicle market. Sales of electric cars fell nearly 10% for the first eight months of 2015 compared to the same period in 2014. Hybrid vehicle sales showed a 19% decline for the same period of time. Thus, as a percentage of the U.S. vehicle fleet, electric cars barely register. Given the pushback from people actively involved in the self-driving vehicle industry about the pace with which new regulations should be written for this disruptive technology, we suspect that even the most conservative forecasts for the penetration rate for electric and self-driving cars may prove overly optimistic, unless mandated by government action. Absent that, petroleum-powered vehicles will continue to dominate the transportation business for a long time, meaning that the current 9.5 million barrels a day of gasoline demand is safe for a while.

## Upcoming Hurricane Season Creates Forecasting Challenge

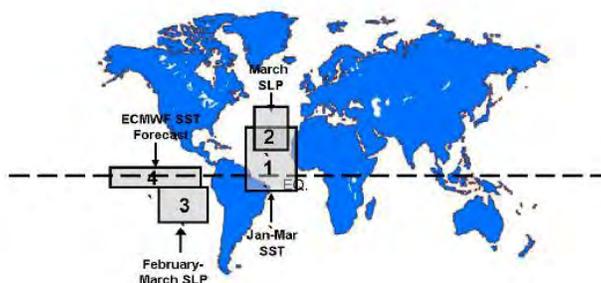
**Their forecast calls for the 2016 hurricane season to be a normal year, but that conclusion may be altered when the CSU team updates its forecast June 1st as a result of possible shifts in key atmospheric conditions that may impact the formation and strength of tropical storms**

**What drives the forecast is the combination of atmospheric pressures and sea surface temperatures in both the South Pacific and Atlantic Oceans**

It is mid-April, so it is time again for the annual Colorado State University (CSU) Department of Atmospheric Science forecast for the upcoming hurricane season. The forecast is prepared by Professor Philip Klotzbach with the assistance of Professor Emeritus William Gray, and it marks their 33<sup>rd</sup> annual forecast. So far, 2016 has been an unusual year in that we experienced the first hurricane of the year in January (Hurricane Alex), well ahead of any other time in the past. As a result, the official CSU forecast provides numbers for the entire year, but their recently issued report focuses exclusively on the period starting in April. Their forecast calls for the 2016 hurricane season to be a normal year, but that conclusion may be altered when the CSU team updates its forecast June 1<sup>st</sup> as a result of possible shifts in key atmospheric conditions that may impact the formation and strength of tropical storms.

The April CSU forecast calls for 12 named storms, six hurricanes and two major hurricanes (Category 3-4-5), but the official projection would add one to each of the named storm and hurricane categories. What drives the forecast is the combination of atmospheric pressures and sea surface temperatures in both the South Pacific and Atlantic Oceans. The connection between these two areas is that conditions in the Pacific sets up wind patterns that dominate the Atlantic basin area where tropical storms form. Those winds, or their absence, impact the sea surface temperatures in the region, which in turn impact the formation and the strengthening or weakening of tropical storms as they move from the West Coast of Africa across the Atlantic and toward North America.

### Exhibit 7. Focus Of Drivers Of Hurricane Activity



Source: CSU

**This weather pattern has hurt energy demand**

Most people know that the dominant weather feature for North America during the past 12 months has been the strongest El Niño in years. It has generated extremely warm temperatures across the United States and brought significant moisture to the West Coast region. This weather pattern has hurt energy demand as it shifted the normally cold winter temperatures of the Midwest and Northeast regions with their large population centers into Canada while cooling

**El Niño produces very warm sea surface temperatures that alters the course of the jet stream keeping it further north than normal**

and dumping more moisture on parts of California, the Pacific Northwest and the Rocky Mountain States. El Niño produces very warm sea surface temperatures that alters the course of the jet stream keeping it further north than normal. As a result, rather than the traditional jet stream course that brings cold weather from the Arctic down into the United States in the Upper Plains States and then across to the Northeast, with occasional dips into the Southeast and Central U.S. States, the jet stream stayed more in Canada allowing more warmth to permeate the winter regions.

#### Exhibit 8. Ending Of El Niño Climate Effects?



Source: CSU

**Right now, the waters off the East Coast of the United States are warm, but they are cooling, so the question is how far across toward Africa the waters cool**

Temperature anomalies in the South Pacific central region where El Niño exists peaked in mid-November and have been cooling quickly, raising the possibility that the region will become either neutral or develop a La Niña weather pattern (opposite conditions and impact of El Niño) by the start of the summer. That would influence both wind conditions and water temperatures in the Atlantic and potentially alter the dynamics for hurricane formation. Normally, during a La Niña weather event, the far North Atlantic sea surface temperatures are colder with a U-shape pattern that cools sea surface temperatures in the tropical region of the Atlantic. Right now, the waters off the East Coast of the United States are warm, but they are cooling, so the question is how far across toward Africa the waters cool as summer arrives. Cooler sea surface temperatures retard the development of tropical storms. Tropical storms strengthen as they gather energy from warm sea waters as they travel toward North America. All of this suggests that the CSU June 1<sup>st</sup> forecast revision will be a more important indicator for the remainder of the 2016 hurricane season than the current forecast.

**They selected years meeting those conditions with a variety of tropical and North Atlantic sea surface temperature anomalies due to “the large uncertainty as to what the Atlantic will look like this summer and fall”**

While the hurricane forecast is based on a statistical model of atmospheric anomalies from the past compared to current anomalies, the forecast team also looks at analog seasons for guidance. In selecting those years for the 2016 season, it was interesting to learn the selection criterion. The CSU team looked for years that were characterized by El Niño conditions in the previous year with transitions to neutral or La Niña conditions in the current year. Additionally, they selected years meeting those conditions with a variety of tropical and North Atlantic sea surface temperature anomalies due to “the large uncertainty as to what the Atlantic will look like this summer and fall.” You now see the perfect forecast hedge. The result of their selection produced the following analog

**Turning off the valves for a few days as hurricanes pass by might not be the worst thing for the oil and gas industry this summer**

hurricane seasons: 1941, 1973, 1983, 1992, 1998 and 2003. The average of these storm seasons compared to the CSU forecast in parentheses showed 9.2 named storms (12), 5.3 hurricanes (5), 2.0 major hurricanes (2) and an accumulated cyclone energy measure of 92 versus 90.

Right now, trying to forecast the upcoming hurricane season can be done with about as much confidence as predicting crude oil and natural gas prices. While hurricane forecasters are always cautioning the public about it only taking one storm to create a disaster even during a benign storm season, a more active hurricane year might actually help the oil and gas business if it forces frequent and extended shutdowns of offshore production. We are not predicting this, and certainly hope that whatever impact is felt will not produce significant damage or human suffering. Turning off the valves for a few days as hurricanes pass by might not be the worst thing for the oil and gas industry this summer.

**Addendum:** We learned that William Gray died last Saturday at age 86. R.I.P.

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