
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

Questioning Which Oil Industry Threats Are For Real

Certain trends do offer long-term threats to the health of the oil business

If you are in the energy industry, you are hounded daily with commentary suggesting doom for the business, and your career, too. The threats to your employment future are keyed off near-term business trends and their projected longer term impact for the financial health of the industry and the companies within it. It is not a given that these threats will come to pass, let alone inflict the predicted harm. On the other hand, industry executives, and especially younger employees, need to focus on those trends that actually will reshape the industry's future, and factor them into their business strategy and personal planning. Certain trends do offer long-term threats to the health of the oil business, or at least as it is currently structured, while others are merely distractions possessing little serious and sustainable disruptive power.

Much of the oxygen in the energy room is sucked up daily by the angst over whether the oil price will go up or down in a particular week, usually tied to what the Energy Information Administration (EIA) reports in its weekly crude oil and petroleum storage report. A component of that report is an estimate of the amount of crude oil produced in the prior week, which, at the moment, has industry executives, oil traders and investors mesmerized over whether the number is up or down compared the prior week's output. The verdict of the report is often taken as direct commentary on the future of global oil supply and world oil prices.

The stock market and commodity exchanges are minute-to-minute forums providing instantaneous judgements on business news

The problem for the weekly EIA report is that the stock market and commodity exchanges are minute-to-minute forums providing instantaneous judgements on business news and how it will impact the supply and demand for petroleum. These judgements usually don't match the workings of the industry. Yes, the oil and gas business is a 24/7 enterprise, and events do upset it from time

A fire at a refinery, or a foggy day in Houston harbor, will have quick impacts on oil supplies, yet the flexibility built into the industry structure (storage) enables it to deal with such surprises

to time, but those are typically rare occasions. A tropical storm may force the shutting down of offshore producing wells, meaning less supply available. A fire at a refinery, or a foggy day in Houston harbor, will have quick impacts on oil products, yet the flexibility built into the industry structure (storage) enables it to deal with such surprises. On the other hand, one needs only to remember the impact Hurricane Katrina had on the petroleum industry and oil consumption across the Gulf Coast and in the Southeast USA in order to understand how a short-term event, a few days of storm, may create long-term challenges for the industry. Another example of how instantaneous reactions can harm the industry long-term was the Deepwater Horizon rig accident that led to the Macondo oil spill and months of offshore industry disruption.

For petroleum executives, understanding the risks of another Katrina or Macondo event forces them to anticipate potential disaster scenarios and develop recovery plans. On the other hand, weekly gasoline demand or crude oil production estimates that surprise forecasters are not something industry executives can, or should necessarily, react to. We acknowledge that oil industry executives can use weekly data surprises and the stock market reaction as a timing event for share repurchases or equity offerings, but that is a rarity, as both of these actions typically require long-range planning since they are integral components in the exercise of a corporate strategy.

The petroleum industry needs to evaluate its ability to improve its sustainable return on invested capital, especially compared with its expected capital investment requirements

So what issues and potential events should petroleum executives focus on? Rather than providing a laundry list of topics, we would single out a few over-arching themes. First is the broad question of what is the role of petroleum in meeting the future economic and social needs of the global economy. Secondly, the petroleum industry needs to evaluate its ability to improve its sustainable return on invested capital, especially compared with its expected capital investment requirements. Third, considering the question of organizational sustainability, companies must think about how they are going to staff their future enterprise, especially with technical employees, given the strong anti-fossil fuel attitude of most Millennials, which is now the largest segment of the population and workforce and will be for the foreseeable future. Lastly, executives must worry about what actions governments might take that would impact the industry's fundamentals.

We have gone from “peak oil” to “peak demand” to “peak automobiles” and now to “the Summer of the Electric Car”

While there are numerous issues surrounding the question of petroleum product demand, 2017 has witnessed several condition shifts that are useful in framing the debate. We have gone from “peak oil” to “peak demand” to “peak automobiles” and now to “the Summer of the Electric Car,” a phrase recently coined by Karel Beckman, editor in chief of *Energy Post*. He went on to write that this summer is “when it became really certain, for the first time, that the electric car is here to stay.” That might surprise people, but the point he was making about this summer is that there has been a

Another potential market mover was the pledge by the new French government to go all-electric by 2040

series of specific events that have cemented the future role for electric cars, regardless of whether their economic and carbon emission propositions are currently realistic. Those events include the UK government's recent announcement that it would ban the sale of "new conventional petrol and diesel cars and vans" by 2040. There was also the launch of the new Tesla Model 3, Elon Musk's equivalent of Germany's "people's car." Then there was the pledge by Volvo that it will soon produce only electric cars or hybrids, which was followed by similar pronouncements by other vehicle manufacturers such as Porsche, Daimler and Cummins. Other potential market movers include the pledge by the new French government to go all-electric by 2040 and Germany's diesel scandal.

Bloomberg noted that "when the boss of Europe's biggest listed oil company says his next car will be electric, it says a lot about the future of fossil fuels"

Some commentators have pointed to Ben van Beurden, the CEO of Royal Dutch Shell (RDS.A-NYSE), who said, in an interview with *Bloomberg*, that his next car will be electric - a plug-in Mercedes Benz S-500e. *Bloomberg* noted that "when the boss of Europe's biggest listed oil company says his next car will be electric, it says a lot about the future of fossil fuels." That point has also been made by Wall Street portfolio managers evaluating the planned initial public offering of Saudi Aramco, targeted for early next year. Portfolio managers' views are: Why would you want to buy these shares when the Kingdom is selling? What does this say about their view of the long-term future for oil? These are good questions and should not be brushed away by petroleum executives when they plot their companies' long-term future.

Those shareholders want company managers to 'put pedal to the metal' in order to grow production and capture substantial returns when oil prices climb

As a part of that discussion must be an examination of how to improve the return on invested capital metric of petroleum companies. Oil executives point to the cyclical nature of their business – reflected by fluctuations in global oil prices – as to why returns are low, but they seldom talk about how better they can exercise capital spending discipline. In many ways, executives are catering to the wishes of their shareholders, many of whom rent the shares when they expect oil booms. Those shareholders want company managers to 'put pedal to the metal' in order to grow production and capture substantial returns when oil prices climb. Of course, those same shareholders are quick to sell their shares when they sense an impending industry downturn, because they know the companies can't stop spending overnight, so financial returns will fall sharply, destroying earnings and bringing down share prices.

A consideration oil company managers are wrestling with is how the shale revolution has changed the nature of how the industry, and companies, will work in the future. The industry is a long way from the days when exploration produced success only 10%-20% of the time, rather than the nearly 100% associated with shale exploration. We have moved from exploration to exploitation as the driving force behind the industry. What this means is that oil companies need to acquire larger contiguous acreage spreads to enable wells to have the longest lateral lengths possible to tap the maximum amount

If managed properly, this process can help reduce well costs, but some of those gains come at the expense of the service industry that faces increased investment needs while fighting to increase prices

of resources under the land. This has changed the nature of the initial exploration phase of the business.

Secondly, the move to a ‘manufacturing process’ to exploit shale formations results in the need for larger drilling and producing complexes with greater technology. This increases the strains on oilfield service companies with respect to their required investment, as well as placing much greater stress on supply systems and logistical networks. If managed properly, this process can help reduce well costs, but some of those gains come at the expense of the service industry that faces increased investment needs while fighting to increase prices.

At some point, well costs will have to rise or the service industry will not be able to provide the amount of new equipment and staff necessary to meet oil company needs. For the oil company customers, technology and increased efficiency may offset some, or all, of the service industry’s price increases. Balancing input costs in the face of continued relatively low oil prices is a challenge oil companies must address in planning their investments if they want to ensure consistent financial returns.

The diesel emissions scandal in Germany is raising the specter of the death of that power source

Even given the most aggressive forecasts for the growth of electric vehicles (EVs), the oil business is not going away any time soon due to the hundreds of millions of conventional gasoline and diesel cars that dominate the global vehicle fleet. The diesel emissions scandal in Germany has raised the possibility of the death of that power source, which will force auto companies to embrace EVs. This event will force a modification of many oil market outlooks. A 2014 chart from the International Energy Agency (IEA) shows how oil’s use by sector has changed over the 40-year span since 1973. Transportation’s use of oil has increased from about 45% in 1973 to

Exhibit 1. How Transportation’s Oil Use Has Changed



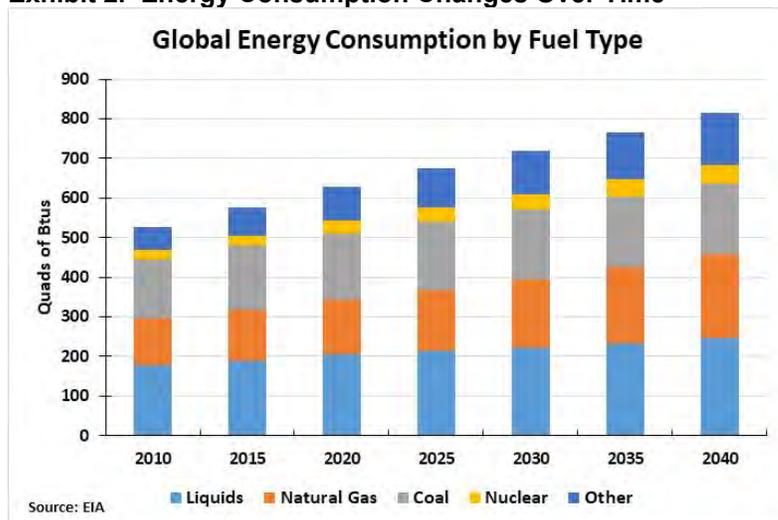
Source: IEA

The two oil companies assert that more EVs in the global fleet will have only a minimal impact on the growth of oil consumption

nearly 64% in 2013. This growing share came despite the consumption slowdown due to improved fuel-efficiency.

While history is nice to study, the question for oil industry executives is: What about the future? Transportation’s use of oil will continue to be the driving force for oil consumption growth, even while EVs gain a meaningful share of new vehicle sales. Much distain has been heaped on the long-term oil forecasts of Exxon Mobil Corp. (XOM-NYSE) and BP plc (BP-NYSE) by environmentalists and EV proponents. The two oil companies assert that more EVs in the global fleet will have only a minimal impact on the growth of oil consumption. Those oil company forecasts seem to be in line with the Reference Case projection of the EIA’s 2016 International Energy Outlook. It shows liquids (oil, ethanol and natural gas liquids) use, measured in quadrillions of British thermal units (Btus), growing steadily throughout the forecast period extending to 2040.

Exhibit 2. Energy Consumption Changes Over Time



Source: EIA

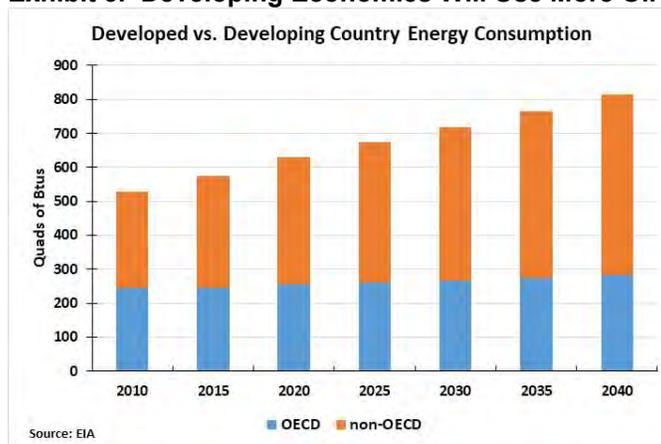
In total, between 2010 and 2040, the EIA expects energy demand to grow by 54.4%. Liquids fuels are projected to grow over this period by 37.7%, while natural gas growth will soar 78.7%. In physical terms, natural gas (93 QBtus increase) consumption will grow by nearly a third more than oil’s use (68 QBtus), while coal consumption (34 QBtus) will increase by barely over half of the growth in liquids’ consumption. Nuclear power increases the least of all the fuels (19 QBtus), but posted one of the largest percentage gains (+67.9%) due to its small base in 2010. Most interestingly, the Other category, which includes renewables, is predicted to increase consumption by 74 QBtus, or an impressive 128.5% gain.

A consideration that should not be overlooked is where this growth is happening. Exhibit 3 (next page) shows energy consumption

OECD economies will increase their energy use by 15.8% compared to the 87.5% growth projected for non-OECD economies

divided between the developed countries of the world (OECD) and the developing ones (non-OPEC). The difference in energy demand growth between these two groups is astounding. The OECD economies will increase their energy use by 15.8% compared to the 87.5% growth projected for non-OECD economies. For a domestic exploration and production company, this may seem to be a worthless consideration, but now that the United States has become an oil exporter, the health of the global oil market should be of increased interest to the executives of these E&P companies.

Exhibit 3. Developing Economies Will Use More Oil



Source: EIA

Natural gas was initially embraced by environmentalists as the “bridge fuel” to a cleaner energy mix until renewable fuels could mature sufficiently to become the “carbonless fuel” for the future

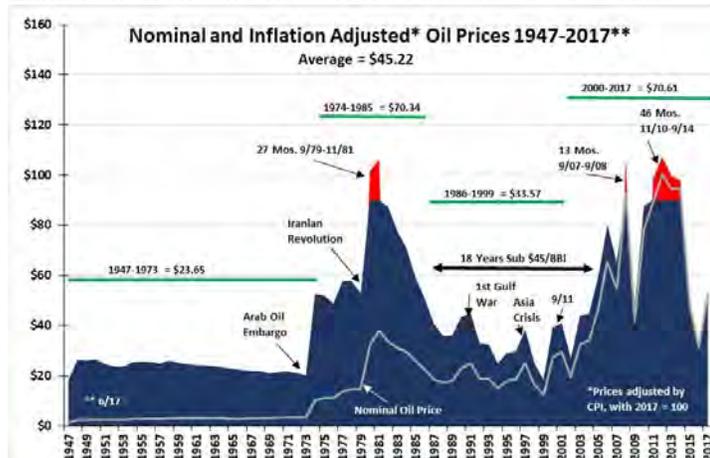
What the EIA forecast demonstrates is that the portfolio shifts underway at several major integrated oil companies – BP, Royal Dutch Shell (RDS.A-NYSE) and TOTAL S.A. (TOTF.PA) – from crude oil to natural gas resource exploitation, are founded on the expectation that the world’s energy market has entered a new era that will be dominated by natural gas. The quest for cleaner fossil fuels, in response to global pressure to reduce carbon emissions, has focused on increased use of natural gas, which has considerably fewer carbon emissions than either crude oil or coal. That explains why natural gas was initially embraced by environmentalists as the “bridge fuel” to a cleaner energy mix until renewable fuels could mature sufficiently to become the “carbonless fuel” for the future. The double-digit price at that time may explain why the environmentalists loved natural gas as it provided a price umbrella over expensive renewables.

Oil supply tends to grow in a stepwise function, meaning that it often exceeds demand at times and depresses oil prices

The projected growth for energy doesn’t necessarily translate into stable oil prices. They are determined by the relative balance between supply and demand. The problem is that oil supply tends to grow in a stepwise function, meaning that it often exceeds demand at times and depresses oil prices. Weak demand growth often coincides with a surge in supply growth. What we know, however, is that temporary oversupply conditions usually are resolved as the low oil price stimulates increased use, at

the same time the industry reacts to low prices by slowing the addition of new supplies. The issue is always how quickly these adjustments occur.

Exhibit 4. How Oil Prices Have Fluctuated Over Time



Source: EIA, BEA, PPHB

We would also point out the 18-year span of sub \$45 a barrel oil price, with the exception of the First Gulf War and the 9/11 attacks, that followed the first period of extremely high oil prices

Given all these forces, the challenge for the industry is understanding the managerial and technological skills as well as the thought processes necessary to successfully manage through the uncharted waters of the future

The history of oil prices is enlightening in that regard. The long-term inflation adjusted oil price is near where the current oil price is trading. Over the 1947-2017 period, average inflation adjusted oil prices were highly sensitive to those periods when oil was above \$90 a barrel. We would also point out the 18-year span of sub \$45 a barrel oil price, with the exception of the First Gulf War and the 9/11 attacks, that followed the first period of extremely high oil prices. If history repeats, after the recent, and longer, period of extremely high oil prices, we may be condemned to repeat a long period of lower oil prices, as some oil company CEOs are suggesting.

In light of the potential for an extended period of lower oil prices, coupled with issues about future oil demand growth, an ominous challenge for energy executives is planning their organization's structure for the future. This challenge is shaped by the impact that a changing fuel mix will have on the business, the ability of oilfield technology to disrupt traditional oil market dynamics, and the potential for a greater role for digital technology to either help or disrupt the business. Given all these forces, the challenge for the industry is understanding the managerial and technological skills as well as the thought processes necessary to successfully manage through the uncharted waters of the future.

The Great Crew Change for the oil business, a topic that has been widely discussed within the industry, remains a significant challenge for executives. Although the oil business is often portrayed as being conducted by the seat of one's pants, this is an industry with substantial technological content and managerial demands. The technology aspect often rivals that which was employed in the space

Dirty oil is not as attractive an employment opportunity as technology gadgets and software

program. Increasingly, technology has been embraced by the oil and gas industry, which has helped its performance in recent years (the shale revolution) and will be increasingly important for its future success. Dirty oil is not as attractive an employment opportunity as technology gadgets and software. Attracting and keeping the skilled personnel necessary to drive the increased technological content that will be necessary for the future success of the oil business will be a major undertaking for industry executives.

The 'dog days of summer' are a good time for oil industry executives to be addressing these long-term challenges. More time should be devoted to understanding these issues, and less time devoted to weekly data releases. There are no easy answers for managing the future, but that's why oil leaders are paid the big bucks.

Natural Gas Market Making Progress Toward Improved Balance**Since 2016, the industry has struggled with lower than anticipated (hoped for) prices as power demand and weather have not cooperated to lift consumption as high as originally expected**

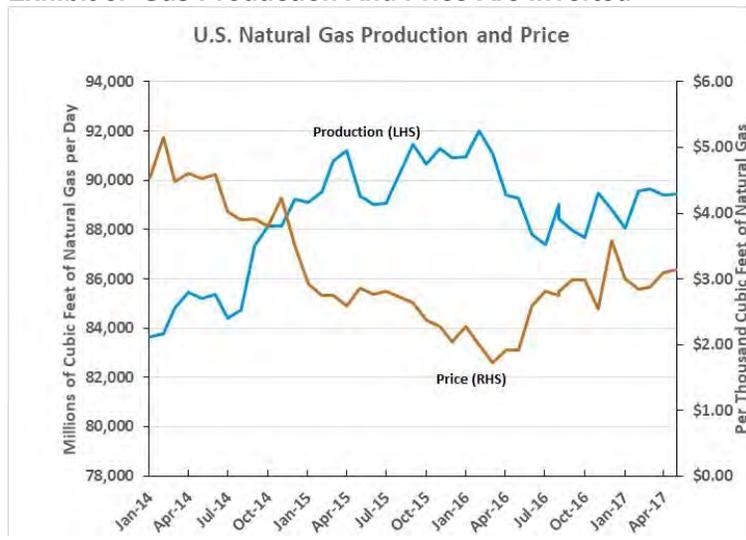
The natural gas market, after ending the winter withdrawal season with the third most gas in storage since 2000, trailing only 2012 and 2016 totals, is struggling to bring supply down to more normal levels. Since 2016, the industry has struggled with lower than anticipated (hoped for) prices as power demand and weather have not cooperated to lift consumption as high as originally expected. Liquefied natural gas (LNG) exports have helped on the demand side of the equation, but the growth of associated gas output, particularly given the strong oil shale drilling effort in the Permian Basin, continues to restrain gas prices.

Gas demand did improve some, but nowhere near as much as expected

As Exhibit 5 (next page) shows, natural gas production peaked at the start of 2016, before falling sharply in the year's early months as the drilling slowdown, in response to the collapse of oil and gas drilling in late 2014, caught up with gas output. The prospect of less natural gas output encouraged gas traders to bid up prices as that would be necessary to encourage the additional output necessary to meet the anticipated gas demand growth. The increased demand assumption was keyed to more gas being used to generate electricity to support economic growth and higher air conditioning loads from a warmer summer. Gas demand did improve some, but nowhere near as much as expected.

Following the early cold weather, more normal temperatures prevailed, which were not conducive for driving gas demand higher

As we headed into the 2016 winter season, gas production was surprisingly growing. That was due to the rebound in oil shale drilling and increased associated gas output. This caused gas prices to dip, before the first wave of cold weather arrived, which encouraged traders to speculate on a colder winter season that would further boost demand. Unfortunately, following the early cold weather, more normal temperatures prevailed, which were not conducive for driving gas demand higher.

Exhibit 5. Gas Production And Price Are Inverted

Source: EIA, PPHB

Gas storage as of July 28th stood at 3,010 billion cubic feet (Bcf), some 278 Bcf below the same week in 2016, but importantly, only about 56 Bcf above our estimate of the five-year average storage volume

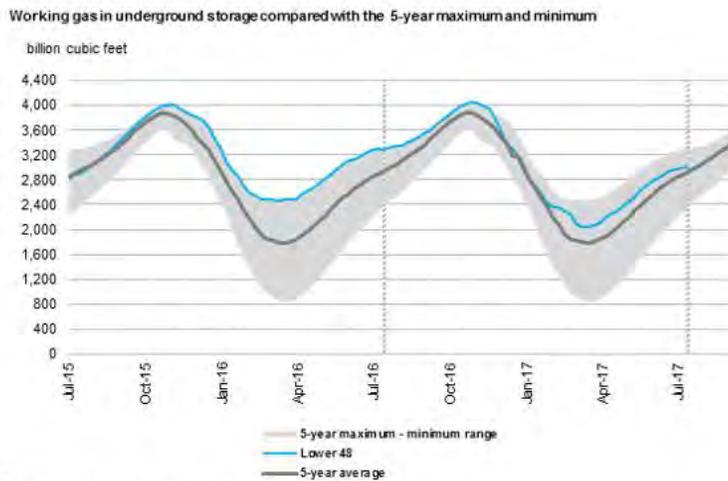
Once the gas output rebound peaked at the start of 2017, production growth slowed but it has not fallen back to the earlier lows of 2016. The lack of an increase in gas output, coupled with some warm periods so far this summer, has helped restrain weekly gas storage injections. As a result, gas storage as of July 28th stood at 3,010 billion cubic feet (Bcf), some 278 Bcf below the same week in 2016, but importantly, only about 56 Bcf above our estimate of the five-year average storage volume. The weekly chart published by the Energy Information Administration (EIA) accompanying its report on gas storage now shows this year's gas storage volume solidly within the five-year high and low range of weekly storage volumes.

In fact, as the blue line in Exhibit 6 (next page) shows, then current-year gas storage volumes rose to the top of the five-year range by summer's end in 2015, and remained there until November 2016. Following the initial cold weather of December 2016, gas storage volumes fell to the five-year weekly average and tracked it until January 2017, at which point storage rose above the five-year average as the winter turned warmer. Gas storage climbed higher, but stayed within the high-low range, and since late spring has trended downward. The next few weeks will be important for whether gas storage falls below the five-year average, which would likely boost gas prices above the \$3 per thousand cubic feet threshold.

The biggest question is what is the long-term outlook for gas output in light of oil prices holding around \$50 a barrel, or below?

For natural gas prices, the biggest question is what is the long-term outlook for gas output in light of oil prices holding around \$50 a barrel, or below? Will that price outlook cause oil shale drilling activity to slow, or possibly fall, producing less associated natural gas output? On the other hand, a lower price may cause producers to drilling higher quality prospects with greater output per well.

Exhibit 6. Natural Gas Storage Nearing 5-Year Average



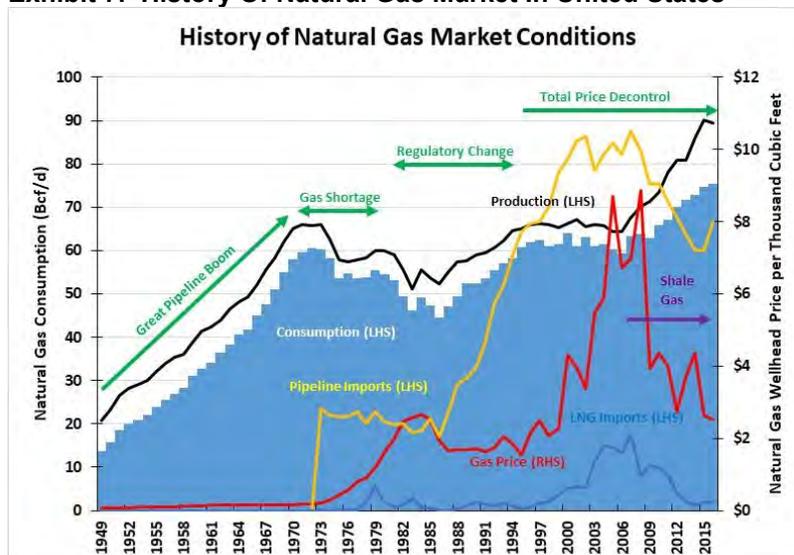
Source: U.S. Energy Information Administration

Source: EIA

Will we have less associated natural gas, or more? Another aspect about the market output question is what happens to gas demand. Will it climb with a hotter second half of summer and potentially a warm fall? What about the upcoming winter? Will it be colder or warmer than normal, or merely normal?

In an attempt to gain a better understanding of the current state of the natural gas market, Exhibit 7 shows the industry's long-term history. While the chart is busy, it addresses virtually all the key variables impacting the market.

Exhibit 7. History Of Natural Gas Market In United States



Source: EIA, PPHB

Much of the history of the domestic natural gas market has been influenced by flawed regulatory policies that attempted to address the perceived state of the physical gas market

Much of the history of the domestic natural gas market has been influenced by flawed regulatory policies that attempted to address the perceived state of the physical gas market. The regulators felt that natural gas supply shortfalls were a product of geological issues rather than the result of regulators always acting to rectify mistakes resulting from past regulatory policies instead of looking forward and addressing future potential supply and demand challenges. As natural gas prices are now totally decontrolled, and pipelines are regulated as transportation vehicles, many of the problems that plagued the industry since World War II up until decontrol in 1993 no longer exist. Instead, the gas market is being re-shaped by the success of the shale revolution.

When the weather map in USA Today showed white extending from Maine to Texas and from the Atlantic Ocean westward to the Great Plains

As the chart shows, natural gas production always exceeded consumption. What created the gas shortages in the late 1970s were the regulations that controlled who could obtain supply and at what price, along with who was favored with gas supply during extreme cold weather events. As a Wall Street analyst who followed the natural gas pipeline industry during the 1980s and 1990s, I would always tell investors they should be most concerned about one scenario. I described the scenario as when the weather map in *USA Today* showed white extending from Maine to Texas and from the Atlantic Ocean westward to the Great Plains. That meant gas supply would be restricted due to well freeze-offs at the same time gas demand would soar with the cold weather. Supply shortages would result. People might die. (Research shows that more people die from cold rather than hot weather.) The push for more onerous regulation would be the outcome.

Today, that scenario is less likely to occur. We have more supply and greater transportation and distribution pipelines. Moreover, we have the shale revolution. The chart shows the dramatic supply growth, which has increased much faster than consumption. As a result, pipeline and large LNG imports have dropped equally as dramatically, as have natural gas prices. If natural gas output resumes growing at a rate consistent with recent years, then LNG exports, more pipeline exports to Mexico and Canada, and lower gas prices than desired will be the result.

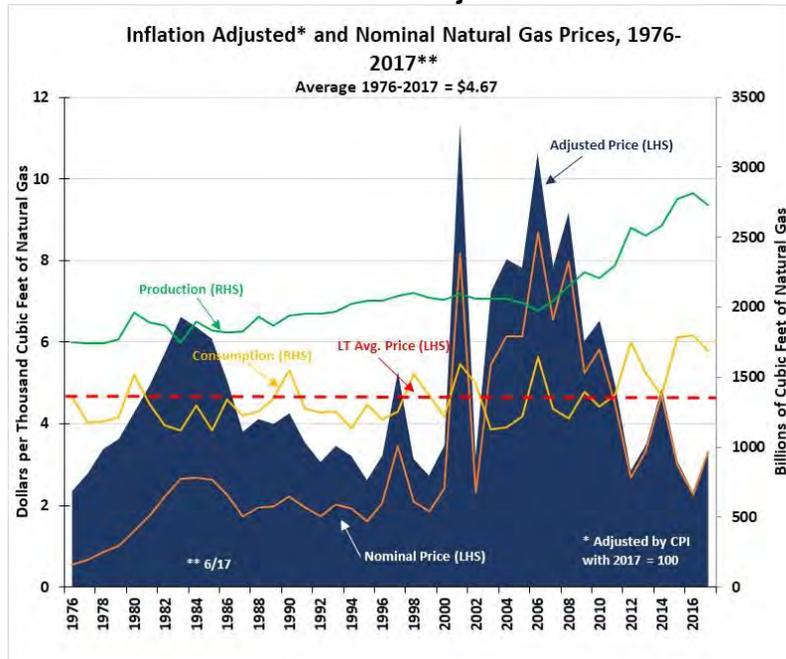
The inflation adjusted natural gas price since 1976 shows that the average is \$4.67

An examination of the inflation adjusted natural gas price since 1976 shows that the average is \$4.67 per thousand cubic feet. That is a significantly higher gas price than now, and well above even the most optimistic forecasts. That shows the shale revolution's power to reshape the domestic natural gas market.

Will that price provide sufficient profitability to encourage gas explorers?

Given current gas market dynamics, unless consumption rises or output stops growing or declines, it is hard to see gas prices rising materially in the near term. The hoped-for \$3.50/Mcf gas price target envisioned earlier this year may be the best the industry can expect for the foreseeable future. Will that price provide sufficient profitability to encourage gas explorers? Today, producers are

Exhibit 8. Nominal And Inflation Adjusted Natural Gas Prices



Source: EIA, BEA, PPHB

What market dislocations may come from this scenario?

producing more associated natural gas with negligible economic value since the well's profitability is derived from its crude oil flow. If shale oil output continues growing, there will be more associated natural gas with no profit requirement, which will act as an anchor on gas prices. What market dislocations may come from this scenario? One benefit is that cheap natural gas will help LNG exporters compete in global markets. Cheap natural gas will further reshape the global chemical business as shown by the Gulf Coast's boom in new chemical and expanded chemical plants.

Just as the gyrations in natural gas markets in the past due to regulatory policies completely disrupted corporate business strategies, we can envision similar changes for the gas industry in the future. Globally, natural gas is a driving force changing the petroleum business. A similar shift is underway in the domestic gas market, yet one which could be derailed by regulatory policies limiting the growth of gas consumption for power markets. That will force the U.S. gas industry into becoming a more significant global player unless building more LNG export terminals is restricted.

Al Gore's Frustration As NASA Data Shows Oceans Falling

Al Gore's sequel to his 2006 movie, "An Inconvenient Truth," debuted on the weekend of July 28th, but only in four theaters. It grossed \$152,371 in ticket sales that weekend and finished the weekend in 28th place of all movies shown. This debut was part of a

The sequel was shown on 180 screens in its second weekend (August 4-6), but finished a dismal 16th in the rankings

two weekend rollout plan by Paramount, the movie distributor. The original climate change movie was awarded the 2007 Best Documentary Oscar, and later that year Mr. Gore was awarded the 2007 Nobel Peace Prize. Keyed by numerous high profile interviews on television, the sequel was shown on 180 screens in its second weekend (August 4-6), but finished a dismal 16th in the rankings according to *Box Office Mojo*.

While film critics rated it a 77 on Rotten Tomatoes, an aggregate review website for movies and television, audiences only gave it a 48% favorable rating

“An Inconvenient Sequel: Truth to Power” has earned considerably less money than Mr. Gore or Paramount anticipated – a grand total of \$1,113,564, helped by last weekend’s \$961,193 in ticket sales. Mr. Gore’s heavy promotional effort that week culminated in an email to supporters on Friday, August 4th, stating, “By filling theatres, we can show Donald Trump and the other climate deniers in the White House that the American people are committed to climate action — no matter what they do, say, or tweet!” There must have been a conflicting event.

Sea levels have actually fallen since the start of 2016, based on satellite data

Mr. Gore was shocked, and, we assume, disappointed with the film’s performance. His supporters are railing against Paramount’s strategy, since the sequel has only earned about \$5,000 per screen compared to the 2006 film, which generated \$17,600 per screen at the same point in time in its distribution life. While film critics rated it a 77 on Rotten Tomatoes, an aggregate review website for movies and television, audiences only gave it a 48% favorable rating on the same site. Critics of Mr. Gore are calling the sequel a “bomb.”

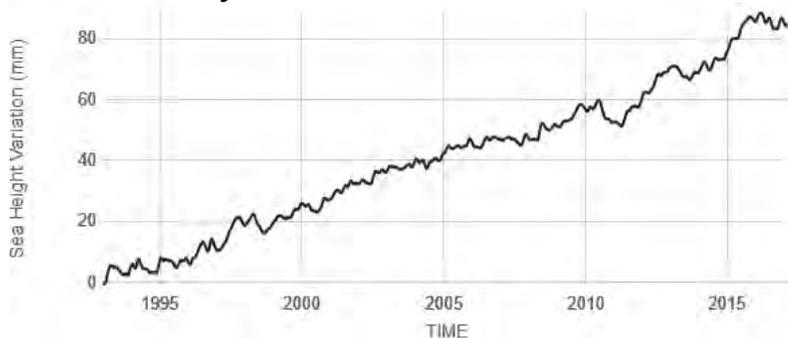
Sea levels have risen about the thickness of a dime and a nickel stacked together

The 2006 film earned an estimated \$50 million dollars in ticket sales, and it created significant controversy with its climate change disaster predictions. These predictions were challenged in a British court, which determined there were 11 material falsehoods about the science depicted and required that correct science findings be presented to students before the movie could be shown in schools. Since the film was released over a decade ago, much about the climate change science has been proven to be inaccurate. The most recent example is data from the National Aeronautical and Space Administration’s (NASA) Goddard Space Flight Center showing that sea levels have actually fallen since the start of 2016, based on satellite data.

The NASA satellite sea level observations for the past 24 years show, on average, that sea levels have risen by 3.4 millimeters (0.134 inches) per year, or about the thickness of a dime and a nickel stacked together. What the recent data shows is that from early 2016 to now, sea levels have fallen rather than increased.

An examination of the most recent data shows exactly how the sea level has declined. This development has not received much attention from the media, but even larger declines were experienced in 2011 and 2013, raising questions about projections that the sea level rise will continue forever. Those earlier periods of falling sea

Exhibit 9. History Of NASA Satellite Sea Level Measurements



Source: climate.nasa.gov

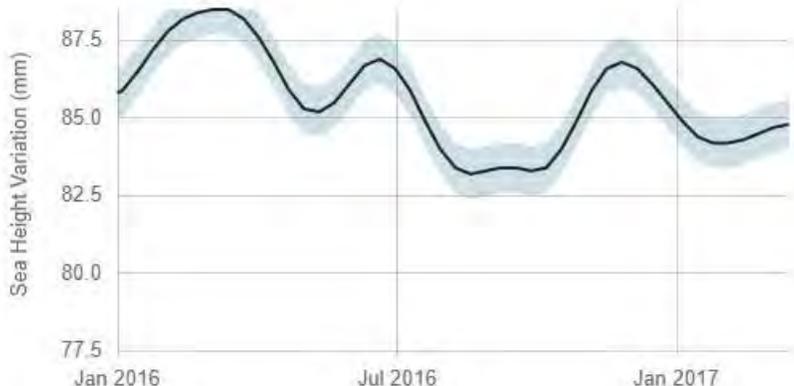
Source: NASA

levels were also ignored by the media. Moreover, no one has questioned the National Oceanic and Aeronautical Administration’s (NOAA) claim that sea levels rose by 3.4 mm in 2016 when NASA’s data clearly shows sea levels falling. Is this potentially the use of misleading data?

Exhibit 10. Falling Sea Level Data From NASA

SATELLITE DATA: 1993-PRESENT

Data source: Satellite sea level observations
Credit: NASA Goddard Space Flight Center



Source: NASA

The projection of rising sea levels has provided ample opportunity for climate change scientists to present graphic projections

The melting of the polar ice caps and the resulting sea level rise that will flood significant amounts of the globe’s coastlines has been a key tenet of climate change science. The projection of rising sea levels has provided ample opportunity for climate change scientists to present graphic projections of how the higher water levels will inundate coastal regions. Super Storm Sandy is often cited for showing how rising sea levels and climate change can impact

coastal regions, despite the damage being due to storm surge and not higher tides. Equally compelling is the picture of water seeping into the streets of Miami, Florida, again without considering the possibility of land subsidence. A simulation of what happens in the future with rising sea levels is shown below. These animations are used to show water’s potential encroachment, and primarily as a fear tactic.

Exhibit 11. Showing Rising Seas Inundating Coastal Sites

FIGURE 2. Expanding the Chronic Inundation Zone



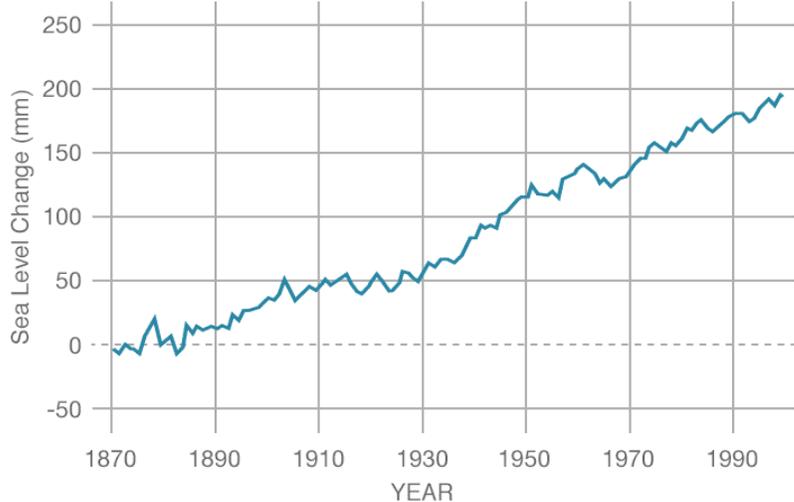
As sea level rise extends the zone of chronic inundation deeper into communities, chronic flooding may affect commercial, industrial, and residential areas, along with key infrastructure. The left panel shows the current zone of chronic inundation (light blue) in an East Coast community. The center panel shows the chronic inundation zone in 2045, when a densely developed neighborhood can expect to have to deal with twice monthly saltwater inundation. The right panel shows the chronic inundation zone in 2060, when much of the town’s coastal area floods with regularity—a sobering challenge for local and state governments.

SOURCE: ESRI, DIGITALGLOBE, GEOEYE, EARTHSTAR GEOGRAPHICS, NCE/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY

Source: ESRI

When NASA published a chart showing the sea level rise from 1870 to 2000, based on coastal tide gauge records, the average annual increase was a mere 1.5 millimeters per year.

Exhibit 12. NASA Data On Sea Level Increases

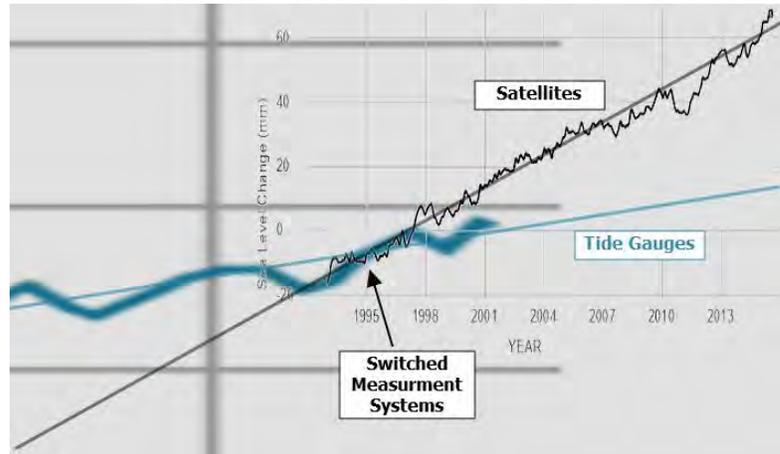


Source: NASA

The satellite data showed a similar pattern as the coastal tide data from 1993 to 1997, but then the two measurements diverged

Some analysts point to the shift NASA made to satellite measurements in 1993, which may not be properly adjusted to actual conditions, as the reason for the acceleration in sea level increases. A graph showing the impact of this shift was presented on the web site *realclimatescience.com*. The satellite data showed a similar pattern as the coastal tide data from 1993 to 1997, but then the two measurements diverged, with the satellite data showing a faster rate of sea level increase than the land-based data.

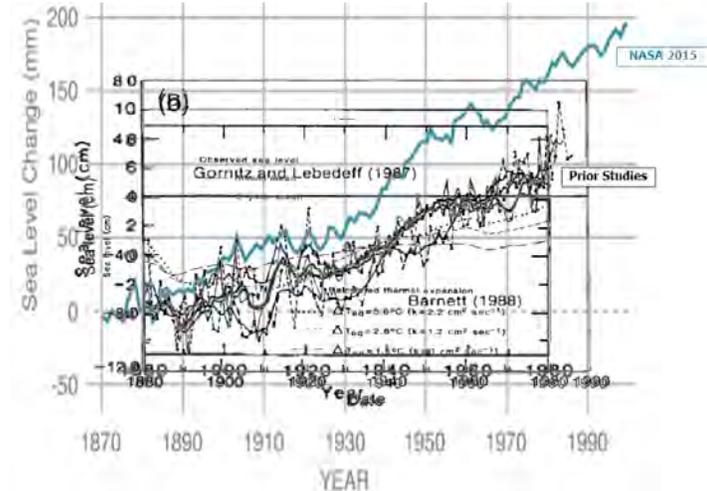
Exhibit 13. Satellite Measurements Deviate From Land Data



Source: *realclimatescience.com*

When compared with the montage of all prior sea level measurement studies, the higher rate of sea level increase measured by NASA's satellites, conducted by climate scientists, shows a much more dramatic deviation. One of the land-based studies was prepared by James Hansen, the leading scientist at the Goddard Space Institute

Exhibit 14. Satellite Measurements vs. All Prior Studies



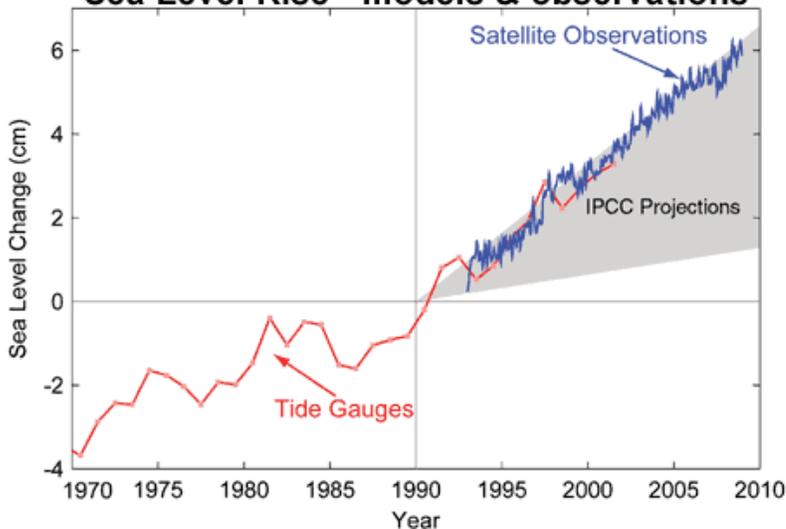
Source: *realclimatescience.com*

It is believed that the calving process is accelerating, but the scientists admit they do not understand the dynamic process

and one of the most high-profile global warming proponents. Interestingly, the 1990 Intergovernmental Panel on Climate Change (IPCC) report stated that there was “no convincing evidence of acceleration” during the 20th century.”

The two main contributors to sea level rise are thermal expansion of water and melting ice. Predicting the future contribution of melting ice to rising sea levels is challenging, as it comes from the calving process in which chunks of ice break off from glaciers and fall into the ocean and melt. It is believed that the calving process is accelerating, but scientists admit they do not understand the dynamic process. This was reportedly why the IPCC didn't include the effects of the dynamic process in its earlier reports, arguing that it couldn't be modelled. In 2001, the IPCC Third Assessment Report projected a sea level rise of 20 to 70 centimeters (cm) (7.9 to 27.6 inches) by 2100. In 2007, the IPCC Fourth Assessment Report reduced its estimate range of sea level rise to 18 to 59 cm (7.1 to 23.2 inches) by 2100. The 5th IPCC Assessment Report has the sea level rise prediction at 28 to 61 cm (11 to 24 inches). A study showed that satellite observations were tracking at the high end of the IPCC predictions. We would note, however, that the red line in Exhibit 15, which shows the increase measured from tidal gauge data, is at the low end of predictions by the IPCC.

Exhibit 15. Sea Level Forecasts Are Tracking IPCC Forecasts
Sea Level Rise - models & observations

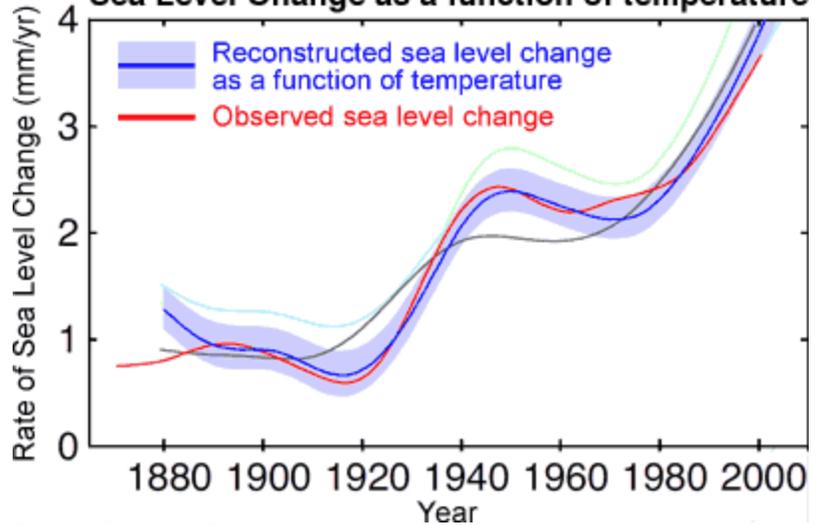


Source: Skeptical Science

Because the sea level predictions are tied to ocean thermal expansion and ice melting, the forecasters are modeling the rise based on assumed global temperature increases. Exhibit 16 (next page) shows a reconstructed sea level change based on global temperatures compared to observed sea level changes. The observed data is based on NASA's satellite measurements, and

even then it is at the bottom of the range of the forecast. If one were to plot the tidal gauge data, the observed data would track well below the forecasted range.

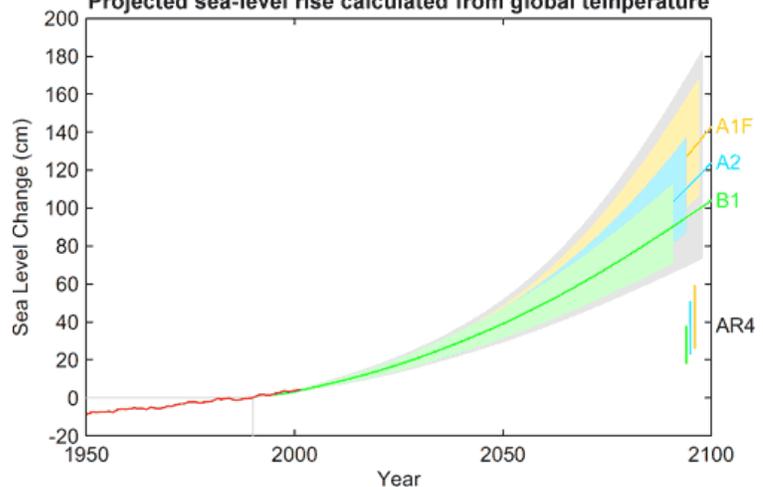
Exhibit 16. Reconstructed Forecast Exceeds Actual Sea Level
Sea Level Change as a function of temperature



Source: Skeptical Science

Those scientists forecasting more dire outcomes from a warming planet show sea level rises based on three IPCC carbon emission scenarios and the temperatures assumed to come from them. These forecasts show the sea level increase between 1990 and 2100 of 75 to 190 cm (29.5 to 74.8 inches), rather than smaller rise as presented as the most likely case. Those estimates are three times the predictions made in the IPCC's Fourth Assessment Report, which are shown as the lower bars in the chart in Exhibit 17.

Exhibit 17. The IPCC Promotes Worst Case Sea Level Rises
Projected sea-level rise calculated from global temperature

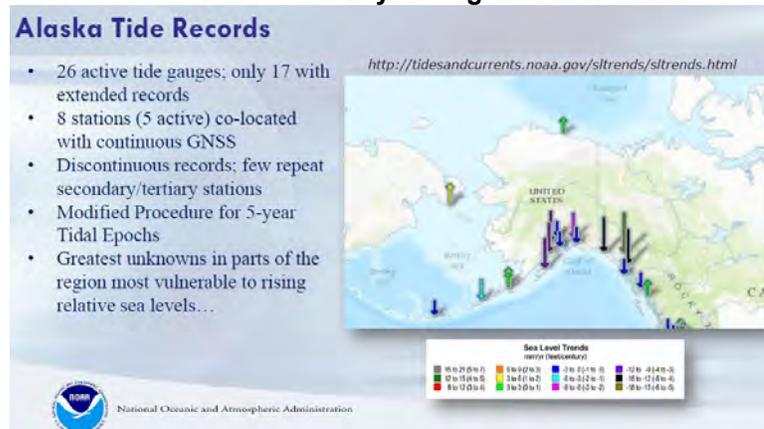


Source: IPCC

The continents and the oceans of the world “float” on tectonic plates that move, both up and down

A dynamic in the sea level rise debate is understanding the movement of the land and the sea floor. The continents and the oceans of the world “float” on tectonic plates that move, both up and down. This movement makes measuring relative sea levels a challenge. For example, while much attention is directed to rising sea levels along the Atlantic Coast of South Florida, we see relative sea levels falling along much of Alaska’s coast. What is interesting in Exhibit 18 is that there are spots in Alaska where sea levels are also rising amidst areas with major declines. How does that happen, unless there is movement of the tectonic plate? Why do these plates move? We really don’t know.

Exhibit 18. Alaska Has Mostly Falling Sea Level Rises



Source: NOAA

EPA head Scott Pruitt is considering a radical plan – to have a debate between red and blue teams that would argue the two sides of the CO2 issue

To argue that the science of climate change is settled is disingenuous and the argument is used as a tool to try to shut down legitimate debate by employing the scare tactic that time is too short to take action to save the world. The new head of the Environmental Protection Agency (EPA), Scott Pruitt, is considering a radical plan – to have a debate between red and blue teams that would argue the two sides of the CO2 issue. This is an accepted process in the military when it is devising strategic plans as a way to make sure that all contingencies surrounding a particular strategy are considered. It was also used in the space program and other industrial settings.

The red team would challenge the scientific assessment consensus, while the blue team would have to respond

The red/blue debate proposal was promoted in a *Wall Street Journal* op-ed written by Steven Koonin, a professor at New York University. He argued that the exercise of subjecting the scientific consensus on climate change to a rigorous test could help convince people about its seriousness. The red team would challenge the scientific assessment consensus, while the blue team would have to respond. Dr. Koonin’s view is that “The outcome of a Red/Blue exercise for climate science is not preordained, which makes such a process all the more valuable.” He went on to say that “It could reveal the current consensus as weaker than claimed. Alternatively, the

Dr. Mann's legal woes have continued in a British Columbia defamation case in which he refused to provide the court his data, as ordered

consensus could emerge strengthened if Red Team criticisms were countered effectively." Would that sway the opinions on either side?

Based on the criticisms of this idea from leading proponents of climate change and global warming, they must be fearing the answer to that question. The debate idea has been called "un-American," "dangerous," "redundant," "wasteful," and "a sellout to the fossil-fuel industry." These opponents argue that the effort would elevate minority opinions and undercut the consensus science of climate change research. They argue that the Red/Blue process already exists via the "peer review" process. The problem is that peer review truly needs to be able to independently repeat the research being reviewed. As we have seen in the legal cases involving Michael Mann, the Penn State climate researcher who created the "hockey stick" global warming chart that has been discredited, and as shown in the pirated East Anglian University e-mail scandal, climate scientists have worked to restrict critics from publishing articles questioning the climate science in peer-reviewed scientific journals. Dr. Mann's legal woes have continued in a British Columbia defamation case in which he refused to provide the court his data, as ordered. His action has resulted in him being positioned for a summary judgement in favor of the scientist he defamed, but importantly, the court will declare his study invalid and that it cannot be relied upon by other scientists, calling into question a number of other climate change studies that depended on his research to support their conclusions.

While most people are fascinated by the weather, they do not fully comprehend the financial cost of the proposed solutions advocated by the climate change proponents

It will be interesting to see whether the Red/Blue debate goes forward. The position of the environmental movement would be greatly enhanced by a successful debate, as the public could see the facts presented and vigorously debated. While most people are fascinated by the weather, they do not fully comprehend the financial cost of the proposed solutions advocated by the climate change proponents. Hopefully, such a Red/Blue debate would help people understand the risks of climate change, how best to manage them, and how much people are willing to pay to protect against such a potential risk. With greater understanding of the issue, we remain hopeful about a successful outcome, as we know to never underestimate the intelligence of the American public.

Germany's Diesel Car Emissions Scandal Propels EV Market

Besides facing potentially billions in euro fines, the managers of the companies are also figuring out how to correct the problems, while not alienating their customers

Scandals over carbon emissions cheating, as well as possibly decades of collusion over technology that may have contributed to the diesel scandal, are rocking German car makers. Besides facing potentially billions in euro fines, the managers of the companies are also figuring out how to correct the problems, while not alienating their customers. A proposed software solution was not considered sufficient, so the question quickly became how much of an incentive is needed to be given to car owners to get them to give back their compromised vehicles and purchase new ones.

65% of transportation fuel used in Germany is diesel

Recently, there was a diesel summit in Germany where the issue of the emissions scandal and solutions was discussed. Germany is the birthplace of the modern automobile, and the government was a financial backer of the development of diesel technology. Thus, the country has a long history with cars. It is an important industry for Germany. Diesel vehicles in the country are extremely important, as demonstrated by the fact that 65% of transportation fuel used in Germany is diesel. But, as the government moves forward with shutting down its nuclear power plants, the increased use of lignite coal for power generation and oil for driving has contributed to a 2% increase in Germany's carbon emissions during the first half of 2017. The country is falling well behind its emissions reduction target.

800,000 German employees are dependent on the automobile industry

The emissions scandal is now seeping into the current election campaign as every party campaigning has expressed concern over the 800,000 German employees who are dependent on the automobile industry, making it one of the country's most important industrial sectors. Even the green political parties are not in favor of shutting down internal combustion engine (ICE) cars, recognizing the economic pain it would inflict on the economy.

The judge argued that the city's responsibility to safeguard health is more important than the right to property and the general liberty of the car owners affected by such a ban

Numerous German cities are wrestling with nitrogen oxide and particle matter emission levels that exceed legal limits. Their potential remedies include a ban on the driving of certain types of diesel cars in cities, which may be the easiest solution for protecting citizens' health. Driving bans are the prerogative of Germany's states, with the federal government possibly acting as a facilitator. However, the federal transport ministry has long opposed the banning of older diesel cars in order to bring nitrogen oxide emissions within European Union (EU) limits. This led to a non-profit organization filing suit in which a German court ruled that the city of Stuttgart had the right to ban diesel cars from its roads due to the pollution created by them. The judge argued that the city's responsibility to safeguard health is more important than the right to property and the general liberty of the car owners affected by such a ban. The city continues studying its response to the ruling.

"We expect to increase the efficiency of classic engines by at least 10 to 15 percent in the years ahead"

There is a movement in Germany pushing to restrict car registration in 2030 to only zero-emission vehicles. At the same time, as Matthias Wissmann, head of the German carmakers' association VDA, pointed out: "Petrol and diesel still have a significant potential. We expect to increase the efficiency of classic engines by at least 10 to 15 percent in the years ahead." In addition, the industry is researching synthetic fuels that are "practically climate neutral," he said, adding that with fuels like these, ICE cars would have a long life expectancy. If the German auto industry can deliver the engine efficiency and a "climate neutral" fuel, that might change the electric vehicle (EV) market outlook somewhat.

As France, the UK and several other countries move to ban ICE cars, and various European cities restrict diesel cars from their city

This will require “a significant contribution by the electrification of new cars and should have priority,” according to the document

centers, the EU publicly announced that while it was looking into ways to promote the use of low-carbon energy and transportation, it was not considering quotas for EVs. However, last year Germany approved its Climate Action Plan 2050, which includes an ambitious carbon emissions reduction target for its transport sector - about 40% by 2030 - compared to 2014 levels. That year’s emissions were almost the same as in 1990. This will require “a significant contribution by the electrification of new cars and should have priority,” according to the document.

A “considerable share of e-vehicles” will be needed by 2025 in order to reach the EU and German climate targets

Peter Mock, European managing director at the International Council on Clean Transportation, said that a “considerable share of e-vehicles” will be needed by 2025 in order to reach the EU and German climate targets. He does not favor an outright ban on the sale of new diesel cars. Instead, he wants to see CO₂ targets set in a technology-neutral way. According to Mr. Mock, “...the government must make it clear that it is serious about its climate goals; that manufacturers must rearrange their portfolios accordingly; and that the share of electric vehicles must dramatically increase over the coming years.”

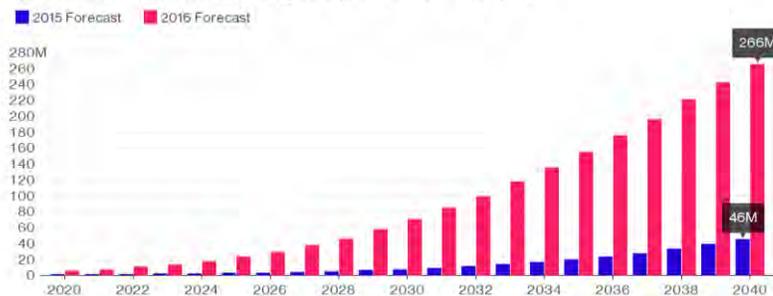
The organization increased its 2040 estimate of the number of EVs that will be on the roads by nearly 500%

However, the move to ban diesel cars and other ICE vehicles, or seriously restrict their use, has led to oil forecasters beginning to reassess their projections for EVs. One of the most significant forecast revisions was done by OPEC. The organization increased its 2040 estimate of the number of EVs that will be on the roads by nearly 500%. That might mean a reduction in petroleum demand by up to eight million barrels a day, a not insignificant amount.

Exhibit 19. How OPEC’s EV Forecast Has Changed

Growing Expectations

OPEC’s electric vehicle forecast grew by almost 500% last year



Source: Bloomberg New Energy Finance

Bloomberg

Source: **Bloomberg**

An example of how the EV is reshaping the auto industry and will impact the petroleum industry was highlighted in a recent *Wall Street Journal* article on Volkswagen AG (VLKAY-Nasdaq) and the diesel emissions scandal. The disclosure of the diesel emissions software cheating led to a shake-up of the company’s leadership. The new

The managers remain convinced about the superior technology of the diesel engine, so much so that they were willing to cheat to beat the emissions tests

CEO, Matthias Müller, is facing pushback from his own managers, who would like to see a return to the company's former autocratic corporate culture. Moreover, the managers remain convinced about the superior technology of the diesel engine, so much so that they were willing to cheat to beat the emissions tests. This blind support caused VW to fall behind the rest of the industry in developing EVs and to scorn shifts away from the car ownership culture in favor of ride-sharing and car-sharing.

“Volkswagen must change because our industry is going to change more deeply in the coming 10 years than in the 100 years before”

So far, the scandal has cost VW \$25 billion in fines, penalties and customer payments, while also significantly eroding the company's share in the important European market. Mr. Müller, speaking at an industry gathering last May, said, “Volkswagen must change because our industry is going to change more deeply in the coming 10 years than in the 100 years before.” Even though it achieved an 8.2% share of the global plug-in EV market in 2016, Mr. Müller plans to launch 30 new EV models, including a global EV family to be built in Germany, China and the U.S. in 2020. He is also pushing VW into ride-sharing and other mobility services to offset the lost revenues that will result from the new attitude of buyers toward car ownership that is evolving.

Regardless of whether EVs are as environmentally friendly as advertised, or as cost-competitive as buyers want, government policies are driving this market

Once more, the disruption of an industry, in this case the automobile industry, and ultimately the petroleum industry, is driven by government in response to poor management choices – emissions cheating and collusion. Regardless of whether EVs are as environmentally friendly as advertised, or as cost-competitive as buyers want, government policies are driving this market. OPEC is recognizing this juggernaut. Saudi Arabia has recognized it, too. Whether the EV market achieves the optimistic forecasts is impossible to know, however, it is and will remain a disruptive market force that forces executives of all companies touching the vehicle market to reassess their thinking and strategies. The market for buggy whips is very small, and no one wants to face that potential outlook.

Once Again Canada's Oil Industry Is Fought By Its Government

The government also says it will not grant the remaining permits allowing construction on Crown land

The newly installed coalition government in British Columbia has just announced it will attempt to join the legal battles over Kinder Morgan Inc.'s (KMI-NYSE) Trans Mountain pipeline expansion to move more oil from Alberta to the Canadian West Coast. The government also says it will not grant the remaining permits allowing construction on Crown land, in an attempt to prevent the project from going forward. The project is scheduled to begin construction in September on its storage terminal and port facilities, which are on private land.

This move by the province's New Democratic Party (NDP) and Green Party, which are promoting anti-fossil fuel agendas, is not surprising. The Trans Mountain pipeline has been approved by the Canadian federal government, the previous Liberal British Columbia

The Canadian green folly continues

government and Alberta, so there are serious questions about the legality of the recent government move. Choking off exports to international markets will slowly bleed the Canadian oil and gas industry as its output sells at a discount to world market prices, but importantly, the move will also cut potential tax revenues besides the creation of well-paid jobs for its citizens. The Canadian green folly continues.

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