PPHB
ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

July 10, 2018

Allen Brooks
Managing Director

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

From Coast To Coast Oil Companies Under Climate Attack

On July 2, the state filed suit against 121 oil and gas companies

From sea to shining sea, the climate change movement is cranking up its legal actions against oil companies. The latest launch was in the State of Rhode Island and Providence Plantation. On July 2, the state filed suit against 121 oil and gas companies for damage caused to the state from their continued production and marketing of oil, coal and natural gas, while ignoring the impact burning these fuels has on climate change, which has altered the hydrologic and meteorological cycles contributing to sea level increases, droughts, extreme participation events, and heatwaves.

"They have known for decades that those impacts could be catastrophic and that only a narrow window existed to take action before the consequences would be irreversible"

According to the complaint: "Defendants, major corporate members of the fossil fuel industry, have known for nearly half a century that the unrestricted production and use of their fossil fuel products create greenhouse gas pollution that warms the planet and changes our climate. They have known for decades that those impacts could be catastrophic and that only a narrow window existed to take action before the consequences would be irreversible. They have nevertheless engaged in a coordinated, multi-front effort to conceal and deny their own knowledge of those threats, discredit the growing body of publicly available scientific evidence, and persistently create doubt in the minds of customers, consumers, regulators, the media, journalists, teachers and the public about the reality and consequences of the impacts of their fossil fuel pollution."

This is the San Francisco law firm representing California municipalities suing oil companies over climate change

As we read the suit, signed by State of Rhode Island Attorney General Peter F. Kilmartin, filed with the state's Superior Court, we noticed some interesting points. First, the suit was also signed by lawyers from Sher Edling LLP. This is the San Francisco law firm representing California municipalities suing oil companies over climate change. The firm currently represents Imperial Beach, Marin and San Mateo counties, Richmond, Santa Cruz, and Santa Cruz

County in suits against oil companies and industry association groups. A federal judge ordered three of the law suits be directed to state court. Another law firm involved in these climate suits is Hagens Berman Sobol Shapiro LLP, which represents Oakland and San Francisco in a suit recently dismissed by the judge.

While a Chevron executive acknowledged that the climate is warming, which was the position of the plaintiff's climate experts, the issue is the uncertainty of its future impact

U.S. District Judge William Alsup became famous for holding a climate science tutorial in his court with the respective parties presenting expert testimony on climate change and its impact. The judge called his tutorial a fact-finding session since no one testifying was under oath and only the judge asked questions. While a Chevron executive acknowledged that the climate is warming, which was the position of the plaintiff's climate experts, the issue is the uncertainty of its future impact. Chevron's lawyer made the point after the hearing that climate change should be decided as a policy matter. The lawyer said, "The key argument we made is you can't resolve issues like this in court. You can't resolve these sorts of global issues in one case." That would appear to be consistent with the federal precedent established in American Electric Power Co. v. Connecticut in 2004, which said corporations cannot be sued for greenhouse gas emissions because the Environmental Protection Agency regulates them through the Clean Air Act. Judge Alsup's decision said that while climate change science is established, the court was not the proper venue for resolving the issue.

That contract said the law firm would keep 23.5% of damages, plus certain costs

After the California climate law suits were filed and various state fraud investigations (New York and Massachusetts) began, the primary targets – Exxon Mobil Corp. (XOM-NYSE) and Chevron Corp. (CVX-NYSE) – began to fight back. While the companies waged their own efforts, the Manufacturers' Accountability Project (MAP), an oil industry supporter, and an arm of the National Association of Manufacturers, moved to obtain records relating to how these law suits were started from the eight municipalities under California's open records law. Most of the municipalities denied the requests, claiming the documents were covered under attorney-client protection. San Francisco, however, did provide its contract with the Hagens firm. That contract said the law firm would keep 23.5% of damages, plus certain costs. The remaining 76.5% would go to San Francisco for "abatement, adaptability, and other costs related to the global warming injuries at issue." Sher Edling LLP is participating in the Rhode Island law suit on a contingency basis.

Another interesting point in the law suit was the mischaracterization of one of the defendants, Motiva Enterprises, LLC. The law suit said: "At times relevant to this Complaint, Motiva Enterprises LLC has been a wholly owned subsidiary of Royal Dutch Shell PLC that acts on Royal Dutch Shell PLC's behalf and subject to Royal Dutch Shell PLC's control." Now, that description has to be limited to the time from 1988 to 1997. Since last year, Motiva is 100% owned by Saudi Refining, which, in turn, is owned by Saudi Aramco, the national oil company of Saudi Arabia.

The history of Motiva is convoluted and begins in 1988

The history of Motiva is convoluted and begins in 1988 when Texaco agreed to form a joint venture, known as Star Enterprise, in which Saudi Refining would own a 50% share of Texaco's refining and marketing operations in the eastern United States and Gulf Coast. In 1997, Texaco and Shell (RDS.A-NYSE) merged their respective marketing and refining operations into two joint ventures – one, Equilon, held the western and midwestern assets of the companies, while the second, Motiva, held the eastern and Gulf Coast operations. At that time, Motiva's ownership was split between Shell with 35% and Texaco and Saudi Refining each with 32.5%. Shell controlled the joint venture. In 2000, Texaco was acquired by Chevron and Shell and Saudi Refining purchased Texaco's interest in Motiva, making it a 50-50 joint venture operated by Shell. That relationship ended in 2017 when Saudi Refining purchased Shell's interest. Without seeing the partnership agreement, it is not clear if Shell controlled Motiva.

We're sure the lawyers would say that this is a minor issue, but the law suit was filed by Rhode Island's legal team, which has experienced several major problems. First, lawyers missed a court response date that cost Rhode Island $24 million. Secondly, it was revealed that several state lawyers did not have valid law licenses. Those mistakes reflect someone not paying attention to details. The Motiva information (we were familiar due to our analyst career) could have been found with a couple of Google searches.

The focus of the climate change endangerment claims revolves around the impact and cost of rising sea levels. The law suit states:

"Historical greenhouse gas emissions alone through 2000 will cause a global mean sea level rise of at least 7.4 feet"

"54. Historical greenhouse gas emissions alone through 2000 will cause a global mean sea level rise of at least 7.4 feet. Additional greenhouse gas emissions from 2001-2015 have caused approximately 10 additional feet of committed sea level rise. Even immediate and permanent cessation of all additional anthropogenic greenhouse gas emissions would not prevent the eventual inundation of land at elevations between current average mean sea level and 17.4 feet of elevation in the absence of adaptive measures.

"Each and every additional unit of CO2 emitted from the use of Defendants' fossil fuel products will add to the sea level rise already committed to the geophysical system"

"55. The relationship between anthropogenic CO_2 emissions and committed sea level rise is nearly linear and always positive. For emissions, including future emissions, from the year 2001, the relation is approximately 0.25 inches of committed sea level rise per 1 $GtCO_2$ released. For the period 1965 to 2000, the relation is approximately 0.05 inches of committed sea level rose per 1 $GtCO_2$ released. For the period 1965 to 2015, normal use of Defendants' fossil fuel products caused a substantial portion of committed sea level rise. Each and every additional unit of CO_2 emitted from the use of Defendants' fossil fuel products will add to the sea level rise already committed to the geophysical system."

According to a National Oceanic and Atmospheric Administration (NOAA) report, “In 2014, global sea level was 2.6 inches above the 1993 average—the highest annual average in the satellite record (1993-present). Sea level continues to rise at a rate of about one-eighth of an inch per year.” This sounds ominous, until you translate the inches into centimeters (cm) and millimeters (mm), which is the format used by the scientists researching sea level rises. The 1993-2014 increase is 7 cm and the rate of increase is 3.5 mm per year.

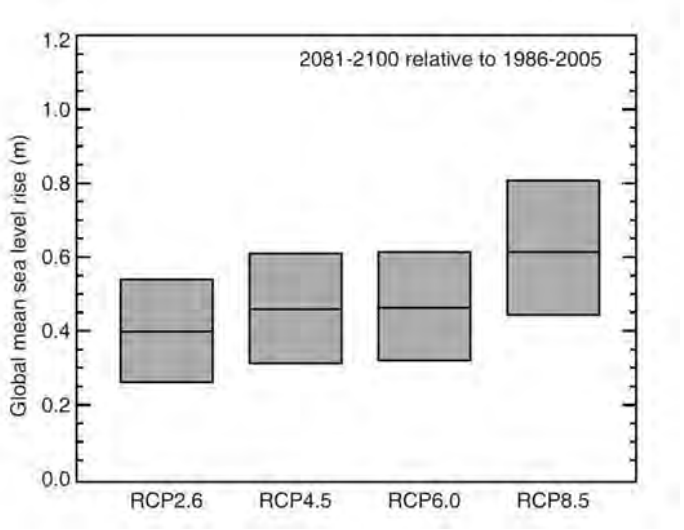
NOAA further makes the point that the sea level isn’t rising or falling uniformly around the world

According to NOAA, there are differences between local sea levels and the ocean level – the former is measured by tidal gauges while the latter is done with satellites. NOAA further makes the point that the sea level isn’t rising or falling uniformly around the world, largely because the ocean’s bottom is no flatter than the earth’s surface.

The UN Intergovernmental Panel on Climate Change Fifth Assessment report said that sea levels by 2100 could rise by 26 cm (10.2 inches) to 82 cm (32.3 inches)

The Rhode Island law suit uses the work of Peter U. Clark to justify their claims of the magnitude of sea level rise the state could experience. The UN Intergovernmental Panel on Climate Change Fifth Assessment report said that sea levels by 2100 could rise by 26 cm (10.2 inches) to 82 cm (32.3 inches). The worst case suggests less than three feet of sea level increase over the next 80+ years. The estimates reflect the minimum and maximum projections for sea level rises based on four scenarios for global temperature increases.

Exhibit 1. Range Of IPCC Projected Sea Level Rises



Source: ***carbonbrief.com***

Under scenario RCP2.6, drastic emissions cuts from 2020 onward are achieved, which keeps sea levels from rising dramatically. They are projected to rise by between 26 cm (10.2 inches) and 54 cm (21.3 inches) by the end of the century. The average increase is 40 cm (15.7 inches).

In scenarios where emissions stabilize by the end of the century (RCP4.5) or soon afterwards (RCP6.0), sea levels are projected to rise by between 32 cm (12.4 inches) and 62 cm (24.4 inches). The average is 47 cm (18.5 inches).

If emissions continue to rise rapidly (RCP8.5), then sea levels are projected to rise by between 45 cm (17.7 inches) and 82 cm (32.2 inches). The average in these scenarios is 62 cm (24.4 inches).

"It found that flooding from rising sea levels could cost $14 trillion worldwide annually by 2100"

Interestingly, a new paper on sea level increases was published July 3rd in *Environmental Research Letters*. The study was led by the UK National Oceanographic Centre (NOC), and it found that flooding from rising sea levels could cost $14 trillion worldwide annually by 2100 if the target of holding the global temperature rise below 2º C above pre-industrial levels is missed.

NOC's Dr. Svetlana Jevrejeva led the study. She was quoted saying: "More than 600 million people live in low-elevation coastal areas, less than 10 meters [33 feet] above sea level. In a warming climate, global sea level will rise due to melting of land-based glaciers and ice sheets, and from the thermal expansion of ocean waters. So, sea level rise is one of the most damaging aspects of our warming climate." This statement would support the concerns expressed in the Rhode Island law suit.

People wonder whether this law suit filing was a photo op

On the day the law suit was filed, Governor Gina Raimondo (D) released "Resilient Rhody." A report that came from a task force she organized last year to study the challenges the state faces from climate change, principally sea level increase, and to develop plans to address them. The press conference announcing the filing of the law suit featured top government officials, including U.S. Senator Sheldon Whitehouse (D), and Representatives James Langevin (D) and David Cicilline (D). Senator Whitehouse is famous for his weekly climate change speeches on the floor of the Senate. The press conference came at the start of the campaign for the fall election, as a result, people wonder whether this law suit filing was a photo op.

"According to the Newport tide gauge, the historic rate of sea level rise from 1930 to 2016 (an 86-year period) is around 2.73 mm/year, or more than an inch per decade"

In "Resilient Rhody," the section dealing with sea level increases reported the following: "According to the Newport tide gauge, the historic rate of sea level rise from 1930 to 2016 (an 86-year period) is around 2.73 mm/year, or more than an inch per decade. In other words, sea level has risen over 10 inches in Rhode Island since 1930. Global mean sea level from 1993 to the present has accelerated to 3.1 mm/year as measured by satellite altimetry. Recent research confirms that if sea level continues to change at this rate and acceleration, the sea level rise by 2100 will more than double the amount if the rate was constant at 3 mm/yr. According to the Permanent Service for Mean Sea Level, the mean annual rate of sea level rise in Newport is 3.98 mm/year for the 30-year period from 1986-2016, a rate greater than the global average mean for the

NOAA projects a high sea level rise scenario for Newport of 2.20 feet by 2040, 8.99 feet by 2100

same period. In January 2017, the National Oceanic and Atmospheric Administration (NOAA) published revised projections for sea level rise globally and, in the United States, regionally. NOAA projects a high sea level rise scenario for Newport of 2.20 feet by 2040, 8.99 feet by 2100 and a substantial increase in the frequency of nuisance tidal flooding. NOAA recommends considering worst-case scenarios in coastal risk management due to the growing evidence of accelerated ice loss from Greenland and West Antarctica."

The 2017 NOAA report, which addresses regional sea level changes reported the following basic conclusion: "The projections and results presented in several peer-reviewed publications provide evidence to support a physically plausible GMSL [global mean sea level] rise in the range of 2.0 meters (m) to 2.7 m, and recent results regarding Antarctic ice-sheet instability indicate that such outcomes may be more likely than previously thought." The range of sea level increases NOAA says are "physically plausible" range from 6.6 to 8.9 feet, which is consistent with the Rhode Island report.

It is important to acknowledge that the latest information about melting ice in Antarctica shows that a previously unknown volcano underlies the glacier

It is important to acknowledge that the latest information about melting ice in Antarctica shows that a previously unknown volcano underlies the glacier. Thus, whenever the volcano is active, there will be more rapid melting of the ice. When it is inactive, presumably there would be no melting. This would counter some of NOAA's fear about rapid melting of the Antarctic ice. In other words, it is not climate change, but rather a geological feature we have no idea how to control.

It is also important to note another conclusion from the 2017 NOAA report. The study was an attempt to adjust the GMSL to account for key factors at the regional scale. These include: 1) shifts in oceanographic factors such as circulation patterns; 2) changes in the Earth's gravitational field and rotation, and the flexure of the crust and upper mantle, due to melting of land-based ice; and 3) vertical land movement (VLM; subsidence or uplift) due to glacial isostatic adjustment (GIA, which also changes Earth's gravitational field and rotation, as well as the overall shape of the ocean basin), sediment compaction, groundwater and fossil fuel withdrawals, and other non-climatic factors.

Note that all these conditions are outside of climate change, and have little to do with fossil fuels

The first conclusion impacts Rhode Island. NOAA wrote, "Along regions of the Northeast Atlantic (Virginia coast and northward) and the western Gulf of Mexico coasts, RSL [regional sea level] rise is projected to be greater than the global average for almost all future GMSL rise scenarios (e.g., 0.3-0.5 m or more RSL rise by the year 2100 than GMSL rise under the Intermediate scenario)." Note that all these conditions are outside of climate change, and have little to do with fossil fuels, other than their withdrawal from the ground, which would impact the Gulf of Mexico coastal forecasts and not the East Coast since no oil and gas production is done offshore.

The July 3rd sea level rise study referenced earlier followed on research Dr. Jevrejevra has been conducting, including a major study published in 2013 in the journal of *Global and Planetary Change*. That study, "Trends and acceleration in global and regional sea levels since 1807" contained a chart of sea level reconstruction since 1807 to 2010.

Exhibit 2. 150 Years Of Steady Sea Level Rise

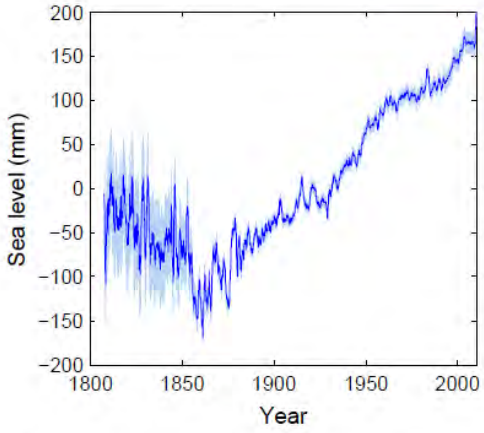


Fig. 3. Global sea level reconstruction since 1807, blue shadow represents 5 and 95% confidence interval. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

Source: ***Global and Planetary Change***

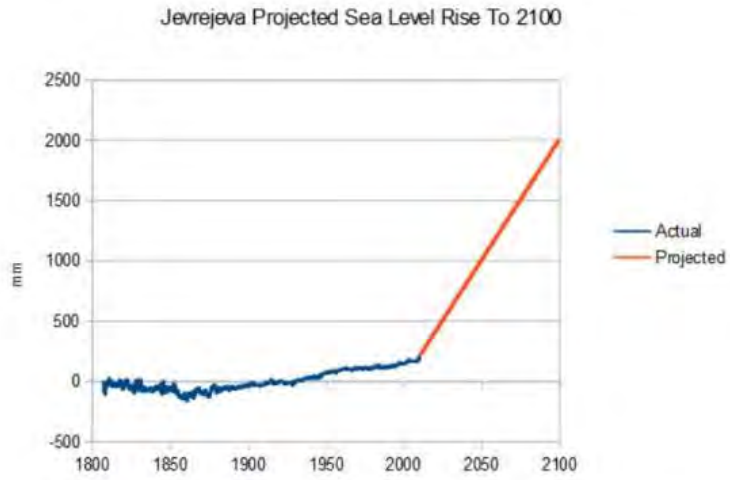
The abstract for that report concluded the following: "There is a good agreement between the rate of sea level rise (3.2 ± 0.4 mm/yr) calculated from satellite altimetry and the rate of 3.1 ±. 0.6 mm/yr from tide gauge based reconstruction for the overlapping time period (1993-2009). The new reconstruction suggest a linear trend of 1.9 ± 0.3 mm/yr during the 20th century, with 1.8 ± 0.5 mm/yr since 1970."

"But, if the 2°C target is missed, we will see a median sea level rise of 0.86m (2.8ft), and a worst-case rise of 1.8m (5.9ft)"

In the July 3rd study, the objective was to find out what might happen to sea levels if the world achieved the Paris Accord goal of keeping global temperatures from increasing by more than 1.5°C by 2100. Dr. Jevrejeva concluded: "We found that with a temperature rise trajectory of 1.5°C, by 2100 the median sea level will have risen by 0.52m (1.7ft). But, if the 2°C target is missed, we will see a median sea level rise of 0.86m (2.8ft), and a worst-case rise of 1.8m (5.9ft)." Even under her worst-case scenario, for sea levels to rise by 8.99 feet as NOAA projects, or the 17.4 feet the lawsuit claims, there must be other considerations than climate change at work.

Paul Homewood, who posted the July 3rd article, was asked to go back and integrate the latest projections from Dr. Jevrejeva and her colleagues with the sea level history from her earlier study. He posted the following chart, which certainly raises questions about the reality of the latest projection.

Exhibit 3. Sea Level Forecast Looks Aggressive



Source: Paul Homewood

Nowhere in the 25-page section on the economics of Rhode Island was there mention of economic risk from the climate damages the state alleges

While assessing the details of the Rhode Island law suit, we went back and read the prospectus for the state's latest bond offering, dated April 3, 2018. Nowhere in the 25-page section on the economics of Rhode Island was there mention of economic risk from the climate damages the state alleges. If they truly believed that there would be such a devastating impact on the state from rising sea levels and increased weather events as cited in the law suit, then one has to question the future of the state's finances. In fiscal 2017, personal income taxes contributed 34% of the state's revenues, with business taxes adding another 11%. State sales taxes brought in 27% of the revenue, while the state's lottery and gambling industry contributed 10%.

It cited that "3,765 buildings and residences of over 10,000 people" would be impacted by a seven-feet sea level rise

In the claims for action in the suit, the state cites: "By the end of the century, 6,660 Rhode Island coastal properties, worth roughly $3.6 billion, will be at risk under a high-sea level rise scenario, reducing property tax revenue by as much as $47.8 million." Earlier, it cited that "3,765 buildings and residences of over 10,000 people" would be impacted by a seven-feet sea level rise. With 6,660 properties damaged, it means nearly 20,000 people would be impacted state-wide, with employment and tax revenue impacts.

This would result in lost revenue for the state so desperate for income it is installing tolls for trucks traveling through Rhode Island on Interstate 95

The largest, and fastest growing, employment category is tourism, which would be subject to significant impact if the predicted massive change to Rhode Island's seashore happens. Not only would expensive shoreside homes be impacted, but so would marine businesses and tourist-related activities. This would result in lost revenue for the state so desperate for income it is installing tolls for trucks traveling through Rhode Island on Interstate 95.

One repercussion coming from the California climate law suits is the launch of an investigation into fraudulent disclosure in municipality

bond offerings undertaken by the Securities and Exchange Commission. Not disclosing the climate change risk, if known, would be securities fraud. If the communities knew of this risk, as they claim, then they look to have a legal problem by not disclosing it. Rhode Island may have the same problem.

Send money seems to be the message

We were also intrigued with the remedy the state wants. The following language is in every cause of action: "Therefore, the State requests an award of punitive damages in an amount reasonable, appropriate, and sufficient to punish these Defendants for the good of society and deter Defendants from ever committing the same or similar acts." Send money seems to be the message. We wondered how the Defendants could stop from committing the acts they are accused of short of stopping selling oil and gas products in the state. That would send the state back to an economy and society when Roger Williams founded Rhode Island.

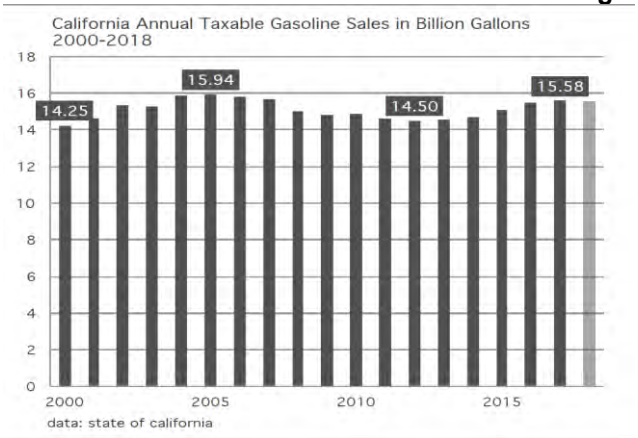
At this point, we believe the law suit is a publicity stunt designed to help the governor's re-election campaign. However, based on our experience with Rhode Island courts, we will not be surprised if the oil companies lose.

California Gasoline Sales: Warning Or One-Off For Industry?

Slowing and/or flat gasoline sales in California represents the 'canary in the coal mine' for energy companies

A leading West Coast environmental and energy writer, discussing the energy transition currently underway, promotes a scenario that slowing and/or flat gasoline sales in California represents the 'canary in the coal mine' for energy companies. In his view, when gasoline sales flatten, or start declining, this should be a warning sign for the oil industry. The absence of fuel growth means either that attitudes toward mobility are already changing, or that alternatively powered vehicles – primarily electric cars (EV) – have made sufficient market penetration to impact gasoline usage.

Exhibit 4. California Gas Sales Are Not Growing



Source: ***Terrajoule***

U.S. gasoline demand was down in 2017 by 0.2%, while California saw sales rise 0.5%. The first quarter of 2018 reportedly shows California's gasoline sales declining by 0.2%, which the author suggests means the year is shaping up to either be a flat or slightly declining year. [Using EIA data for 2017 and State of California data, we could not replicate the author's assertions.] Although the author doesn't proclaim his analysis reflects much more than a flattening in gasoline sales, it makes him pause.

This flat sales performance comes at the same time California's population has grown from roughly 36 million in 2007 to 40 million in 2017

The pause relates to the author's examination of California annual gasoline sales data showing drivers purchased 15.579 billion gallons in 2017, up slightly from 15.488 billion in 2016. Based on first quarter data, it appears gasoline sales are running at a 15.547-billion-gallon annualized rate for 2018. However, gasoline sales in 2017 and the annualized rate for 2018 are off slightly from the 15.672 billion gallons sold in 2007. This flat sales performance comes at the same time California's population has grown from roughly 36 million in 2007 to 40 million in 2017. The author suggests that focusing on 2007 and 2017 is appropriate because the U.S. and California economies were strong in both years.

Those could include major rail and transit buildouts, fuel efficiency gains, changes in mobility preference, and even the recent uptick in gasoline taxes

Although the author's idea is that California's gasoline consumption should be "significantly higher in 2017" given the population growth, the fact that it was flat suggests other factors at work. Those could include major rail and transit buildouts, fuel efficiency gains, changes in mobility preference, and even the recent uptick in gasoline taxes. Then there is the all too present factor of EVs, as sales have been strong the past several years, and California accounts for about half the EV market.

When we examine the data, we found that California's population increased 11% over 2007-2017. That compares to the U.S. population, excluding California, growing 7.7%. It is also interesting to note the demographic shifts in California's population. While we have 2017 demographic data, we had to use 2005's survey for the earlier point, but we felt it was representative of conditions in 2007.

California is known for its polyglot population. That mix shifted noticeably over 2005-2017. White, non-Hispanic, fell by nearly eight percentage points from 45.5% to 37.7%. The Hispanic population increased by almost five and a half percentage points, going from 33.6% to 38.9%. The Black population fell by one percentage point, while the Asian population grew by 1.3 percentage points. Changes among other population groups were mixed, but they all represent very minor percentages. California also has the largest illegal immigrant population in the country, and possibly the largest homeless population, at least based on stories about walking the streets of San Francisco.

There are many reasons why EVs are popular in California. Continuing to lead national social trends, the large population of

wealthy entertainment and technology people love to show off their social awareness credentials, while taking advantage of lucrative financial and other driving benefits by purchasing EVs. Those benefits are being reduced as EV car manufacturers reach the limits at which federal tax subsidies for EVs are eliminated. The state has recently decided to double down and boost spending to subsidize EV sales. What is interesting, however, has been the elimination of the right to drive EVs in High Occupancy Vehicle (HOV) lanes in Southern California with one person, as too many vehicles have slowed lane speed and increased accident risk when EVs are entering and exiting HOV lanes. When the Toyota Prius lost use of HOV lanes, sales fell the following year. Prepare for similar shocks.

When the Toyota Prius lost use of HOV lanes, sales fell the following year

The article's author says that three considerations will determine if gasoline sales remain flat or begin to decline. Those are the price of gasoline, the pace of EV ownership and the health of the U.S. and state economies. Although gasoline prices have risen lately with oil prices, they still remain low. For the author, the critical factor influencing gasoline sales will be an increase in the EV sales rate and continued improvement in fuel efficiency of internal combustion engines (ICE). But, he points out one irony in that a healthy economy encourages vehicle fleet turnover helping incentivize the shift to EVs and more efficient ICE cars. Since conventional economic wisdom is that there is a recession on the horizon, that could throw a wrench into the author's hopes for the EV revolution.

But, he points out one irony in that a healthy economy encourages vehicle fleet turnover helping incentivize the shift to EVs and more efficient ICE cars

There are many factors impacting gasoline sales in California that may have little to do with EV sales. Demographic shifts in recent years are tilting the state's population away from those more likely to own cars and drive extensively. That population is more likely to rely on mass transit and sharing rides with family and friends within their community than buying cars. Given California's history, energy trends in the state should be watched. No one wants to find the canary dead in its cage.

Demographic shifts in recent years are tilting the state's population away from those more likely to own cars and drive extensively

German Auto Companies Fight EU And Merkel On Emissions

Disagreements among European Union members plague the organization. While most of the media focuses on the struggles between northern and southern members over debt levels and budgets, another high-level struggle exists over immigration. Below the surface, there are struggles over the policies necessary to meet individual government climate change goals. The latest struggle in this regard has emerged involving Germany, with the core issue being policy impacts on the automobile industry.

There are struggles over the policies necessary to meet individual government climate change goals

Since 2015, Germany's leading automobile manufacture, Volkswagen AG (VLKAY-OTC), has been embroiled in a scandal over the use of computer software to deceive carbon emissions testing of its diesel vehicles. The discovery of the testing violations resulted in termination of executives, charging some executives with

The scandal's bottom line is that the clean diesel technology driving diesel car sales came under serious question and has dimmed their future sales prospects

criminal acts, and the payment of billions of dollars in fines to multiple governments. The scandal spread to other auto manufactures of diesel vehicles such as Opal, Fiat Chrysler Automobiles NV (FCAU-NYSE), General Motors (GM-NYSE) and Mercedes-Benz (DDAIF-OTC). In several cases, the autos employ technology helping minimize carbon emissions, but which turns off in real-world driving conditions to improve fuel economy by one to two miles-per-gallon. In other cases, the technology shuts down when ambient temperatures fall below 50° F to protect the engine. The scandal's bottom line is that the clean diesel technology driving diesel car sales came under serious question and has dimmed their future sales prospects.

With the absence of diesel technology as a solution for minimizing carbon emissions, focus has shifted to electric vehicles (EV) and changes in mobility patterns such as autonomous vehicles (AV), mass transportation, and ride-sharing as ways to minimize emissions. Examining the issues enveloping the automobile industry in Germany provides a window into the struggles residents, regulators and companies are experiencing in other countries around the world.

The strategy has produced the most expensive electricity in Europe for the nation's residents, as well as needing to boost the use of coal to ensure stability of Germany's power grid

Germany's political leadership moved quickly following the 2011 Yakushima nuclear accident to accelerate plans for shutting down its nuclear power industry. Their plan required relying increasingly on renewable energy to power the German economy. Unfortunately, the strategy has produced the most expensive electricity in Europe for the nation's residents, as well as needing to boost the use of coal to ensure stability of Germany's power grid. Despite more renewable power, the increase in coal usage is causing Germany to miss its 2020 emissions reduction goal by a wide margin. Although Germany is not the only country missing its emissions target, environmentalists are worried that the euphoria from the Paris Accord of late 2015, designed to set the world on a course toward a zero-carbon world, has dissipated.

As the minister acknowledges, the right framework is needed if the "clean cars" of the future are still to be "Made in Germany"

Compared to 2021 levels, the EU Commission has proposed that car and light-duty vehicle emissions across the community be reduced 15% by 2025 and 30% by 2030. A new position paper produced by the Germany environment ministry, seen and reported on by *Clean Energy Wire*, argues that the EU Commission plan is not aggressive enough. German Social Democrat environment minister Svenja Schulze argues that "transport contributes significantly to climate change." Therefore, she believes "strict environmental standards for the car industry are more than justified." This is important because, as the minister acknowledges, the right framework is needed if the "clean cars" of the future are still to be "Made in Germany."

What is that framework? According to the white paper, Germany needs to be more aggressive in curbing emissions if the country is to

The betting is that the environment ministry's starting position will be weakened due to the importance of the auto industry to the German economy

have a chance at meeting its climate protection goal. The paper argues that the lower limit of what's necessary is "to increase the level of ambition for cars to minus 50 percent by 2030 and minus 25 percent by 2025." This has become the starting point for interdepartmental negotiations involving the ministries of environment, economy and trade, and transport. The betting is that the environment ministry's starting position will be weakened due to the importance of the auto industry to the German economy.

The auto industry is Germany's largest industry sector with revenues of $494 billion, representing 20% of the country's GDP

While some German politicians have suggested that one in seven jobs are tied to its automobile industry, that is a gross exaggeration. According to government data, there are only about 820,000 auto workers in Germany, representing 1.8% of the nation's employment. We are not sure of the exact categories of workers counted, but there is little doubt that the German auto industry is very important to the country's economy. The auto industry is Germany's largest industry sector with revenues of $494 billion, representing 20% of the country's GDP, and accounting for $257.2 billion, or 17.8% of export earnings in 2017, according to the CIA Fact Book.

Germany was also Europe's number one automotive market in 2017 accounting for over 30% of all cars manufactured (5.65 million) and about 20% of all new car registrations (3.44 million) according to *VDA*. In 2015, 77.5% of cars manufactured in Germany were shipped to international markets. Also, the automobile industry's research and development expenditures of $25.6 billion in 2017 represented 35% of the nation's total R&D expenditures.

National economic statistics for 2017 from the Bureau of Economic Analysis showed the U.S. auto industry represented 2.8% of economic activity

The significance of the auto industry to Germany's economy is outsized compared to the United States. In the U.S., according to the Bureau of Labor Statistics, workers in job descriptions composing the auto industry accounted for 2.2% of the nation's labor force in April 2018. According to *Cars.com*, there were approximately 12 million American cars built last year, based on units composed of at least 75% American-made components. National economic statistics for 2017 from the Bureau of Economic Analysis showed the U.S. auto industry represented 2.8% of economic activity; only a fraction of the significance autos represent to the German economy.

The VW workers' council head said the company would have to sell about one million EVs by 2025 to meet the emissions limits proposed by the EU

If the German environment ministry suggestion is embraced, there will be a significant impact on the future shape of its auto industry. Based on recent history, Germany has repeatedly lobbied the EU for weaker emission rules to protect its three auto manufacturers (BMW, Daimler and VW) and their suppliers. According to media reports, the VW workers' council head said the company would have to sell about one million EVs by 2025 to meet the emissions limits proposed by the EU. It would likely require a multiple of those EVs to meet the environment ministry's targets. Meeting these targets would be nearly impossible due to the lack of charging infrastructure and battery costs, according to the workers' council official. He

further argued that if there was no meaningful progress on the crucial issues for EVs of range and price, the shift to this technology could become "a failure."

VW has accelerated its EV development with five models scheduled to arrive in 2019, three of which are targeted for China

The struggle between the various ministries of the German government will prove interesting, especially in light of recent moves by the country's auto manufacturers. VW has accelerated its EV development with five models scheduled to arrive in 2019, three of which are targeted for China. BMW recently awarded a contract worth billions of euros to Chinese battery manufacturer CATL for its planned electric cars. CATL has agreed to build a battery cell factory near the German city of Erfurt to support BMW.

The head of BMW told an interviewer that the battery contract reflected his company's need for a supplier "who's already on the market." BMW also said a top priority was having a battery supplier nearby. This move, however, torpedoes the effort of EU Energy Commissioner Maros Sefcovic, as well as several heads of government including German Chancellor Angela Merkel, to try to avoid having automakers inside the EU being wholly-dependent on predominantly Asian suppliers.

The environment ministry also emphasized that the paper was not proposing an EV quota, but rather is pushing for a technology-neutral approach that would create a system with both incentives and penalties

The environment ministry argues in its white paper that stricter emission levels than those proposed by the EU Commission would benefit the German economy and would also be in the long-term interest of the auto industry. It would force auto manufacturers "to secure the corresponding development and production capacities in Germany and Europe, and to give incentives for the shift to future vehicle technologies in the car industry." The environment ministry also emphasized that the paper was not proposing an EV quota, but rather is pushing for a technology-neutral approach that would create a system with both incentives and penalties.

It will be interesting to watch what comes from the interdepartmental negotiations over responding to the EU Commission's carbon emission targets. Just how much will the German government yield to its auto industry, versus attempting to comply with the Paris Accord rules? Environment versus economy has significant implications for Europe going forward, and for Germany in particular.

EV And AV Futures Brighten; But As Much As Anticipated?

EVs are one way to control and eventually reduce transportation carbon emissions, but other ways include embracing the concept of mobility as a service

Back in 2016, barely two years ago, there were numerous reports on the technology revolution underway in the transportation industry. Many reports focused on the push for electric vehicles (EV) as the proper response to climate change, a movement whose euphoria peaked with the Paris Accord. EVs are one way to control and eventually reduce transportation carbon emissions, but other ways include embracing the concept of mobility as a service. The social changes underway in the transportation industry include use of ride-sharing and vehicle-sharing services, as well as autonomous

That meant actually testing AVs on roads

vehicles (AV). Virtually every auto manufacturer and numerous leading technology companies have programs to bring AVs to market. To do that, the companies needed not only to develop the technology for self-driving by cars, but also prove the technology in real-world situations. That meant actually testing AVs on roads.

Over the past two years, the testing of AVs has progressed, although recently it was marred by an accident claiming the life of a pedestrian. That accident forced Uber, the company testing the AV, to abandon its testing effort in Phoenix. The accident investigation subsequently revealed that Uber had disabled the automatic braking function of the car and the backup safety driver was video-streaming a show and was distracted.

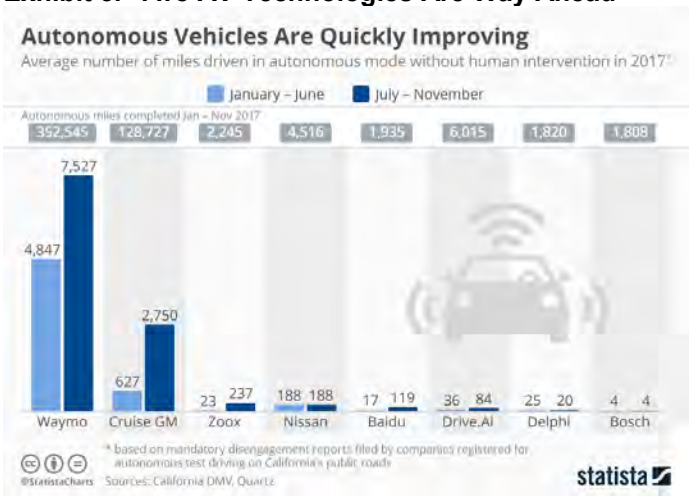
In 2017, AVs being tested completed more than half a million miles in self-driving mode on California roads

California has led the nation in AV testing, largely because many of the technology companies headquartered in Silicon Valley have been leading autonomous technology development. In 2017, AVs being tested completed more than half a million miles in self-driving mode on California roads. Waymo, formerly Google's (GOOG-Nasdaq) self-driving car project, and Cruise, a General Motors (GM-NYSE) subsidiary, were the busiest test drivers.

But, from July to November, the company's backup drivers only had to take control every 7,527 miles

As part of the testing, each company must file reports with the California Department of Motor Vehicles detailing their experience. The reports show the progress the companies are making with AVs. The frequency of human interventions, or when the human driver decided or was forced to take control of the vehicle, was significantly lower in the second half of 2017 compared to the first. Waymo's cars drove an average of 4,847 miles between human interventions in the first six months of the year. But, from July to November, the company's backup drivers only had to take control every 7,527 miles.

Exhibit 5. Two AV Technologies Are Way Ahead



Source: ***Statista***

A report by McKinsey & Company discussed disruptive trends in the automotive industry. We are highlighting a few we consider to be the most important.

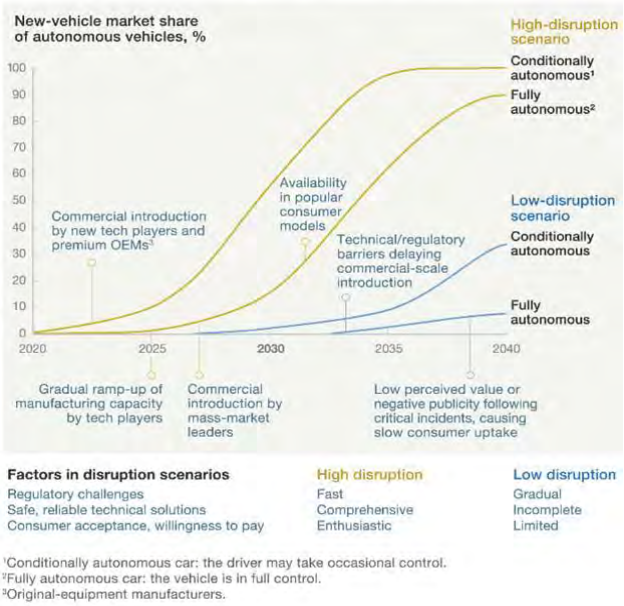
Once technology and regulatory issues are resolved, up to 15% of new cars sold in 2030 will be AVs

- Shared mobility and connectivity services will become a huge new market for auto companies that will drive shifts in their business models. This new market could add 30% to the industry's business, or $1.5 trillion by 2030.
- New car sales will continue to grow, albeit at a slower rate – 2% per year versus the 3.6% annual average for 2010-2015. The slower growth is a direct response to the growth of mobility services.
- Mobility service use will result in one of ten new cars sold in 2030 being shared.
- City type will replace country or region as the most relevant segmentation that determines mobility behavior, which will determine the speed and scope of the automotive revolution. In other words, the car market in New York City will more closely resemble that of Shanghai rather than Kansas.
- Once technology and regulatory issues are resolved, up to 15% of new cars sold in 2030 will be AVs.
- EVs are now viable and competitive, but adoption will vary strongly at the local level. Urban markets with ease of charging points and shorter distances traveled may be more receptive of EVs as opposed to rural areas.

With a lack of enthusiasm for AVs, market share reaches only 30% for the least autonomous technology, and the fully autonomous market share tops out at 10% in 2040

McKinsey is high on the outlook for AVs, which is reflected in its projections. As with many forecasts, McKinsey offered alternative scenarios for how AV markets might develop. In its forecast, the two cases are high-disruption and low-disruption. In the high-disruption scenario, commercial introduction of conditionally autonomous cars, in which the driver can take control of the vehicle, begins in 2020 with 100% market share reached by 2033. But getting fully autonomous vehicles accepted begins later due to regulatory requirements, thus commercial introduction doesn't happen until 2027, and the technology only reaches 90% market share by 2040. On the other hand, in the low-disruption case, markets do not open until 2027, or 2033 for fully-autonomous cars. With a lack of enthusiasm for AVs, market share reaches only 30% for the least autonomous technology, and the fully autonomous market share tops out at 10% in 2040.

Exhibit 6. Scenarios For AV Growth
How many new cars may be fully autonomous by 2030?



Source: McKinsey & Company

These disruptive trends will certainly revolutionize the transportation business, with the automobile sector experiencing the maximum impact. While the trends suggest unit volume of auto manufacturers will continue to grow, the nature of the vehicles built and sold will shift. New adjacent auto markets will also evolve, providing growth opportunities for those auto manufacturers who elect to participate in them. Although the new markets auto companies select to enter will vary, government mandates for addressing carbon emissions, especially in the transportation sector, will result in virtually every auto manufacturer being pushed to play in the EV market.

Government mandates for addressing carbon emissions, especially in the transportation sector, will result in virtually every auto manufacturer being pushed to play in the EV market

One of the most bullish outlooks for the EV industry has been provided by ARK Invest for several years. Late in 2017, the firm estimated that 17 million EVs will be sold in 2022, which they contrasted with the Energy Information Administration (EIA), as well as others, only forecasting 2-4 million units being sold. In ARK's view, all forecasts are underestimating EV growth.

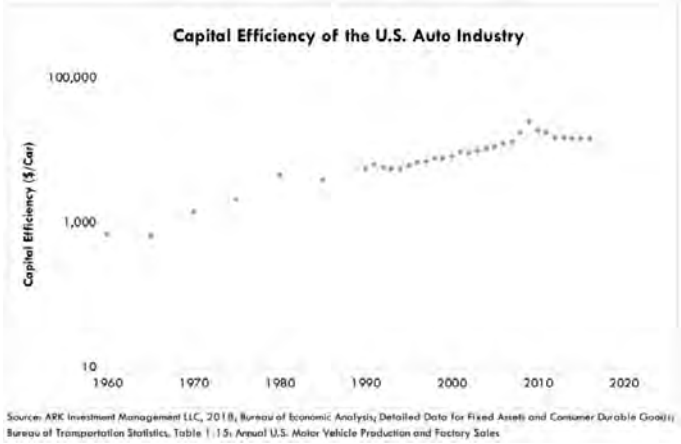
Late in 2017, the firm estimated that 17 million EVs will be sold in 2022

Recently, ARK analyzed auto manufacturers' capital spending plans for EVs in light of the industry's capital efficiency record. Their conclusion is that these spending plans support ARK's aggressive EV growth projection.

ARK began by analyzing the capital efficiency of the U.S. auto industry. They compared annual auto production to the industry's capital investment in equipment and plant from 1960 to 2016.

ARK compared annual auto production to the industry's installed base of capital equipment and structures from 1960 to 2016. The amount of capital required to produce a car powered by an internal combustion engine (ICE) in the U.S. has been rising steadily. It should be acknowledged that part of the reason for the rise is associated with mandated improvements in vehicle safety and fuel-efficiency. [The reader should note that the capital efficiency scale in Exhibit 7 is logarithmic.]

Exhibit 7. Takes More Capital To Build New US Cars

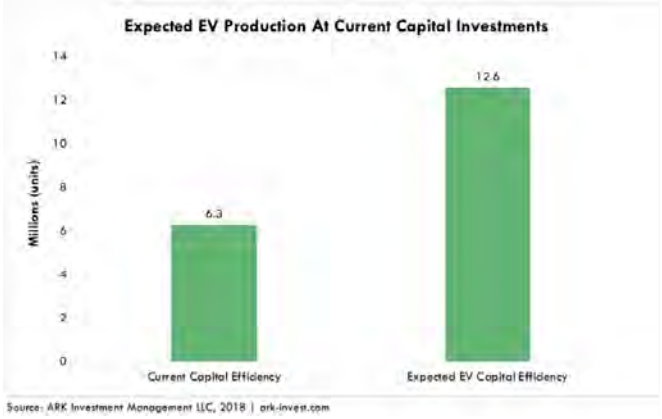


Source: ARK Invest

Dividing the planned capital spending by the $14,000 per vehicle estimate yields a manufacturing capacity for EVs of 6.6 million a year

As of 2016, the auto industry had invested more than $14,000 in fixed assets for every car produced that year. In January of this year, reports suggested the auto industry would be investing $90 billion for EVs over the next 5-10 years. Dividing the planned capital spending by the $14,000 per vehicle estimate yields a manufacturing capacity for EVs of 6.6 million a year. That estimate is slightly more than 50% higher than the EIA's high-end estimate, but it doesn't reach ARK's 17 million EV estimate.

Exhibit 8. Lower Costs Boost Output For EVs

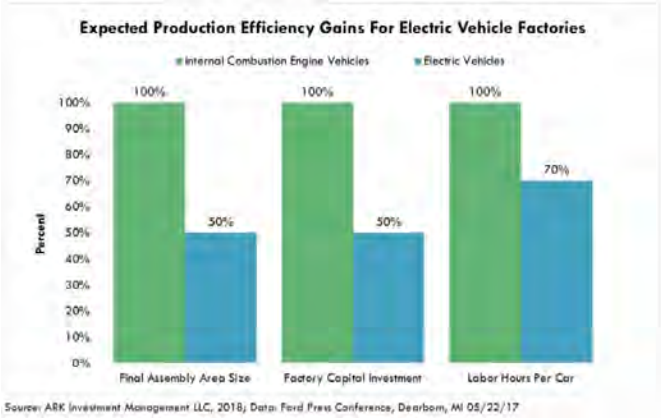


Source: ARK Invest

They see potentially a 50% reduction in factory capital investment and a 30% savings in labor productivity

EVs have a fraction of the moving parts of traditional ICE cars. Therefore, they should be able to be manufactured more efficiently. Executives of Ford Motor Company (F-NYSE), in an analyst meeting, said they expect significant efficiencies in building EVs. They see potentially a 50% reduction in factory capital investment and a 30% savings in labor productivity. ARK also pointed to comments from Elon Musk of Tesla (TSLA-Nasdaq) in his 2017 fourth quarter earnings call suggesting that the Model Y could be twice as capital efficient as the Model 3. Given the production problems Tesla has had with its Model 3 and the need to create a third production line housed in a tent in order to reach the corporate goal of assembling 5,000 Model 3's by the end of June, one wonders whether Mr. Musk's comments are valid. While these problems were not public knowledge at the time ARK issued its latest report, they suggested that the $90 billion spending could lead to output of 12.6 million EVs per year.

Exhibit 9. Reasons For EV Output Forecast Gains



Source: ARK Invest

It is hard sometimes to hold back the wave of enthusiasm, but there are many challenges still to be addressed that will prove critical to the pace of acceptance and output

Based on this capital efficiency analysis, ARK held to its 17 million EVs in 2022 forecast based on expectations of the global auto industry rapidly ramping up its spending and output forecasts, boosted by the expected productivity improvements. While holding to their production target, ARK admits the journey from here to their elevated estimate will likely prove bumpy. It is easy to become overly optimistic about the trajectory of EVs and AVs. It is always easy to climb on bandwagons. It is hard sometimes to hold back the wave of enthusiasm, but there are many challenges still to be addressed that will prove critical to the pace of acceptance and output. We're not ready to buy the 17 million EV projection just yet.

A Potpourri of Energy News Of Note

World Electricity Access

The World Bank has published its "2017 State of Electricity Access" report. A key data point is: "1.06 billion people still do not have

"In Sub-Saharan Africa, 609 million people (6 out of 10) do not have access to electricity"

access to electricity, and 3.04 billion people still rely on solid fuels and kerosene for cooking and heating." That's the bad news, especially for their health. An aspect of that bad news is the geographic concentration of those lacking access to electricity. "In Sub-Saharan Africa, 609 million people (6 out of 10) do not have access to electricity, and in South Asia, 343 million people do not have access to electricity."

It is hard to believe that half a billion people will still lack access to electricity 22 years from now

So, what's the outlook? A conclusion of the report was: "Given current conditions, universal electricity access will not be met by 2030 unless urgent measures are taken. While nearly 1 billion people in Sub Saharan Africa alone may gain electricity access by 2040, due to population growth, an estimated 530 million people in the region will not have electricity access." It is hard to believe that half a billion people will still lack access to electricity 22 years from now. [The report has some interesting information about renewables that we will be revisiting in a future *Musings* article.]

North Sea Profitability

A controversial study from the University of Edinburgh last fall claimed that the North Sea was entering its final 10 years of productive life

Chevron Corp. (CVX-NYSE) announced it was putting up for sale a number of its producing properties in the North Sea. That news broke as oil activity in the basin this summer has been on the rise. A controversial study from the University of Edinburgh last fall claimed that the North Sea was entering its final 10 years of productive life as only about 10% of originally recoverable oil and gas remains to be harvested. The oil and gas industry pushed back on that conclusion, as did the UK government.

Is the North Sea a high-cost basin with little hope of reductions?

However, one wonders how Chevron is thinking about the best ways to deploy its capital in a world demanding increased profitability from oil and gas companies. Is the North Sea a high-cost basin with little hope of reductions? Or, maybe the company sees more higher return projects than they have cash flow to prosecute, in which case disposing of assets becomes a way to free up capital to seize these more profitable opportunities. This is a development to watch more closely.

Correction:

Last issue we misidentified Ontario's new premier. It is Doug Ford. We apologize for the mistake, especially to our Canadian readers.

Contact PPHB:
1900 St. James Place, Suite 125
Houston, Texas 77056
Main Tel: (713) 621-8100
Main Fax: (713) 621-8166
www.pphb.com

PPHB is an independent investment banking firm providing financial advisory services, including merger and acquisition and capital raising assistance, exclusively to clients in the energy service industry.