
MUSINGS FROM THE OIL PATCH

April 3, 2018

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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

Uber Car Accident Shocks Hopes For New Era Auto Market

An autonomous vehicle (AV) in Arizona had hit and killed a 49-year old female pedestrian pushing a bicycle

The headlines on television news shows and across all the media outlets blared the news that an autonomous vehicle (AV) in Arizona had hit and killed a 49-year old female pedestrian pushing a bicycle. The shock reverberated throughout the automotive industry, which now includes a number of high-tech companies, all focused on producing software for controlling the vehicles that are destined to revolutionize transportation's future. On the other hand, a failure to correct what may be a systemic issue could set the revolution back by years.

AVs aren't supposed to hit, let alone kill, pedestrians

How could this happen? AVs aren't supposed to hit, let alone kill, pedestrians. In fact, they are designed to recognize and deal with the potentially unpredictable actions of humans, whether walking, running, biking, motorcycling, or driving a multi-ton vehicle. Only this time, the car didn't even appear to recognize the existence of this pedestrian, nor did it do anything to avoid her.

Uber Technologies Inc. suspended its AV research program

Immediately after the car accident, Uber Technologies Inc. suspended its AV research program, which was testing self-driving cars on the roads in four North American cities – Toronto, Pittsburgh, Tempe and San Francisco. Every other company involved in testing AV technology also ceased its program, or at least that testing being conducting on public roads. Some companies continued testing their AV technology in controlled environments, which would not put people at risk.

The fact that an AV had caused an accident, resulting in a death, something the technology is specifically designed to avoid, set off a wave of questions. Initially, the questions focused on the pedestrian, including: Why did she jump out of the shadows? Why wasn't she crossing in an official crosswalk? Eventually, as more

This accident, and resulting death, fulfilled the worst fears of the people designing AV technology

information came out as the police investigation moved forward, questions shifted to: Why was the human safety operator in the Uber car, who is positioned there for the eventuality of a problem necessitating human intervention, not looking at the road? What happened with the car's systems? All of these questions are excellent, but as the investigation progressed, some of them were dismissed as irrelevant given the reality of the scene of the accident and knowledge about the vehicle. This accident, and resulting death, fulfilled the worst fears of the people designing AV technology.

The confused vehicle is supposed to pull to the curb and stop

The car was reportedly traveling at 40 miles per hour, and a human safety operator was seated behind the steering wheel, ready to take over if needed. Based on video from a camera mounted inside the vehicle, the safety operator was glancing downward immediately before and at the time of the accident. Whether that human safety operator was distracted or not is not the primary issue, as the technology is supposed to work without human intervention. However, the human safety operator is supposed to hold his hands near the steering wheel in order to take over immediately after a problem is perceived. Later in the investigation we learned that Uber had disengaged a braking safety system installed in the Volvo. Exactly why it was disengaged is unclear.

Many questions are being asked about why Uber's AV technology failed to see the pedestrian until immediately before hitting her

One thing we have learned about AV technology is that it can become confused, requiring human assistance or additional data. AV confusion has often been associated with snowflakes and bushes. In each case, the confused vehicle is supposed to pull to the curb and stop until it gains the help needed to move on.

Video from the vehicle shows the female pedestrian crossing the street, going from left to right, and pushing a bicycle, while seemingly carrying a white shopping bag. The accident occurred at around 10 pm on a Sunday night. From the picture, the woman seems to be looking back in the direction of the car moments before the accident. It is possible she heard the vehicle and that is why she looked back. Could that have caused her to slow or stop, momentarily, ensuring the accident? An earlier view shows the reflectors on the heels of her shoes evident even though the rest of her was hidden by a shadow. Many questions are being asked about why Uber's AV technology failed to see the pedestrian until immediately before hitting her.

In the photo, the dotted white line immediately to the right of the pedestrian shows the start of a right turn lane leading into the intersection. The solid white line (also to the right of the pedestrian) shows a bike lane, which may have been where the woman was pushing her bike.

Exhibit 1. Immediately Before Uber Car Accident

Source: www.recode.com

The Wall Street Journal wrote a story on the accident and included an aerial view of the intersection where the accident occurred. The red dotted oval is the estimated site of the accident. The bike was found at the spot of the red X. In the upper right-hand corner of the photo, the solid white line marking the bike lane is visible. Notice that the bike lane seems to end across the street from where a red brick walkway is evident. The yellow strip between the right-hand turn lane and the main lanes of the road is the extension of the bike lane, but the yellow is an edit of the photo of the intersection.

Exhibit 2. Uber Accident Scene In Daylight

Source: *WSJ*

Since these walkways are at the spot where the bike was found, one has to assume that this was likely the target the women was heading toward at the time of the accident

Another view (street level and looking at the intersection from the right-hand side in the direction the Uber car was traveling) shows the bike and right-hand turn lanes. We noticed that there are three red brick walk inserts in the cement sidewalk on the right-hand side of the road that lead to paths that are not obvious from the aerial view. Since these walkways are at the spot where the bike was found, one has to assume that this was likely the target the women was heading toward at the time of the accident. One technology columnist who wrote about all the failures in this accident specifically singled out the City of Tempe for its anti-pedestrian attitudes, which he pointed out included the locations of crosswalks and a lack of street lights and crosswalks at intersections.

Exhibit 3. A Street Level View Of Accident Site



Source: Forbes

The walkways do not end at the intersection, rather, they seem to be closer to where the woman was crossing the street

The *WSJ* reporter visited the intersection at 640 North Mill Avenue in Tempe, Arizona, where the female pedestrian, Elaine Herzberg, was struck and killed on Sunday, March 18, 2018, at the same time at night (10 pm) as the accident, but the following evening. While his visit occurred on a workday evening, the reporter described the scene as “quiet with little traffic, though several pedestrians were walking around, including some pushing bicycles with bags.” As we have seen from multiple pictures of the area, the walkways do not end at the intersection, rather, they seem to be closer to where the woman was crossing the street. We have subsequently seen a photo of a bicyclist riding across the intersection, but there is no crosswalk marked where the rider was crossing.

Exhibit 4. The Uber Test Vehicle Equipped With LiDAR

UBER ATG

- Top mounted lidar units provide a 360° 3-dimensional scan of the environment
- Side and rear facing cameras work in collaboration to construct a continuous view of the vehicle's surroundings
- Roof mounted antennae provide GPS positioning and wireless data capabilities
- Forward facing camera array focus both close and far field, watching for braking vehicles, crossing pedestrians, traffic lights, and signage
- 360° radar coverage
- Custom designed compute and storage allow for real-time processing of data while a fully integrated cooling solution keeps components running optimally

Self Driving Uber sensor suite

- 7 Cameras
- 1 Laser
- Inertial Measurement Units
- Custom compute and data storage
- 360° radar coverage

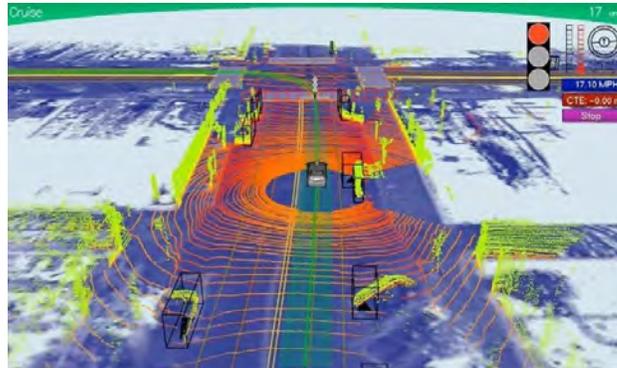
Advanced Technologies Group
UBER

Source: Uber

The technology allows seeing people, objects, animals, trees and other vehicles in either daylight or at night that cameras or human eyes might not detect

An advertisement by Uber for its AV program shows a Volvo XC90 sport utility vehicle, similar to those being tested, equipped with a LiDAR unit on the roof that maps the area the vehicle is traveling to provide guidance to the system driving it. LiDAR is an acronym for Light Detection and Ranging, which is a technology shooting out pulsed laser beams to create 3D “point cloud” images of a vehicle’s surroundings hundreds of feet away. The technology allows seeing people, objects, animals, trees and other vehicles in either daylight or at night that cameras or human eyes might not detect. The Uber vehicle was also equipped with radar to detect solid objects such as the woman’s bicycle, at a further distance. It also had multiple cameras aimed to provide pictures of the surroundings and any objects that could create problems.

Exhibit 5. How LiDAR “Sees” Hazards For Cars



Source: *Technology Review*

The LiDAR sends out laser beams that rebound and enable the software to locate and define items that could present problems for the vehicle and its progress. As shown in Exhibit 5, the 360° camera rapidly fires out the signal, receives indications of obstructions, maps them and displays them for the driving system to adjust the vehicle's path and speed. Note that identified objects the vehicle needs to avoid are included in boxes outlined in black.

“We are as baffled as anyone else”

Various media reached out to the maker of the Uber LiDAR for comment about what may have gone wrong. Marta Hall, the president and chief business development officer of Velodyne told *Forbes* magazine that “We are as baffled as anyone else. We are at the service of engineers and investigators at NTSB [National Transportation Safety Board] and NHTSA [the National Highway Traffic Safety Administration] as the findings and facts of the case are discovered. We haven’t sent engineers there, but are certainly willing to if requested.”

She went on to say, “Our LiDAR is capable of clearly imaging Elaine [the woman killed] and her bicycle in this situation. However, our Uber LiDAR doesn’t make the decision to put on the brakes or get out of her way.” As the investigation is conducted, we expect to

In the digital age in the U.S. pedestrian deaths have grown faster than other traffic deaths

learn the answer to the question of what sensors were on the Uber car that evening, whether they were working, and how they might have been used.

While the various police and regulatory agencies investigate the accident, real world AV testing is virtually totally shut down. Until the explanation of what went wrong is known and understood, Americans will be hesitant to trust the AV technology – but is it Uber's technology or all AV technology? From an article about pedestrian danger, we found it interesting that in the digital age in the U.S. pedestrian deaths have grown faster than other traffic deaths. The latest figures from the Governors Highway Safety Association showed that in 2016, 5,987 pedestrian deaths were recorded out of a total of 37,461 total traffic deaths. Between 2007 and 2016, pedestrian deaths increased 27%, while total traffic deaths declined 9%; non-pedestrian deaths fell by 14%. Crossing a street while looking at a smart phone is quite different from pushing a bike across the street in front of an AV that didn't see the hazard.

The bigger problem for AV technology is human fear

The bigger problem for AV technology is human fear. A January *Gallup* poll found two-thirds of those surveyed were unconvinced about the safety of the technology. That fear is somewhat below that shown in a 2017 AAA poll that had 78% of American drivers fearing riding in an AV. If the accident is due to faulty sensors and/or a flaw in the software, it will set back AV testing and adoption. Overcoming Americans' fears of AV technology may become a significant hurdle for its acceptance, regardless of regulatory approval. At this point, we cannot believe Arizona, where AV testing requirements are minimal, will not consider tighter rules. While the state has suspended Uber's AV testing program, that doesn't fully address the issues and uncertainties. Uber has also suspended its California AV testing where the requirements and reporting are stricter. Reportedly, Uber withdrew its program because it would not be able to provide the required data to the California regulators following the Arizona crash.

Uber cars were having trouble driving through construction zones and next to tall vehicles such as tractor-trailers

The key motivator for promoting AVs is safety. At some point, the safety aspect will push regulators to approve AV technology. The big question is whether they will specify one or more, or all AV technologies. According to research by *The New York Times*, Uber cars were having trouble driving through construction zones and next to tall vehicles such as tractor-trailers. These issues were pointed out by people noticing the bushes lining the road where the pedestrian accident occurred.

Waymo was averaging nearly 5,600 miles before the driver had to take control

The *NYT* also pointed out, based on records they examined, that AV developer Waymo was averaging nearly 5,600 miles before the driver had to take control of the vehicle away from the computer to steer it out of trouble. Cruise, another AV developer, reported to California that its vehicles were traveling 1,200 miles per intervention. Uber, on the other hand, was struggling to meet its

We think the long-term impact on the development of AVs may be similar to the disruption of the Apollo space program following the fire that occurred during a pre-flight test of the space capsule on January 27, 1967

target of 13 miles per intervention in Arizona. At this point, we have not seen details about the differences in the various AV technologies being developed, but we suspect this will become a focal point for state and federal regulators.

We think the long-term impact on the development of AVs may be similar to the disruption of the Apollo space program following the fire that occurred during a pre-flight test of the space capsule on January 27, 1967, which killed all three crew members—Command Pilot Virgil I. "Gus" Grissom, Senior Pilot Ed White, and Pilot Roger B. Chaffee—and destroyed the Command Module. Apollo 1, as it was officially designated after the accident, was scheduled for lift-off on February 21, 1967, for a 14-day, low Earth manned orbital flight. That manned test flight was completed 20 months later in October 1968, following a complete redesign of the command module.

In 1961, President John F. Kennedy had begun America's effort to send a man to the moon and return him safely. The effort had not gained much support, so, in a September 12, 1962, speech at Rice University in Houston, he said.

"We choose to go to the Moon! We choose to go to the Moon in this decade and do the other things, not because they are easy, but because they are hard; because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one we intend to win, and the others, too."

"Why does Rice play Texas?"

Immediately before speaking those words, President Kennedy set forth the rationale for establishing the goal of reaching the moon, while also invoking some local humor. He told the 40,000 assembled in the Rice Stadium, "But why, some say, the Moon? Why choose this as our goal? And they may well ask, why climb the highest mountain? Why, 35 years ago, fly the Atlantic? Why does Rice play Texas?"

On July 20, 1969, the lunar module Eagle, carrying mission commander Neil Armstrong and pilot Buzz Aldrin, landed on the moon. Six hours later, on July 21st, both Americans walked on the moon, in a televised adventure that captivated America and the world. (We were watching.)

Could AVs be equated with the manned missions to the moon?

Could AVs be equated with the manned missions to the moon? In terms of their impact on our society, and the spin-offs that may reshape our economy, AVs could play a greater role than those that came from manned space flight. Could AV testing and its approval be set back for a year and a half? Sure, it could. But, within the scheme of the technological transformation of the global transportation system, that will not be a major disruption.

Worst Stock Market Week Also Showed Oil's Problem

One of the great frustrations for energy investors is the extended underperformance of energy securities while crude oil has done better

Energy investors had to feel better than commodity traders trading hog futures

If the stock market truly reflects the discounted future value of a company's earnings and dividends, then the investment world is projecting an unattractive future for energy companies

The week ending March 23, 2018, saw the Dow Jones Industrial Average fall to its low for the year, as other major averages lost about 6%, on average. That week was not only the worst experienced so far in 2018, but it was the worst weekly performance since the week ending January 8, 2016. One of the great frustrations for energy investors is the extended underperformance of energy securities while crude oil has done better. The table of market performance for commodities, ETFs, stock indices and currencies for that week demonstrated just how widely capital markets were hit by fears of a potential global trade war.

While the introduction of aluminum and steel tariffs was seen as hitting the oil and gas industry by boosting the cost of pipe used in well drilling and completion, that concern failed to hurt oil prices. What we see in the chart from *The Wall Street Journal* is that crude oil futures were the second best performing asset class, rising 5.56% for the week. NYMEX crude oil prices closed trading on March 23rd at \$65.88 a barrel, up \$3.54 for the week. Two refined petroleum products – ultra low sulfur diesel and Rbob gasoline – bracketed the performance of crude oil. At the same time that the raw material did well, the S&P 500 Energy index fell by 0.93%. Although suffering a loss for the week, energy investors had to feel better than commodity traders trading hog futures. Bacon lovers may be rejoicing.

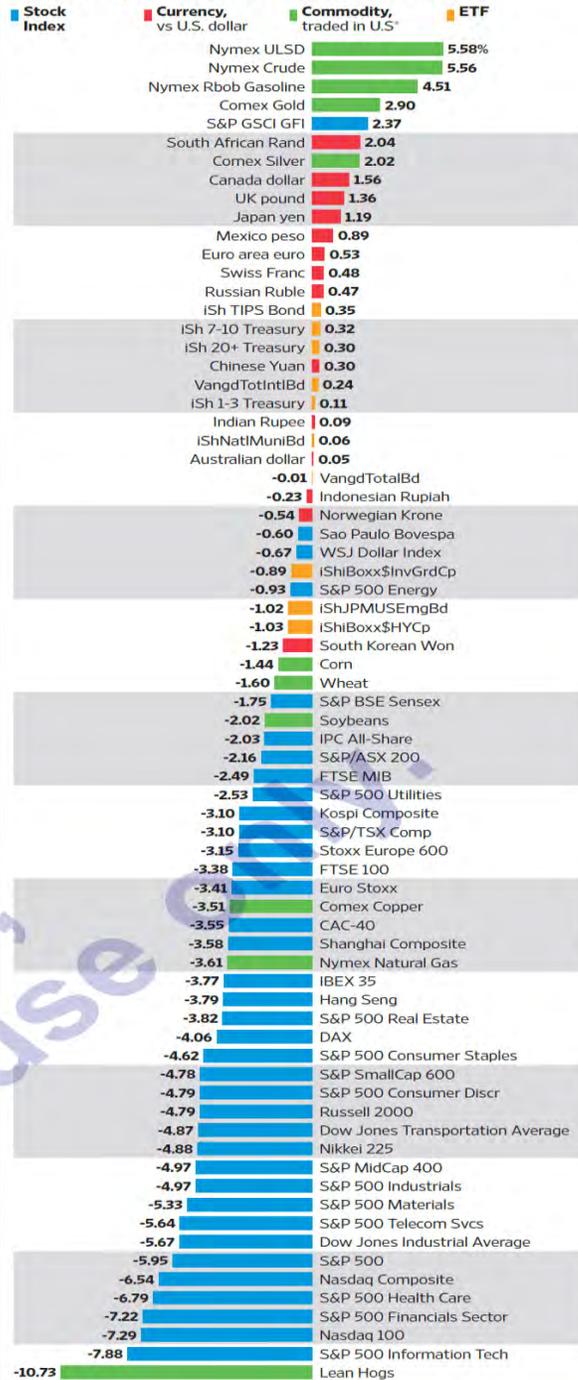
This divergence in performance between the commodity and those companies that drill, produce and refine oil has created a serious challenge for energy investors. In other words, as the fundamentals of the business have improved and are reflected in the rise in crude oil prices, stock market valuations assigned to the earnings of energy companies are shrinking. If the stock market truly reflects the discounted future value of a company's earnings and dividends, then the investment world is projecting an unattractive future for energy companies. But could that view be wrong?

For many investors, especially those leaning toward the view that the global economy is on a path to a decarbonized world, why would you want to own the shares of companies producing fuels with high carbon content? On the other hand, maybe it is all about renewables, electric cars and falling energy demand or at least the demand dependent on fossil fuels. That seems to be the current stock market view of energy stocks.

Exhibit 6. Tale Of The Tape For Worst Week In 2018

Track the Markets: Winners and Losers

A look at how selected global stock indexes, bond ETFs, currencies and commodities performed around the world for the week.



¹Continuous front-month contracts
Sources: SIX Financial Information (stock indexes), Tullett Prebon (currencies), WSJ Market Data Group (bond ETFs, commodities).

Source: The Wall Street Journal

If so, then energy investors will be back quickly and with welcoming embraces

The debt-adjusted financial metrics would impact both long-term compensation programs as well as annual bonuses throughout the company

However, it may be that energy investors, especially those currently avoiding the stocks, are more focused on whether the industry can shift its corporate strategy away from spending to grow hydrocarbon reserves and output without regard to cost, and toward boosting financial returns, growing company earnings and cash flows, and, importantly, sharing a meaningful portion of their cash flows with shareholders. If so, then energy investors will be back quickly and with welcoming embraces.

At the same time the *WSJ* was producing its weekly performance table, its sister publication, *Barron's*, published a stock chart for Anadarko Petroleum Corp. (APC-NYSE) that showed it trading higher over the course of the week, at the same time energy stocks were falling. Unstated was the belief that the contra-performance of Anadarko reflects a new view by investors due to its management's embrace of the capital discipline mantra being pushed onto the industry. Last October, Anadarko was one of the first major oil companies to announce a huge share repurchase program (\$2.5 billion) along with a significant increase in its quarterly dividend. That was followed a few weeks later by management announcing that its future compensation measures would include debt-adjusted financial returns with its traditional incentives around capital expenditures, reserve additions, sales volumes and safety. The debt-adjusted financial metrics would impact both long-term compensation programs as well as annual bonuses throughout the company.

Exhibit 7. Anadarko's Stock Price Has Improved Recently



Source: *Big Charts*, PPHB

Anadarko's share price has closed the performance gap with the oil index

When we plotted the share price performance of Anadarko versus the S&P 500 Index and the oil index since March 2015, we could see the significant underperformance of energy shares versus the overall market. What is interesting is how after the October announcement embracing capital discipline, and a later one boosting the share buyback amount by \$500 million, Anadarko's share price has closed the performance gap with the oil index. While the oil industry's underlying fundamentals have improved, closing the share

A third of the 25 largest exploration and production companies have increased, or have pledged to increase dividends

price gap suggests investors are rewarding Anadarko for its capital discipline stance. To close the gap further, investors will want to see the company's performance improve and the capital discipline become ingrained in the company's culture. With *Reuters* recently reporting that a third of the 25 largest exploration and production companies have increased, or have pledged to increase dividends, the capital discipline mantra seemingly is being adopted. Its longevity will be key for future share price performance.

Boy, Was Punxsutawney Phil Right. Now What?

Officers from the Monroe County Sheriff's Office announced they were seeking to arrest Punxsutawney Phil for deception

On February 2nd, Groundhog Day in Gobbler's Knob in Punxsutawney, Pennsylvania, the hairiest meteorologist in history saw his shadow and scurried back into his burrow, thereby predicting six more weeks of winter. Last week, as the fourth nor'easter to blast the Northeast region of the country with snow and cold was unfolding, officers from the Monroe County Sheriff's Office announced they were seeking to arrest Punxsutawney Phil for deception. Their charge is that his six-weeks of winter forecast expired on March 16th. Now, on the second day of spring, with snow continuing to fall, Phil was targeted for being a fraud.

Exhibit 8. What Happens When Promises Fail

Race:	Groundhog	Sex:	M	Hair:	ERO
Length:	22"	Weight:	20 lbs	Eyes:	ERO
DOB:	5/01/2010	Alias:			
Scars/Marks/Tattoos:					

ADDITIONAL COMMENTS:
 THE MONROE COUNTY SHERIFF'S OFFICE IS SEEKING THE APPREHENSION OF PUNXSUTAWNEY PHIL FOR DECEPTION. ON FEBRUARY 2ND, 2018, PUNXSUTAWNEY PHIL PROMISED THAT THERE WOULD BE 6 MORE WEEKS OF WINTER. THAT PROMISE EXPIRED ON MARCH 16TH. WE ARE NOW ON THE 2ND DAY OF SPRING AND WE ARE IN THE MIDDLE OF YET ANOTHER SNOWSTORM.

ANY POSITIVE INFORMATION PLEASE CALL:
 MONROE COUNTY SHERIFF'S OFFICE

(570) 555-5555

Source: CNN

The frustrating experience during these nor'easters is the constraint they impose on the recovery effort

We were at our summer home in Rhode Island from March 1-12, and were subject to the first two nor'easters, forcing us to shovel snow for the first time in years. In fact, the snow shovel had cobwebs that needed to be wiped away before we could use it. For those unfamiliar with nor'easters, the temperatures are not bitter cold, such as those experienced during an Arctic Vortex, but the moisture is significant and the winds are powerful. For Rhode Island, which is covered in second-growth woods and has its power lines in the air, electricity outages during nor'easters are common. In fact, during the first storm, we lost our power for 24 hours spread over two days. The frustrating experience during these nor'easters is the constraint they impose on the recovery effort.

In Wal-Mart's parking lot were about 25 utility repair trucks waiting for the wind speeds to drop, allowing the repairmen to go to work

In our case, we lost power around 11 am, so by dinner time we headed out to purchase several battery-operated lamps and to find an open restaurant. In Wal-Mart's parking lot were about 25 utility repair trucks waiting for the wind speeds to drop, allowing the repairmen to go to work. First, the fallen trees that pulled down the electric wires had to be cleared away. Then, either the old wires, or new ones, need to be strung, and possibly new power poles installed, before electricity can be reconnected. Our power was restored at 11 am the following morning. Searching for a restaurant with power that evening was interesting, as large crowds overwhelmed those fortunate few which had electricity.

Yes, people are tired of winter. While still dealing with winter, we were surprised on March 14th for WeatherBELL Analytics LLC, home to leading weather forecaster Joe Bastardi, to issue a preliminary hurricane forecast for the upcoming summer and fall seasons. With the hurricane season lasting from June 1 through November 30, many of the weather services or even the specialist hurricane forecasters usually don't venture forth with specific predictions until April, or even June.

CSU saw a 60% probability for a more active season, with only a 20% probability of a below-average season happening

One of the leading tropical storm forecasters, the Tropical Meteorological Project of the Atmospheric Science Department at Colorado State University (CSU), issued a very preliminary view back in December 2017 of what the 2018 tropical storm season might look like. At that time, they did not forecast the number of storms or severity, but rather projected the amount of accumulated cyclone energy (ACE) for the season, which is a measure of the strength and longevity of a tropical cyclone. In that forecast, CSU saw a 60% probability for a more active season, with only a 20% probability of a below-average season happening.

Around the same time, another climate firm, Nevada-based Climate Forecast Applications Network headed by Judith Curry, said that based on its reading of specific sea surface and atmospheric circulation patterns, they see an 80% probability of an above-normal 2018 hurricane season. Both of these forecasts could, and are likely to, be modified after considering the existence of El Niño or La Niña.

The WeatherBELL 2018 hurricane season outlook calls for the following activity:

Total Storms: 11-15
 Hurricanes: 5-7
 Major Hurricanes: 1-3
 ACE: 90-110 (near normal)

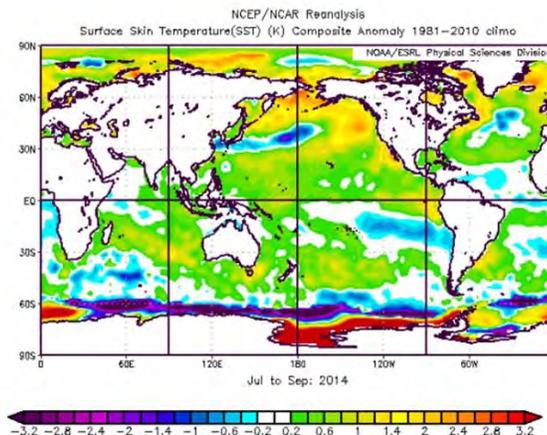
They have also added 2014, as it has the closest match to current climate conditions

The WeatherBELL forecasters are fascinated that the same five analog seasons they used last year, are still working for this spring

In putting its forecast together, WeatherBELL used the SSTs from the Euro climate model, which are similar to 2014's, which was a relatively down year. The forecasters are using various analog years to adjust their forecast. At the moment, they have elected to double-weight the 1951 and 2006 seasons. They have also added 2014, as it has the closest match to current climate conditions as shown in Exhibit 9.

Based on the distribution of surface pressures, it appears the intensity this season is going to be near and off the East Coast of the U.S. and into the central region of the Atlantic Ocean. The WeatherBELL forecasters are fascinated that the same five analog seasons they used last year, are still working for this spring. Because these analogs are so close to the blend of the EU climate forecast model, for the future, WeatherBELL forecasters believe they should stick with them until proven otherwise.

Exhibit 9. 2014 Climate Similar To Today's Climate



Source: WeatherBELL

The forecasters also point out that two of the analog years – 1951 and 2006 – experienced weak El Niños. In three of the analog years – 1951 with the El Niño, 1996 and 2011, fairly active hurricane seasons followed. This pattern may become the focal point of research as we approach the start of this hurricane season.

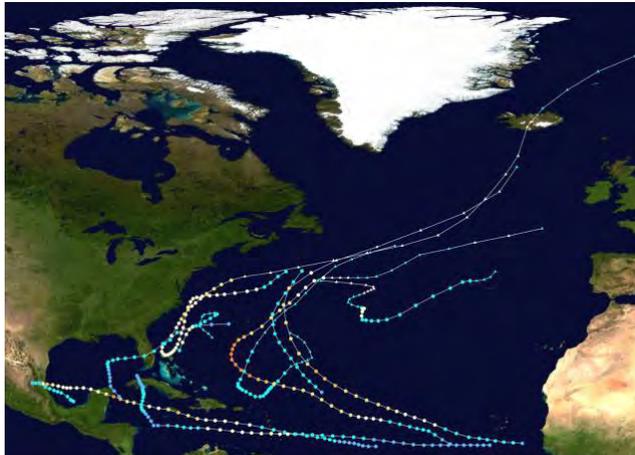
The following exhibits show the analog hurricane seasons WeatherBELL is using to help guide its upcoming forecast.

Exhibit 10. What The 1934 Hurricane Season Was Like



Source: WeatherBELL

Exhibit 11. What The 1951 Hurricane Season Was Like

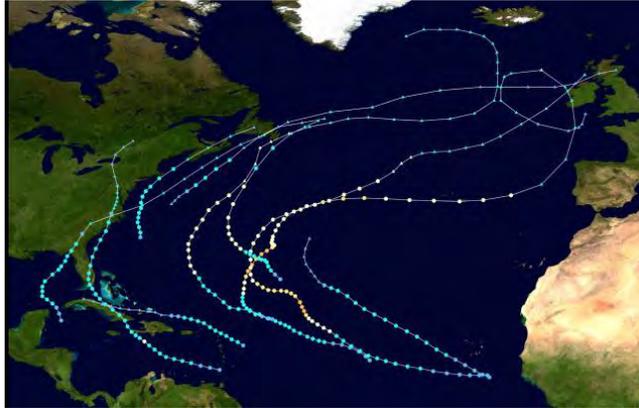


Source: WeatherBELL

Exhibit 12. What The 1996 Hurricane Season Was Like



Source: WeatherBELL

Exhibit 13. What The 2006 Hurricane Season Was Like

Source: WeatherBELL

Exhibit 14. What The 2011 Hurricane Season Was Like

Source: WeatherBELL

One should note how much of the activity occurred in the Atlantic Ocean and on the East Coast

The observation we would make about the analog years is that while they all were fairly active seasons, one should note how much of the activity occurred in the Atlantic Ocean and on the East Coast. There were very few storms that hit the mainland. Hopefully, tropical storms this season will experience the same pattern.

Natural Gas Continues To Struggle – Some Are Writing It Off

Environmentalists supported natural gas as the “bridge fuel to a cleaner world” because high gas prices were helping their cause

There was a time – a decade ago – when the future of natural gas was considered as bright as the flame created when it burns. America was just coming to grips with global warming and rising carbon emissions, so a fuel that promised a fraction of the emissions of coal or crude oil was welcomed by environmentalists. While natural gas no longer traded at double digit prices, they were still substantially higher than prices gas fetched prior to 2000. Secretly, environmentalists supported natural gas as the “bridge fuel to a cleaner world” because high gas prices were helping their cause. High gas prices helped support the even more expensive renewable fuels that were the true focus of environmentalists.

Historically, explorers avoided or rapidly drilled through the shale formation since it created risks that could result in well failures or the need to have to re-drill them

Although the United States had struggled with periodic gas supply shortages, a small exploration and production company in Houston was making headway in drilling the gas shale formation underlying the Barnett Basin in central and north Texas. This source rock for gas hydrocarbons had proven a challenge to drill, and an even greater challenge to mine the gas molecules. Historically, explorers avoided or rapidly drilled through the shale formation since it created risks that could result in well failures or the need to have to re-drill them. The success George Mitchell and his associates achieved in utilizing horizontal drilling technology and then applying massive hydraulic fracturing pressures and more sophisticated proppants to crack and hold open the fissures within the shale, suddenly produced a gas bonanza.

Suddenly, natural gas output was surging. Higher initial production helped improve well economics – more money back earlier in the life of a producing well. The biggest help, however, was that the surge in new natural gas production was coming when spot gas prices were in the \$7-\$9 per thousand cubic feet (Mcf) range. Not too long after solving the shale challenge, Mitchell Energy and Development Corp. sold to Devon Energy Corp. (DEV-NYSE) in a \$3.5 billion transaction. Over the following decade, Devon reports that it produced 3.3 trillion cubic feet of natural gas equivalent from the Barnett shale, and estimated that its reserves were five times that amount. But, with this drilling and production success came the downside of falling gas prices. Shale gas had proven to be too much of a good thing.

Surging gas output and falling gas prices forced petroleum producers to seek other applications for this technology miracle

Falling natural gas prices forced environmentalists to take another look at the fuel, after which they decided that it wouldn't fulfill the desired transition role envisioned. Surging gas output and falling gas prices forced petroleum producers to seek other applications for this technology miracle. Light crude oil and distillates became the new target as the industry pivoted away from natural gas. Low gas prices, however, sparked a different revolution as this cleaner fossil fuel undercut dirty coal – the true target of the environmental movement. Since natural gas was the ideal fuel for turbines that could be built and installed quickly, and that offered nearly instantaneous power supplies when utilities needed additional electricity to meet spikes in demand, the rush was on to use more natural gas.

Based on the latest data for the month of January 2018, coal plants generated slightly over 50% of the electricity produced in the U.S.

By early 2015, the share of electricity generated by natural gas and coal was even. Since then, despite the "war on coal" that drove prices lower, natural gas has held on to its market share leadership role. That has not prevented some utilities from switching back to coal due to its lower price, which gave the utilities funds to spend on cleaning up the greater carbon emissions from coal and still generate electricity cheaper than if they had used natural gas. Based on the latest data for the month of January 2018, coal plants generated slightly over 50% of the electricity produced in the U.S.,

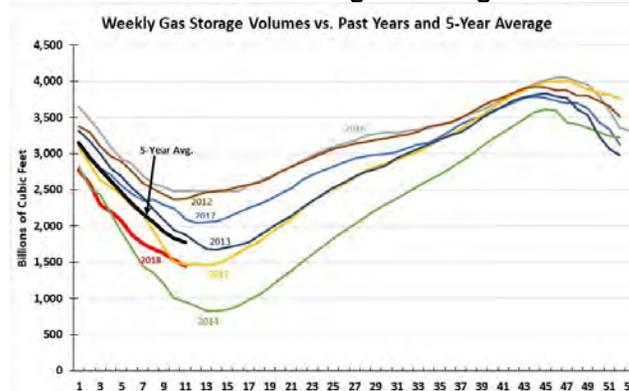
The current low natural gas price reflects a view that there is, and likely will continue to be, adequate gas supply to meet demand

but that was probably a unique situation caused by power needs in the Northeast that could not be satisfied by gas, which forced the re-starting of several coal-burning power plants.

One of the key issues confronting natural gas is the surge in production, a substantial amount of which is associated with the growth in shale oil output. While this winter produced several periods of extremely cold temperatures in the populous regions of the country, which helped electricity and heating demand for natural gas, the gas price spike associated with the large weekly gas storage withdrawals failed to be sustained. By implication, the current low natural gas price reflects a view that there is, and likely will continue to be, adequate gas supply to meet demand. If the market thought otherwise, natural gas prices would be either higher (an impending supply shortage) or lower (further substantial supply growth). The supply pendulum is signaling oversupply.

In order to examine the current gas market, we prepared two charts that provide a view of where current gas supply is in relation to recent years. The first shows natural gas in storage for the years 2012-2018 along with the most recent 5-year average (2013-2017). Exhibit 15 shows that through the week ending March 16, 2018, the volume of natural gas remaining in storage following the withdrawal of 86 billion cubic feet (Bcf) that week is 283 Bcf below the most recent 5-year average, or 16.3% lower. As the chart also shows, the remaining storage volume is almost exactly even with the volume at the same point in time in 2015, and below all other years from 2012 to 2017, with the exception of 2014.

Exhibit 15. 2018 Gas Storage Pushing Bottom Of Barrel



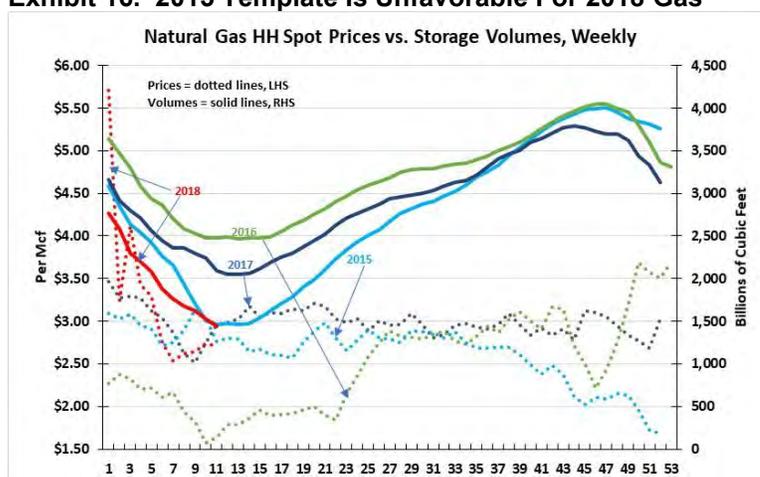
Source: EIA, PPHB

With natural gas storage volumes so low, one would logically expect gas prices to be moving higher in order to incentivize producers to drill and produce more. In Exhibit 16 (next page), we have plotted the storage volumes for each year of 2015-2018, as well as the corresponding weekly spot natural gas prices for those years. As we point out with our arrows, one can compare gas storage each week against the spot gas price.

Just as the storage volume in 2018 was equal to that of 2015, the weekly spot gas prices were also essentially equal

It is easy to see the impact that the early January cold spell had on natural gas spot prices in 2018 (in red). However, as gas volumes were withdrawn in subsequent weeks, natural gas spot prices fell sharply, but did spike up for a couple of weeks, before falling to the year's lowest point in mid-February. Natural gas prices have risen in the past several weeks. The most interesting observation is that just as the storage volume in 2018 was equal to that of 2015, the weekly spot gas prices were also essentially equal. While that may seem surprising, it suggests that the market views the future supply/demand relationship for natural gas as similar to what it was three years earlier.

Exhibit 16. 2015 Template Is Unfavorable For 2018 Gas



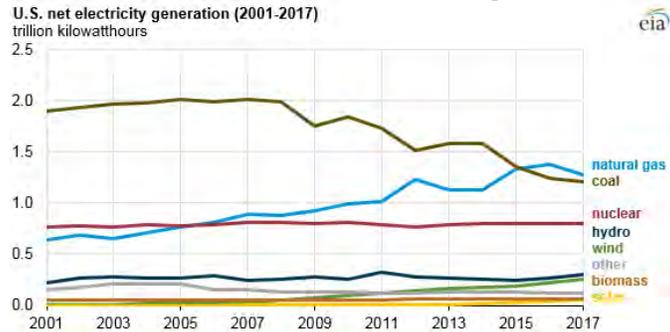
Source: EIA, PPHB

Exhibit 16 allows us to imagine what may happen to future gas storage volumes if 2018 continues to follow the pattern of 2015. The disappointing conclusion for gas producers is that if storage volumes are rebuilt at a similar pace as they were in 2015, spot gas prices are likely heading lower. It is this price/volume pattern that may have some analysts writing off the future of the natural gas market.

Renewables have taken a greater share of the power generation market in recent years

Increasingly, the opening up of natural gas exports in liquefied form may become the safety valve keeping gas prices from crashing as output continues to grow. Natural gas consumption in the electricity generating business has increased since 2005, as shown in Exhibit 17. It also shows how natural gas has become the primary fuel provider to electric generating utilities since 2015. The Energy Information Administration (EIA), in its article commenting on the shifts within the electricity business, highlighted how renewables have taken a greater share of the power generation market in recent years. It is obvious that renewables market share gain has come primarily at the expense of coal generation.

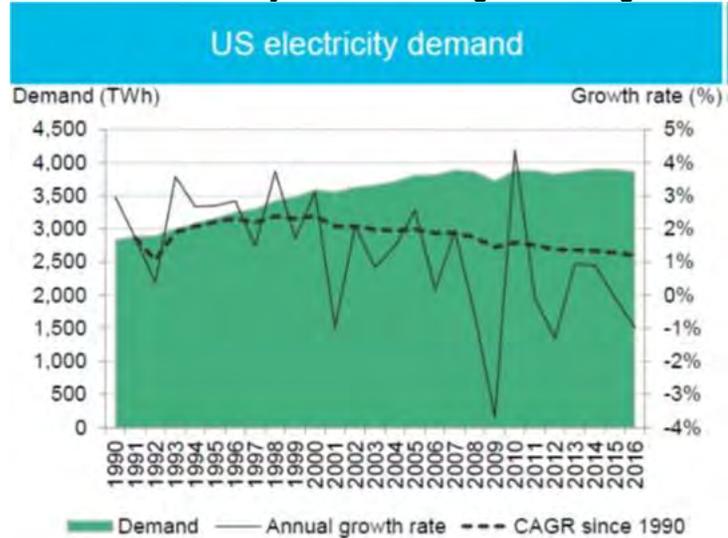
Exhibit 17. Natural Gas Now Is Primary Power Fuel



Net electricity generation fell by 1.5% in 2017

The greater challenge for the electricity industry is the recent decline in total electricity consumption. According to EIA data, net electricity generation fell by 1.5% in 2017, which it attributes directly to lower electricity demand. When one considers the chart in Exhibit 18, the focus should be on the trend in annual electricity demand growth, and, importantly, on the compound annual growth rate since 1990.

Exhibit 18. Electricity Demand Falling Pressuring Gas



Renewables growth was driven in 2017 by wind, which comprised 6.3% of total net generation, while utility-scale solar made up 1.3%, both figures are record market shares for the fuels

If electricity demand is falling and renewables are growing, then the question becomes: What is the future for the natural gas industry? Renewables growth was driven in 2017 by wind, which comprised 6.3% of total net generation, while utility-scale solar made up 1.3%, both figures are record market shares for the fuels. Due to the contribution from the rains and snows in California, hydro power's share increased in 2017 to a total of 7.5% of total net electricity generation. Hydro power is highly susceptible to the vagaries of winter and summer rains.

There are multiple forces working in the natural gas market, often at cross-purposes

There are multiple forces working in the natural gas market, often at cross-purposes. Will natural gas retain its leadership role in the electricity generating business? Will electricity consumption resume growing? Will that growth be met by increased power generated from renewables or natural gas? Will natural gas output continue to grow? How much can natural gas exports – either via pipelines or as LNG – grow in the near-term? It appears likely that none of these forces will work in favor of natural gas prices, so there will be dislocations in the petroleum market, utility industry and the global LNG trade. Many questions. Few answers. Plenty to watch.

Canada's Fractured Energy Politics May Reflect Cabin Fever

How can there be clashes over so many energy and environmental issues?

The snows have stopped. Temperatures are rising. Spring break-up has arrived. Canada's political discourse over energy policy reflects a cabin-fever mentality – or maybe it is more like mentally ill but enlightened ex-TV anchor Howard Beale, played by Peter Finch in the 1976 movie *Network*, who leans out of a window and yells: "I'm as mad as hell, and I'm not going to take this anymore!"

It is clear that they both support LNG projects and are extremely frustrated that most of the proposed ones have been dropped or remain in limbo

The political tensions over Canada's energy and environmental policies seem to be breaking out all over – oil pipelines, liquefied natural gas, energy permits, environmental protesting, First Nations, and gas vs. oil representation. How can there be clashes over so many energy and environmental issues?

A new report prepared by the British Columbia government and First Nations LNG Alliance attempts to discredit environmental groups and green lobbyists who claim that indigenous people are opposed to LNG developments. Based on a series of focus group meetings with First Nations people, it is clear that they both support LNG projects and are extremely frustrated that most of the proposed ones have been dropped or remain in limbo. These projects are seen as environmentally sound, but more importantly, offering employment and economic benefits for the people, something they want.

About the same time as the report was issued, a Federal Court of Appeal declined to hear an appeal by the government of British Columbia and a handful of opposed municipalities challenging a ruling by the National Energy Board allowing Kinder Morgan Canada (KML-TSE) to seek construction permits for the Trans Mountain pipeline expansion directly from Canada's pipeline regulator. This means localities such as Burnaby, B.C., where the export terminal is to be constructed, cannot stop the project by merely failing to issue construction permits.

Exhibit 19. B.C. – Alberta Energy Battleground



Source: *Financial Post*

It has failed to disrupt the Trans Mountain expansion, a project approved by the prior provincial government as well as the federal government.

Additionally, environmental protesters at the Burnaby site were slapped with a restraining order preventing them from getting within 5 meters (16.5 feet) of the construction site. For all the efforts of the New Democratic Party (NDP) coalition government in B.C., formed with the support of the Green Party, it has failed to disrupt the Trans Mountain expansion, a project approved by the prior provincial government as well as the federal government.

While fighting more oil sands output transiting the province, the B.C. NDP government announced new conditions and tax incentives designed to help LNG projects, with the target being Shell Oil's (RDS.A-NYSE) proposed terminal at Kitimat. The tax incentives – a reduction in the carbon tax and a suspension of provincial sales tax on the construction - were welcomed, but one wonders whether the condition that the project be consistent with the province's greenhouse gas initiative will trip it up.

Although most of the energy battles have been waged between environmental groups and the industry, we now see that gas producers are starting to tussle with their oil sands and large conventional oil producer brethren. The fact that AECO gas prices are so depressed, having even fallen into negative territory last year,

As a gas producer, however, depressed prices are sapping their economic viability, as well as depressing their asset valuations

has heightened the concern of small gas producers. As they point out, oil sands producers buying gas to assist in their oil extraction process are happy to have low gas prices to power the heating needed. As a gas producer, however, depressed prices are sapping their economic viability, as well as depressing their asset valuations. The lack of progress in developing a viable LNG industry is also weighing on pure natural gas producers.

One can only hope that with the spring, the frustrations built up over the winter will disappear. Given the magnitude of the industry's issues, coupled with the environmental leanings of key federal and provincial leaders, it is hard to see this happening. We are witnessing the start of a struggle for the economic health and future of Western Canada. What happens in Canada, however, will not stay in Canada.

Auto Executives Are In The Center Of A Storm

The clean vehicle push has created significant pressure on auto executives who are being pressured to build electric vehicles

Managing a business during periods of market upheaval is a challenge. When the upheaval is coming from all directions, the challenge may seem even greater. Automobile executives are the latest to be caught up in this maelstrom. They are buffeted by the environmental and regulatory push for clean vehicles, while facing increased pressures in the market place from the squeeze on consumers, along with that of suppliers.

The clean vehicle push has created significant pressure on auto executives who are being pressured to build electric vehicles (EV). That pressure has been augmented by the diesel emissions scandal. Although that scandal was focused on Germany's Volkswagen AG (VLKAY-OCT), it has now extended its reach to every German car manufacturer. While some executives hold out hope that new diesel technology will revitalize sales, prospects are that relying on diesel vehicles to help the industry meet stricter emissions requirements has become a high-risk strategy. Maybe diesel cars can be resurrected, but the likelihood is that this technology will be eclipsed by battery-powered technology.

The push for EVs is also being engineered by China, which hopes to claim a global leadership role by virtue of its industrial policy

The push for EVs is also being engineered by China, which hopes to claim a global leadership role by virtue of its industrial policy requiring non-Chinese auto manufacturers to partner with local companies, enabling them to secure knowledge of the battery technology at the heart of EVs. While threatening to ban the sale of internal combustion engine (ICE) cars at some point in the future, auto companies wishing access to China, the world's largest auto market, will have to go along with these punishing rules. In reality, the Chinese are largely copying the thrust of transportation policy in the largest U.S. auto market – California. That state is aggressively incentivizing the sale of EVs and using the threat of a mandate that EVs represent a minimum amount of a manufacturer's total sales in the state in order for the company to continue selling in the state.

Americans have capitalized on low gasoline prices to load up on sport utility and cross-over vehicles, along with pickup trucks that all have low mpg-ratings

Already, EVs and hybrids are being seized upon by auto manufacturers as the only viable way to meet the current Environmental Protection Agency (EPA) rule that new vehicle sales by 2025 cut emissions sufficiently so that enough vehicles are sold such that the fleet averages 50 miles per gallon (mpg). Auto makers have said that the future standards, which for 2025 equate to roughly 36 mpg in real-world driving, are too difficult to meet in an era of cheap gasoline. Americans have capitalized on low gasoline prices to load up on sport utility and cross-over vehicles, along with pickup trucks that all have low mpg-ratings.

Auto customers are also facing higher financing costs

In response to the pressure from auto manufacturers about these future emissions standards, the EPA is considering possibly modifying them. Any relief in the standards will likely take a while to occur and will face legal challenges from environmental groups. At the same time, auto companies are facing a squeeze of its customers from rising vehicle costs. The higher sticker prices, aided somewhat from the needed changes to meet the increased emissions standards, may be pushed even higher if the Trump administration's steel and aluminum tariffs lift input costs. Auto customers are also facing higher financing costs as the Federal Reserve's boost in short-term interest rates filters through the financing world.

The decisions being pressed on the automobile industry will likely leave customers unhappy

According to *Edmunds.com*, the average monthly auto loan payment exceeds \$525 per month, an eight-year high. Auto loans are already stretching out to 96 months, or eight years duration. For dealers, this lift in financing costs, which cannot be offset by stretching payments further, insures that many future vehicle sales will be postponed because customers will be underwater in their loan on their vehicle trade-in. Any downturn in the economy will further pressure automobile sales. It is no wonder that auto manufacturers are pushing hard for emissions relief that may help them hold down vehicle prices for the next several years and offset the pressure from rising financing costs. Given the push for more expensive EVs, the auto industry is clearly caught in a vise. The decisions being pressed on the automobile industry will likely leave customers unhappy.

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