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Energy Musings

Insights into the Energy Industry



Allen Brooks, Managing Director

Energy Musings contains articles and analyses dealing with important issues and developments within the energy industry, including historical perspective, with potentially significant implications for executives planning their companies' future. While published every two weeks, events and travel may alter that schedule. I welcome your comments and observations. Allen Brooks

October 18, 2022

On The Road Again

Summer is over and we just made our return drive from Rhode Island. Highlights: Lighter than normal traffic; fewer trucks; no lines at restaurants or gasoline stations. An uneven economy!

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Gas Versus Electric: Vehicle Use Determines Choice

Electric vehicles drive farther every year, and well exceed average American's daily distance. We compare the statistics and economics of different types of cars. Range anxiety still governs.

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Biden's Energy Policy Clashes With Geopolitics

From fist bumps to punches in the nose is our energy policy. Biden's naked political push to stop OPEC+ from cutting production and hiking pump prices ahead of the election was fully exposed.

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China Mounts Challenges To Global Clean Energy Industries

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On The Road Again

Our Rhode Island summer came to an end a little over a week ago. Our annual drive back to Houston had us thinking we were witnessing a booming economy in some spots, and a recessionary environment elsewhere. At a high level, there was less traffic, fewer trucks, no crowds at restaurants, and no problem securing a hotel room, albeit having to upgrade because of high occupancy at that hotel given it was the night before Saturday college football games, and inflation evident in food, room, and gasoline prices.

We left contractors at work finishing the remodeling of our summer home's basement entertainment room, a project committed to in early June, but which became a victim of labor and material shortages. Things we were told normally would be available in 1-2 days were not ready for 1-2 weeks! With a new Ring camera that moves and allows communication, we can monitor the final work, which is currently held up awaiting a welder for the posts supporting a 16-foot steel beam holding up the house. Unlike the oilfield, welders in Rhode Island are few and far between.

After extending our departure by a week, we hit the road on a Friday morning, planning a two-night trip as has become our routine. The routine evolved from the heavy traffic we have been encountering that limited how far we could travel each day. Therefore, our journey usually broke into roughly two 750+ mile days and one 300-mile day. This routine makes for a comfortable three-day drive with two nights in hotels. On this trip, we were surprised at how much lighter traffic was other than in a few locations, which enabled us to get home in two days.

Most people are familiar with the "Virginia is for Lovers" signs and bumper stickers. It is the tourism and travel slogan of the Commonwealth of Virginia, a state we have enjoyed traveling in and touring for decades. The slogan has been used since 1969. In 2012, *Advertising Age* called "Virginia is for Lovers" "one of the most iconic ad campaigns in the past 50 years," a conclusion with which we concur.

After this trip, we are changing the slogan to "Virginia is for Traffic Backups." Many times, we were sailing along at the speed limit, only to suddenly come to a full stop for backed-up traffic. We would crawl along for a while, only to suddenly return to full speed. There were no accidents, construction, or police activity involving vehicles on the side of the road. These backups were prevalent throughout Virginia, although we did encounter a couple of backups in Pennsylvania.

Amazingly, we had traveled through Connecticut's Fairfield County, where Stamford always presents heavy traffic, slowdowns, and backups, during the morning rush hour with almost no slowdown. It was only when we entered New York State, just a few miles from the I-287 turnoff that an accident brought us to a stop. Our navigation system told us the accident was 800 feet ahead, but it later turned out to be one exit ahead that was several miles beyond where we were turning off. We crawled the final mile to our exit.

The highway across Westchester County to the Governor Mario Cuomo bridge, which replaced the old Tappan Zee Bridge, where you cross the Hudson River has always been heavily trafficked with backups, especially as you approached the bridge. This time there was very little traffic. (Remember, though, we are talking in relative terms.)

The Lehigh Valley of Pennsylvania, which has been transformed from a mining and metal processing district into a distribution hub for the New York/Pennsylvania region, saw very heavy truck traffic. That was not surprising given the huge distribution warehouses visible from the

highway, including one sporting a huge smiling mouth sign on its side. The farther we traveled away from Lehigh Valley, the fewer trucks we encountered. Stretches of Pennsylvania highway that initially had truck-to-car ratios of 80/20 gradually morphed into stretches with 20/80 ratios.

When it came to truck traffic, we noticed that in Pennsylvania and Virginia some of the truck stops and rest areas were overloaded with trucks parked for the night. We passed one rest area where there were trucks parked for a quarter of a mile before the entrance ramp and an equal distance after the exit ramp. We glanced and saw no empty parking spots in the rest area. Then we would pass another truck stop or rest area with very few trucks parked. Either everyone left early, or fewer trucks were spending the night. This was far different from recent trips where every truck stop and rest area appeared overwhelmed by truck drivers spending the night per the new work rules for over-the-road truckers. We take the pattern we observed as an indication of a slowing economy.

Fewer trucks and lighter traffic contributed to an unusual trip home. Our return drives offer one big advantage – we gain an hour when we cross into the Central Time Zone on day two. But the traffic on day two was so much lighter and with fewer trucks to slow the highway speeds that we made incredible time. We had anticipated day two being another long day of driving that would have us spending a second night on the road. Of course, with the gift of the additional hour, we started wondering whether it made sense to push to get home on day two, even if it meant a late night or early morning arrival. In those few times that we have made the two-day trip, we do not bother to unload the car until the next morning.

According to our vehicle's odometer, our trip consisted of 1,771 miles. On day one, we covered 825 miles from Charlestown, Rhode Island to a Hampton Inn located just north of Knoxville, Tennessee off I-75. We left Rhode Island at 7 am and arrived in Knoxville at 10 pm for an elapsed time of 15 hours, which included stops for gasoline, lunch, and dinner. Using the elapsed time, we averaged roughly 55 miles per hour.

Day two brought another cool day (55° F). It was still dark at a few minutes to 7 am when we departed. We were shocked at how much traffic there was on I-75 heading into Knoxville at that time. The traffic remained heavy for a Saturday morning through Knoxville and south to Chattanooga. Fortunately, there were few trucks. What shocked us was when we came out of Chattanooga where the highway splits. At that point, we turn off I-75 and onto I-59 heading south toward Birmingham, Alabama, but 85% of the traffic turned north on I-24 heading toward Nashville. That meant the traffic through Georgia and Alabama was even lighter. We were surprised there were not more vehicles around Tuscaloosa sporting Alabama flags, as the stadium signs were out directing cars to the Alabama-Texas A&M game. Maybe we were too late for the crowd heading to the game and too early for anyone to be leaving. Lucky us!

As we kept doing the math on when we would be arriving at various cities along the route, we began speculating that we might, assuming no major traffic issues ahead, get to Houston late Saturday night. When we entered Mississippi, we knew we could be at Laurel by lunchtime, meaning we might be looking at a 10-11 pm Houston arrival.

We always enjoy driving I-59 through Mississippi as the traffic is usually light and the landscape is restful. We were not disappointed this time. We were able to make better time than expected. Our only surprise was encountering a few crazy drivers who were too busy with their cell phones to pay attention to their driving and the traffic. We thought these types of drivers were only found in New York and Massachusetts, but surprisingly we found many more than we anticipated in Mississippi, Louisiana, and Texas. The biggest surprise was the absence of truck traffic, which again left us wondering why. Was it just because it was a Saturday, or is the state suffering a

worse economy than states in the Northeast or Mid-Atlantic? We have made this drive on Saturdays before, so the absence of truck traffic was surprising.

Traffic picked up once we go on I-12 in Louisiana, but the highway expansion has helped improve the driving experience by reducing the crowding and potential for slow-moving vehicles to impede the traffic flow. However, when we reached Baton Rouge, we came to a dead stop on I-10 heading toward the Mississippi River bridge. We never figured out why the traffic only crawled until we were past the bridge, so we attributed the slowdown to the few trucks being slow in climbing the steep bridge incline. It must be that high to allow ships to pass under.

For the remainder of the trip through Louisiana and Texas, the traffic was light to moderate with a handful of crazy drivers. We stopped for gasoline and dinner between Beaumont and Houston and arrived home at 8:40 pm. We traveled 946 miles on day two and averaged 65.5 miles per hour, 19% faster than our average speed on day one. Of course, the speed limits from Virginia to Texas are higher than those in the Pennsylvania/New York/Connecticut region. Ah, Virginia.

Paying attention to gasoline prices was a must. The first interesting experience was tracking the prices at the service plazas on I-95 in Connecticut. There are five plazas and three had roughly similar prices, with the other two higher. There was no rhyme or reason for the deviations, except Darien is in the “expensive” part of Connecticut. Prices are listed from the Rhode Island border to the New York border. The plaza locations and regular gasoline prices per gallon posted on their electronic signs are as follows:

Madison	\$3.499
Branford	\$3.399
Milford	\$3.799
Fairfield	\$3.399
Darien	\$3.679

Our purchases provided additional data. First, there were no crowds at gas stations when we stopped. Also, the cheapest gasoline was found in the southern states and close to the Gulf Coast. These states also have lower state gasoline taxes, but we are not sure which states have reduced their taxes.

Charlestown, RI	\$3.499
Carlisle, PA	\$3.799
Christiansburg, VA	\$3.599
Trenton, GA	\$3.259
Laurel, MI	\$3.179
Beaumont, TX	\$3.209

We noticed an Exxon station at the intersection of the Sam Houston Tollway feeder road and Westheimer was advertising \$3.169 a gallon, while up the street a Phillips 66 station was at \$3.129 while a nearby Shell station was \$3.399. We wondered what the problem was with the Shell station.

Another observation is about food inflation that came from both watching billboards and menu prices. We traditionally eat dinner at Cracker Barrel. They have a varied menu, the food is consistent, and the service is satisfactory. They are also large enough that one normally does not have to wait to be seated or if so, the wait is generally short. What we noticed while driving was that those Cracker Barrel billboards that use to advertise menu options and prices were lacking the prices in most cases. At both our dinners, we were able to estimate the food inflation

from our May trip, because we eat similar meals. Although these were not the same Cracker Barrels where we ate on the way to Rhode Island, all the restaurants have consistent pricing. We estimated that menu prices, at least for the meals we favor, were at least 20% higher than in May. Given the national inflation rate, especially for food, we were not surprised.

We did notice there was no waiting for seating at the Cracker Barrels and there was no help wanted signs visible. The Christmas goods were on display, but we had been shocked to see them out at the Home Depot in Rhode Island before the end of September. Even the help commented on how early it was to be putting up their Christmas merchandise. Rushing the season.

The absence of help-wanted signs was surprising given the publicity about the tight labor market and how job openings exceed the number of unemployed workers. We saw fewer help-wanted signs such as we used to see on the sides of trucks. Again, we are not sure what to make of the observation other than this economy has an uneven feel to it. That is probably why everyone is confused whether we are in a recession, heading for a recession, or will avoid a recession.

We did get a chuckle from an overhead electric highway sign in West Virginia. It flashed up “Nice car” and then followed up with “Did it come with turn signals?” One of our pet peeves. Our line is that drivers overpaid for their cars because they were charged for something they did not need.

This trip was surprising in many ways. The traffic was lighter than in any of our recent trips, even during the pandemic year of 2020. Other than in a few areas, there was much less truck traffic than in the past. There were very few police seen, and none in several of the states we passed through. There was less highway construction than in the past. All of it was concentrated in the Mid-Atlantic states. The mysterious traffic backups of Virginia still have us shaking our head, but their impact, confirmed by our average travel speed on day one versus day two, did not contribute to a third travel day. Our basic conclusion is that the U.S. economy continues to percolate but it is uneven and likely showing early signs of a slowdown.

Gas Versus Electric: Vehicle Use Determines Choice

Should you buy an electric vehicle (EV) or a conventional internal combustion engine (ICE) car for your next vehicle? The answer to that question, besides how much money you must spend, depends on how you envision using the vehicle. Is it for use around town with no long-distance trips? Or are you driving long distances daily or frequently, so you need greater range? There are other considerations such as whether you are hauling stuff or numerous people (large family) or are a single user. In contemplating a next vehicle purchase, the following two charts visualize the issue of range and driving cost between EVs and ICE vehicles.

A major issue with EVs has been their driving range before needing to be recharged, referred to as “range anxiety.” According to a survey by consultant EY, 33% of new car buyers chose range anxiety as their top concern in purchasing EVs. However, as shown in the chart below, the average EV range is well beyond the miles the average American drives daily. This is the argument offered to those worried about range anxiety – you have a substantial driving distance margin over your typical daily use, so do not worry about running out of battery charge. Of course, this does not address the concern about EVs from buyers without garages or the ability to charge their vehicle at home using their residential electricity so they must rely on commercial charging stations.

Exhibit 1. EVs Satisfy Most American's Driving Needs

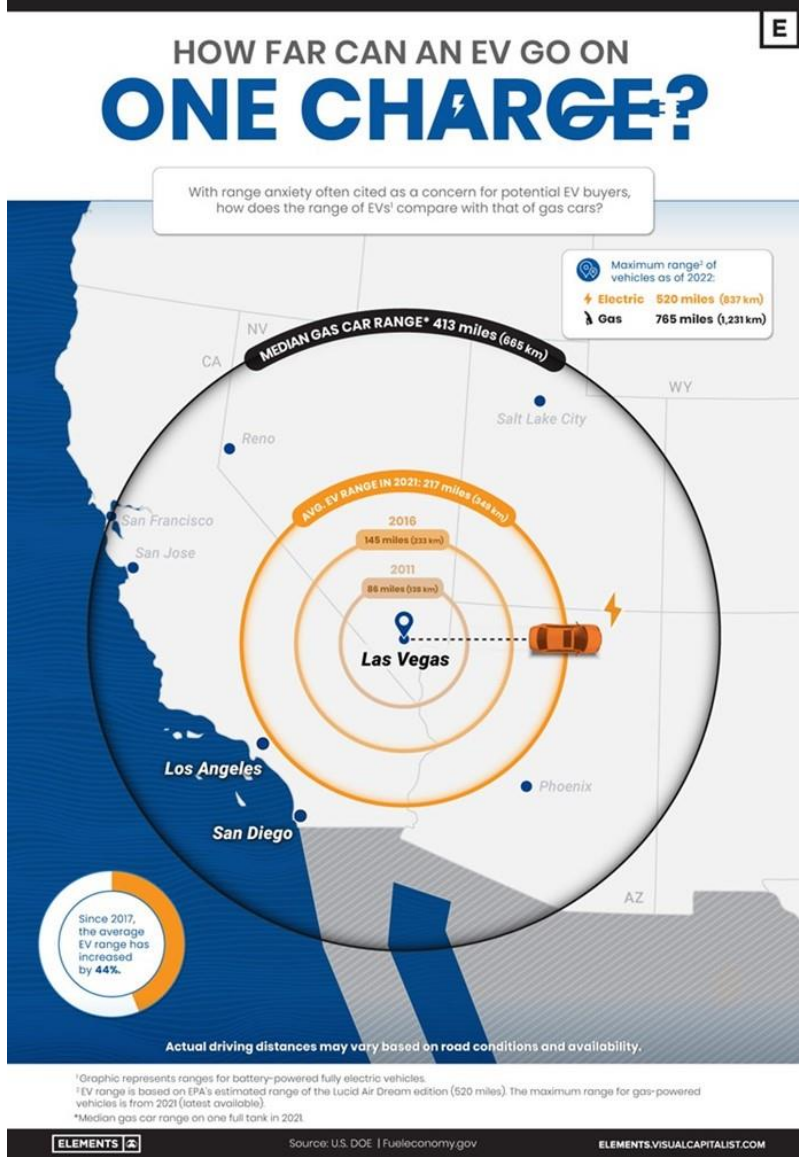
Average EV range nearly 6 times further than the average American's daily drive



Source: elements.visualcapitalist.com

Another range anxiety issue is just how far you can drive an EV before having to find a charging station. The chart below visualizes the differences in range for EVs versus ICE vehicles. When compared, there is a 195-mile difference between the median range of an ICE versus an average EV. The difference between the maximum EV range and that of an ICE is even greater at 245 miles.

Exhibit 2. EV Driving Range Has Increased Steadily



Source: elements.visualcapitalist.com

EV enthusiasts suggest that as the nation's EV charging network expands, range anxiety will become less of a buying impediment. The table below shows just how steadily the average range and maximum range of EVs have increased in recent years. Expectations are that this progress will continue, but one wonders whether it will need new battery chemistries to reach the next level. What we see reflected in the chart is how much of the maximum range increase has likely come from larger EV batteries that inherently add substantial range.

Exhibit 3. How U.S. EVs Have Seen Range Grow Over Time The Rise in EV Ranges

Thanks to improvements in battery technology, the average range of electric cars has more than doubled over the last decade, according to data from the International Energy Agency (IEA).

Year	Avg. EV Range	Maximum EV Range
2010	79 miles (127 km)	N/A
2011	86 miles (138 km)	94 miles (151 km)
2012	99 miles (159 km)	265 miles (426 km)
2013	117 miles (188 km)	265 miles (426 km)
2014	130 miles (209 km)	265 miles (426 km)
2015	131 miles (211 km)	270 miles (435 km)
2016	145 miles (233 km)	315 miles (507 km)
2017	151 miles (243 km)	335 miles (539 km)
2018	189 miles (304 km)	335 miles (539 km)
2019	209 miles (336 km)	370 miles (595 km)
2020	210 miles (338 km)	402 miles (647 km)
2021	217 miles (349 km)	520 miles* (837 km)

*Max range for EVs offered in the United States.

Source: IEA, U.S. DOE

Source: elements.visualcapitalist.com

A more interesting chart is below showing the cost differential between an EV and an ICE vehicle traveling the same distance. In this case, that difference was 65% in favor of the EV. The respective vehicle costs were calculated based on the average price for a gallon of gasoline and a kilowatt-hour of electricity on September 30. The ICE economics were based on an average performance of 24.6 miles per gallon (mpg) and three miles per kilowatt-hour (kWh). The gasoline price was \$3.67 per gallon and the electricity price was 15.5 cents/kWh. Using that data, the EV's trip cost \$11.16, 65% less than the ICE vehicle's trip expense of \$32.36.

Exhibit 4. Economics Of Driving An EV Versus ICE Vehicle

65% Off! Electric vehicles cover the same trip distance at one-third the cost



Gas cost based on average fuel economy of 24.6 mpg with US average gas cost of \$3.67 (9/30/22)

EV cost based on going 3 miles per kilowatt-hour at the US average price of 15.5 cents per kilowatt-hour (9/30/22)

Source: elements.visualcapitalist.com

To explore these economics further, we decided to see how they worked in California, the home of the largest EV fleet in the nation. The latest residential electricity price available from the Energy Information Administration (EIA) was July, showing residential electricity at 26.8 cents/kWh. At the same time, the average weekly reformulated regular gasoline price in July was \$5.81 a gallon. The difference in the trip cost was \$19.36 versus \$51.25, a 62% spread in favor of EVs.

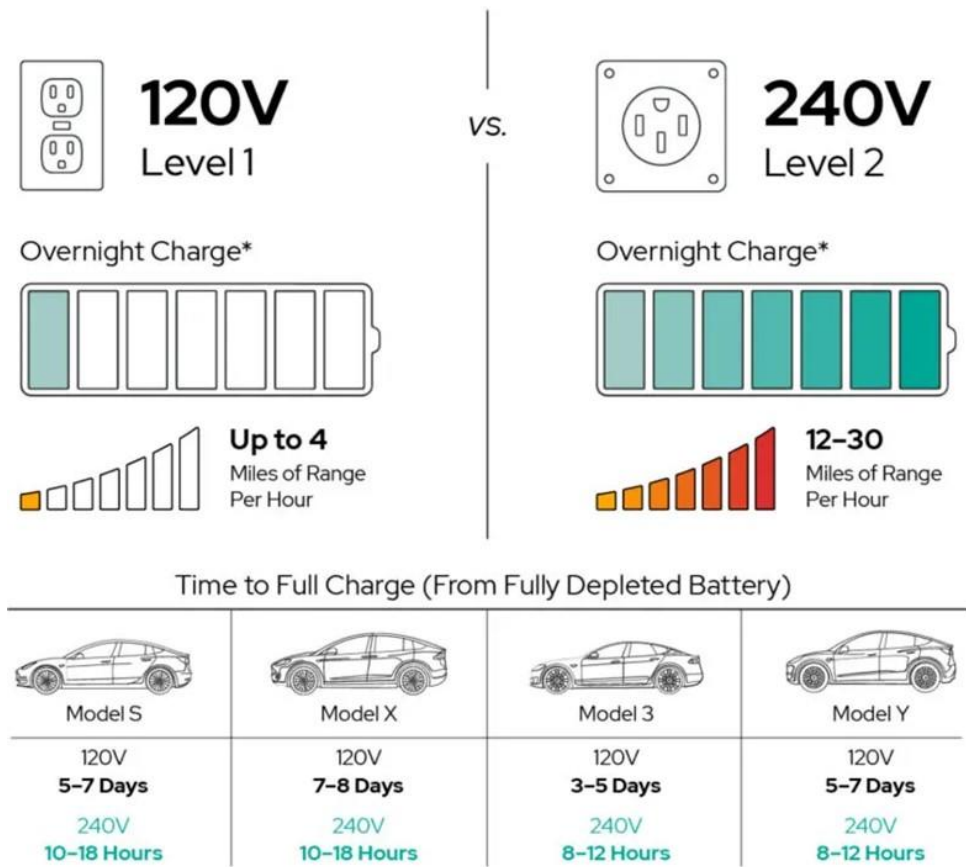
We were curious about what it cost for an EV owner who did not have access to home charging and was forced to charge at commercial sites. The costs differ, but based on information on the *EVgo.com* website, in Los Angeles, the cost to charge at a commercial station on October 3 was 32.0 cents/kWh, a 19.4% premium to the July California average residential electricity price. Besides the cost of power, there is a \$0.99 session fee. If the EV owner wanted to ensure that the charger would be available, a reservation could be made at the additional cost of \$3.00. In reading up on commercial charging stations, and understanding that situations will vary, we found that a commercial charging station power cost would be at least 20% more than charging at home, besides associated fees as outlined above. These power rates are for Level 2 and Level 3 chargers. A Tesla site informed us that to use a DC charger (super-fast charger), the EV owner should expect the power price will be 30% to 35% higher than residential electricity rates. Of course, the vehicle would be charging for less time. Given the cost differences we calculated above, the commercial charging station should still leave the EV as the least-cost vehicle.

If you have a garage and the ability to install a charging station, there will be an additional expense. Again, the cost will be site-specific and will depend on what level of charger one wants to install. For example, if you have a spare 240-volt plug (typical service for an electric dryer), the cost will be just for the charging equipment.

Understanding that actual costs will be site-specific, reports are that if you install a Level 2 charger you could be looking at a cost ranging between \$350 and \$900 for the charging equipment, and installation labor costs of \$400 to \$1,700, putting the full cost at \$750 to \$2,600. We have seen EV articles outlining the cost estimates of a Tesla charger installation at between \$1,000 and \$7,000 plus the cost of the Tesla Wall Connector estimated at \$500. All the labor cost estimates depend on what the electricians' hourly costs are and whether the garage's electric service needs to be upgraded.

We found a chart on a Tesla-related website showing charging times for Level 1 versus Level 2 chargers of interest. It highlighted why an EV owner would want to invest in a higher-level charging station, assuming access to adequate power and a secure location for the station's placement. We had located this chart shortly before reading that charging a new electric Hummer from a typical household outlet, 120 volts, could take upwards of four days. Tests by others showed that charging the Hummer from zero to full using a Level 2, 240-volt, charger could cut the time to maybe as little as 24 hours but certainly to less than two days.

Exhibit 5. Why You Want To Install A Larger Charging Station For Your EV



Source: *evadep.com*

The video of the Hummer being charged was circulating widely on the Internet, with both proponents and critics of EVs holding forth on conclusions to be drawn. The massive 9,000-

pound vehicle is powered by General Motors' largest battery package, a 212-kilowatt-hour monster weighing 2,923-pounds with "usable capacity" producing 329 miles of range according to the Environmental Protection Administration. That range has been exceeded but only in ideal test conditions, "which entail modest and consistent speeds hovering around 70 mph on an exceptionally temperate day."

The final issue we examined in comparing EVs versus ICE vehicles was a cost comparison based on purchase prices. According to Kelly Blue Book, the average transaction price of an EV this summer was \$66,000 while that of an ICE vehicle was \$48,000, a difference of \$18,000. At the average gasoline price used above, that price difference would purchase 4,904 gallons of fuel at \$3.67 a gallon, but only 3,098 gallons at California's average pump price of \$5.81 a gallon. Based on 24.6 mpg, at the average gasoline price, the ICE vehicle could drive 120,638 miles versus only 76,211 miles in California.

We then calculated what the electricity bills would be for the EV to drive those extra miles. Based on the national average electricity price of 15.5 cents/kWh, it would cost \$6,233. At the California price of 26.8 cents/kWh, the cost would be \$6,808, and at the commercial charging station rate of 32.0 cents/kWh, the cost would be \$8,129. EVs would still be more economical than ICE vehicles based on all the economics.

That leaves only one other cost comparison, which is insurance. According to a *MoneyWise* column, the average U.S. insurance rate for a 2022 Tesla Model Y is \$3,057, compared to a 2022 Mercedes-Benz GLA250 rate of \$1,838. While actual rates will depend on factors such as the driver's age, Zip Code, and driving history, the cost differential narrows the EV advantage somewhat, but does not change the overall conclusion. Therefore, the decision to purchase an EV becomes centered on the buyer's planned use of the vehicle and level of range anxiety. Like every major purchase, it is personal.

Biden's Energy Policy Clashes With Geopolitics

Many of us in the energy business are not surprised at the daily absurdities emanating from Washington, D.C. concerning U.S. energy policy and international relations with our allies and enemies. We knew the election of Joe Biden as president meant difficult times for the oil and gas industry. To win the election, Biden had to secure the support of the most liberal wing of the Democrat party, which meant he had to embrace the Green New Deal. This explains why Biden declared he would put the oil and gas industry out of business during his presidential campaign in 2020. He seems intent on fulfilling that pledge.

In the second and final debate between President Donald Trump and candidate Biden, Trump asked Biden: "Would you close down the oil industry?" Biden responded: "I would transition from the oil industry, yes." That policy was fully embraced and put into effect beginning on Day One of the Biden presidency. That day, Biden signed 17 executive orders, two of them dealing with oil and gas. One order pledged the U.S. would rejoin the Paris climate accords and commit to the deal's targeted reduction in CO₂ emissions. The other order blocked oil and gas exploration in the Arctic National Wildlife Refuge, forbade drilling in large parts of Utah, and canceled the Keystone XL Pipeline that would have brought 800,000 barrels a day (b/d) of Canadian oil to U.S. refineries. A week later, Biden stopped issuing new oil and gas leases on public lands.

We will not recite the rhetoric and actions by Biden and his appointees over the past 22 months designed to hobble the domestic energy business, while at the same time promoting the fortunes of oil-producing countries with antagonistic policies directed toward the U.S. As a direct result of

Biden's rhetoric and energy policies, energy prices began climbing immediately after he entered office. Oil prices jumped last February when Russia invaded Ukraine and the European energy landscape was fully ravished. Skyrocketing gasoline prices forced the Biden administration to ramp up its anti-oil company rhetoric: "lower prices at the pump – now!"

With little ability to physically alter a tight oil market, baring strong actions necessary to cut demand, Biden elected to release oil from the Strategic Petroleum Reserve (SPR) to fight high pump prices, even though this use of the SPR to influence energy prices is forbidden. While chastising oil company CEOs, who Biden declined to meet with when they are summoned to Washington, and erecting more drilling and production impediments, the President had no problem going hat-in-hand to Saudi Arabia to seek increased oil supplies from the nation he campaigned he would make an international "pariah." Biden barely secured enough additional oil to power Air Force One on his many trips to Delaware. His latest move is to curry favor with President Nicholas Maduro, the ostracized leader of Venezuela, to secure more oil supply.

With the OPEC+ decision earlier this month to cut production quotas by two million barrels a day (mmb/d), the finger-pointing about the rationale behind the U.S. "asks" of Saudi Arabia began. While OPEC+, which includes Russia, agreed unanimously to institute quota cuts, the reality is that most members are unable to pump to their current quota volumes as it is. Therefore, there are only a select few members who are today producing at their quotas and would be subject to volume reductions. The best guess is that the oil output cut is under one million barrels per day (mmb/d), and possibly at little as 600,000 b/d. However, the White House pushback on the OPEC+ move was swift and focused on showing that the administration was working to bring gasoline pump prices down. Ordering another 10 million barrels of withdrawals from the SPR is little more than a blatant sop to help Democrat politicians in the upcoming election.

The statement in response to the OPEC+ cut from National Security Advisor Jake Sullivan and National Economic Council Director Brian Deese opened with the following line. "The President is disappointed by the shortsighted decision by OPEC+ to cut production quotas while the global economy is dealing with the continued negative impact of Putin's invasion of Ukraine." According to Biden, "There's going to be some consequences for what they've done with Russia," which was targeted at Saudi Arabia.

The White House statement and Biden's comment opened the geopolitical rhetoric war between Saudi Arabia and the U.S. Biden officials said they presented an analysis to the Saudis that showed that the oil market was adequately supplied and that there was no need for OPEC+ to act before the next meeting in November. The Saudis judged this analysis as a prod for Saudi to delay the production cut until after the mid-term elections, helping tamp down gasoline prices as a political pothole for Democrat politicians.

Last week, OPEC cut its oil demand estimates for both 2022 and 2023, which was pointed to as justification for the organization's quota cut. OPEC's 2022 projection now calls for a 2.64 mmb/d increase, some 460,000 b/d below its previous forecast. This means demand will only grow by 2.7% this year. The latest reduction marks the fourth cut in OPEC's forecast since April. For 2023, OPEC sees global oil demand rising by 2.34 mmb/d, a 360,000 b/d reduction, putting world demand at 102.02 mmb/d, still above 2019's pre-pandemic consumption.

What appears lost on White House officials is the view from Saudi's perspective. For nearly three years, the royal family has heard nothing from Biden and his supporters except that the U.S. and the western world must rapidly end using fossil fuels and switch exclusively to renewable energy. This rhetoric has been followed by policy actions to restrict the finding and production of more oil and gas in the U.S., the world's largest producer. In turn, the White House has pressured energy

executives to limit reinvestment in their business and return excess cash flow to their investors, while at the same time convincing capital providers to shun putting more money behind the industry. As a result, tightening global oil and gas markets have produced high energy prices that are helping to drive up inflation and push more people into energy poverty. That is not a positive outcome for politicians, especially ones about to face their voters.

For the Saudis, the request by the Biden administration to delay the production cut by a month was seen as an “ask” for political help, while they know that immediately following the election, Biden would begin twisting the knife already stuck in their back. A successful effort by Biden to get the world off oil and gas would leave Saudi Arabia with centuries of fuel for its economy, but no income to support its people.

The idea that the Biden administration offered an analysis showing there was no need for a production cut must have been laughed at by the Saudis. We are reminded of a comment from a *Foreign Policy* magazine article, by Stephen M. Walt, a columnist at the magazine and the Robert and Renée Belfer professor of international relations at Harvard University. His article was titled: “Biden Needs Architects, Not Mechanics, to Fix U.S. Foreign Policy.” The article addressed international relations, but it included a discussion of U.S. policy issues for Iran and the desire for a nuclear deal that would unleash oil into the global market.

Walt points to the problem being that “Washington is plagued by groupthink and a lack of vision that prevents creative solutions to the problems of a new era.” His analogy for the foreign policy field was that “Biden and his team are like experienced Ford or Chevy mechanics trying to service a Tesla.” We found the analogy equally applicable to Biden’s energy policy. He has assembled a group of policymakers with little or no understanding of the workings of the energy business, or a recognition that the talent embedded in the energy industry could help formulate a workable, long-term strategy for reducing our carbon emissions while not crippling the economy or punishing American citizens with crushing energy prices and power blackouts. This policy would slow the race to transition to a decarbonized economy, but likely would avoid the pitfalls we are experiencing and will continue to experience under current energy policies. Yes, such a move would anger some of Biden’s supporters on the Left, but it might win him more respect from people on the Right. However, in our view, this is too great an “ask” of Biden.

Random Energy Topics And Our Thoughts

China Mounts Challenges To Global Clean Energy Industries

Following its solar panel playbook, China continues to ramp up its clean energy industries to compete in more foreign markets to the frustration of domestic producers. What is underway in the wind turbine and electric vehicle markets is reminiscent of Vladimir Lenin’s famous line, “The Capitalists will sell us the rope with which we will hang them.” In the western world where most of the technologies utilized in these clean energy industries have been developed, companies have watched China steal the technology and then leverage its cheap labor and energy to capture greater market shares.

Most of the technology for today’s modern electric vehicle (EV) battery and wind turbine design came from U.S., Japanese, and European companies and their research laboratories. With China’s huge deposits of and processing facilities for the minerals needed in making these devices, the country is primed to become the global low-cost provider of clean energy

technologies. China is capitalizing on its competitive advantages, which is leading to economic problems for the European automobile and renewable energy industries.

While China has only a toehold in the European EV industry, the region's push to ban internal combustion engine (ICE) vehicles in 13 years is setting up a huge market potential for lower-cost Chinese EVs. Recently, China's biggest EV and second-largest battery maker, BYD, announced presale prices for a range of EVs in Europe. BYD's European expansion will start in Germany, home to Volkswagen and Mercedes-Benz, and Sweden, before extending into France and the U.K. later.

"They're looking to go against the big boys," said Tu Le, managing director of Sino Auto Insights, a Beijing-based consultancy, who expects the Chinese models to compete with cars such as the BMW iX3 and Tesla's models. BYD is leading the charge, but other Chinese EV manufacturers such as Nio, XPeng, and Aiyangs plan to be right behind.

BYD began preparing its European offensive five years ago. It started by hiring designers to improve the look of its vehicles. "They really have come a long way in making their vehicles more attractive than they used to," said Michael Dunne, head of ZoZoGo consultancy and an expert on China's auto industry. "What gives momentum to this huge increase is vastly better designed and engineered vehicles," he said.

Recently, BYD announced it will supply German rental-car company Sixt SE with 100,000 EVs by 2028. This follows the company's initial foray into Europe by supplying electric buses for public transportation in the U.K., Sweden, and Spain. It also exported 100 Tang fully electric SUVs to Norway, probably the most aggressive country in deploying EVs. BYD has also announced partnerships with dealers in its target European markets. BYD has also begun selling its EVs to customers in Australia and is now entering the potentially huge India EV market.

As BYD seeks to capture more global EV market share, it is also moving to produce more passenger cars outside of China. It recently announced an agreement with Thai industrial-estate developer WHA Groups to set up an overseas passenger EV factory on the east coast of Thailand, which is expected to deliver 150,000 passenger EVs in 2024, according to WHA.

The Chinese are also making a move in the wind turbine market. According to Nordex Europe CEO Ibrahim Özarslan in an interview with *Recharge* magazine, Chinese wind turbine competitors are "clearly a threat for European suppliers." He went on to tell the magazine, "They are there, they are partly in Europe or just outside Europe. On the onshore side, they are very active. It is a threat? Yes, clearly. It is coming nearer and nearer."

This increased competition from China is coming at a time when the wind turbine industry is struggling to deal with inflation in raw material costs that are often not able to be passed on in contracts previously negotiated with wind farm developers. As a result, manufacturers are cutting costs, including laying off workers. The struggles come as forecasts for new wind capacity installations are being trimmed. The Global Wind Energy Council said it is likely to downgrade its forecast for new capacity added globally this year from around 101 gigawatts (GW) to 94-95 GW. That would result in no growth in 2022.

Both General Electric Renewables and Siemens Gamesa have announced job cuts. GE also has business problems due to losing a patent legal battle and having a court impose a ban preventing it from being able to manufacture wind turbines until GE designs around the patent and proves the worthiness of its newly designed turbine.

Jon Lezamiz Corázar, global head of public affairs at Siemens, told the *Financial Times* that “Everything is getting much more expensive in an already stretched wind industry supply chain.” He suggested that if things did not improve soon, “it may happen that the European Green Deal is installed with non-European technology.”

Morningstar analyst Matthew Donen told the *Financial Times* that “The threat of Chinese competition is increasing. They can match now western turbine manufacturers, which hadn’t been the case in the past.” Because Chinese turbine manufacturers are more financially resilient and can build turbines for less, their threat is much greater than at any time in the past.

The response of European renewables companies including SSE, Vestas, and Siemens Gamesa was for their CEOs to write an open letter to G20 nations asking them to do more to accelerate the deployment of wind energy worldwide. “At the current pace of growth, we are only on-track to reach less than two-thirds of the global wind capacity required by 2030 for a new zero and Paris-compliant pathway,” the executives wrote.

One wonders whether we are witnessing the first stage in the transition of the global wind and EV industries to Chinese dominance. For western and American companies to become more effective competitors, they will need to develop non-Chinese supply chains, especially for the minerals necessary for batteries and turbines. This will take longer than many expect, and the new supply chains will be more expensive. We expect the western renewables and EV companies to begin asking for more tariff protections for their domestic markets, such as are embedded in the recently passed Inflation Reduction Act in the U.S. Europe has an extensive carbon tariff that can be used as a commercial weapon, but these are only temporary barriers to protect high-cost domestic manufacturers. The old commercial order is changing – just how fast and into what new order is unknown.

New Offshore Wind Technology Key To Better Economics?

A Norwegian venture, Wind Catching Systems, is hoping its revolutionary designed wind farm for deepwater will significantly reduce the cost of generating offshore wind electricity. Offshore wind and particularly deepwater wind is very expensive. According to the most recent Energy Information Administration analysis, the levelized cost of generating electricity from offshore wind without tax credits is 3.5-times the cost of power coming from a combined-cycle natural gas plant. Even after a hefty 30% tax credit, it is 2.5-times as expensive. Offshore wind proponents argue that their output is expensive because of the cost of the turbines, their foundations, and their installation. In the case of wind turbines in deepwater, building floating platforms to support them and anchoring those platforms become a cost problem.

Wind Catching Systems, founded in 2017, is working with the Institute for Energy Technology and service company Aibel to commercialize the design of a deepwater wind farm, with a pilot project set to begin in 2022 with installation by 2024. In the Windcatcher design, 117 small turbines would be set within a steel framework and mounted like a sail on a semi-submerged trimaran boat. The framework would be mounted on a rotating turret, allowing it to turn in the direction of the wind, increasing its utilization factor and power output.

According to the engineering, placing the turbines closely together capitalizes on the multirotor effect, where the turbulence created by one turbine can be harnessed by surrounding ones. This will maximize the amount of energy the unit can produce, as ten rotors will produce more total power than the sum of ten individual wind turbines. The visual below shows the Windcatcher design and its scale compared to well-known structures.

Exhibit 6. The Ticket To Drastically Lower Offshore Wind Costs?

Source: Wind Catching Systems

According to Wind Catching Systems CEO Ole Heggheim, the unit is designed for a 50-year lifespan, 2.5-times the lifespan of conventional offshore wind turbines. There is an integrated elevator system within the sail allowing individual rotors to be replaced without the need for an external floating crane.

"By having one unit producing as much energy as five, you're saving on four installations and four mooring systems," Heggheim commented. "We can construct our Windcatchers near shore and then tow them into place, whereas for conventional wind turbines you often need to have specialized vessels doing the installation offshore." By lowering installation and offshore maintenance costs, Windcatcher hopes to significantly reduce the cost of deepwater offshore wind. We will be watching for news on the progress of this project.

Hurricane Ian Reopens Debate Over Storms and Climate

Hurricane Ian roared ashore in the afternoon of September 28 in southwest Florida at Cayo Costa Island in the Fort Myers area with 1-minute sustained winds of 150 miles per hour, a dangerous Category 4 storm. The storm traversed the Florida peninsula, reemerged in the Atlantic Ocean, and regained hurricane status before landing just south of Georgetown, South Carolina before heading north with wind and rain for most of the eastern third of the country. Hurricane Ian's strength tied it with several other storms as the fifth-strongest hurricane on record making landfall on the U.S. coast. The storm claimed a total of 137 lives, with 126 in Florida, and caused an estimated \$100 billion in damage.

Immediately, debates opened over whether the Fort Myers area should have been evacuated sooner and the role of climate in causing and strengthening Ian. All the major hurricane tracking forecasts, except for one, had Ian targeting the Tampa area, which was evacuated. However, it was not until the final 24 hours before landfall that the storm models shifted the landfall target to the Fort Myers region making evacuation impossible.

But the debate about the role of climate change on the frequency of hurricanes and their strength erupted with claims that these storms are only getting worse and will continue to worsen until we stop injecting more carbon into the atmosphere.

Although the past several years have reflected above-average tropical storm activity in the Atlantic basin, this year's hurricane season began with its slowest start in decades. This caused the primary storm forecasters to reduce slightly their projections for the total number of tropical storms and hurricanes this season. An October 6th *Associated Press (AP) FactCheck* targeted claims about the impact of climate on hurricanes with the following:

CLAIM: Climate change isn't real because hurricanes in Florida and across the U.S. haven't increased in frequency, intensity or landfall in more than a century.

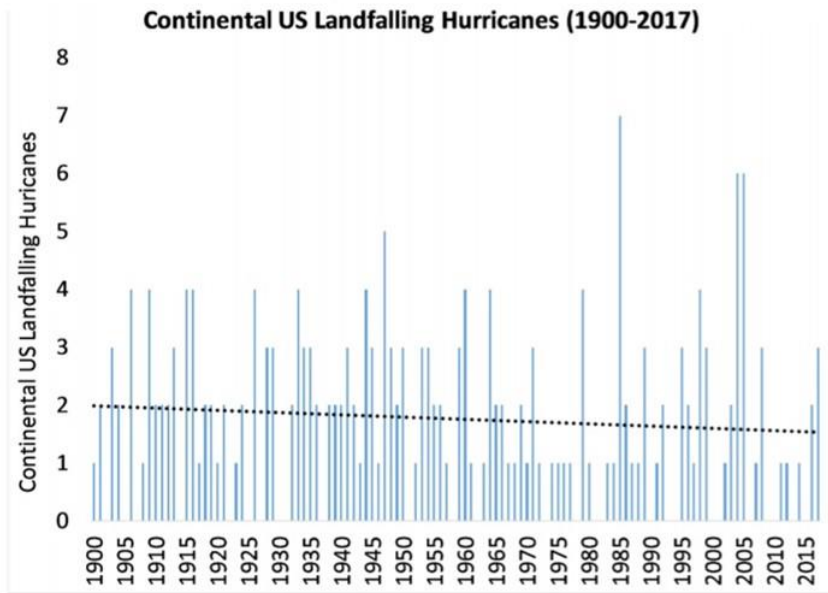
AP'S ASSESSMENT: Missing context. While studies have found no evidence of an increase in hurricane landfalls in the past century in Florida and across the U.S., experts say this data doesn't disprove the fact that climate change is a real phenomenon impacting hurricanes in other ways. Globally, the intensity of tropical cyclones has been increasing, and studies project that trend will continue, even as the frequency of the storms is expected to remain steady or decrease.

While the *AP* article was messaging that Hurricane Ian's intensity and Florida's tropical storm history are linked to climate change, meteorologist Joe Bastardi tweeted his take: "This is so misleading. Hurricane Facts don't disprove climate change. They call the FLa stats cherry picking. What about New England. 0 in 32 years. Previous 60 1 every 7 [years]." We lived in New England during some of that 60-year period when hurricane frequency was high.

Bastardi has always focused on how the pattern of hurricanes has shifted over the years. He is known for pointing out the shift in the frequency of hurricanes along the East Coast versus those impacting the Gulf Coast over the years. He was born in Providence, Rhode Island. His mother was born and raised in Providence while his father came from Bristol, Rhode Island. His father earned a meteorology degree from Texas A&M and was the only student from Rhode Island to earn such a degree. His father (Bastardi's grandfather) was also a meteorologist in the Rhode Island area. Because of where his father and mother were raised, they had experience with the 1938 hurricane, known either as the Great New England Hurricane or the Long Island Express Hurricane, which crossed Long Island and slammed into Providence before traveling due north through the New England region. The storm was rated as a Category 5 before making landfall as a strong Category 3. It killed 682 people. A reanalysis of the storm in 2011 suggested it may have been a Category 4 hurricane at landfall.

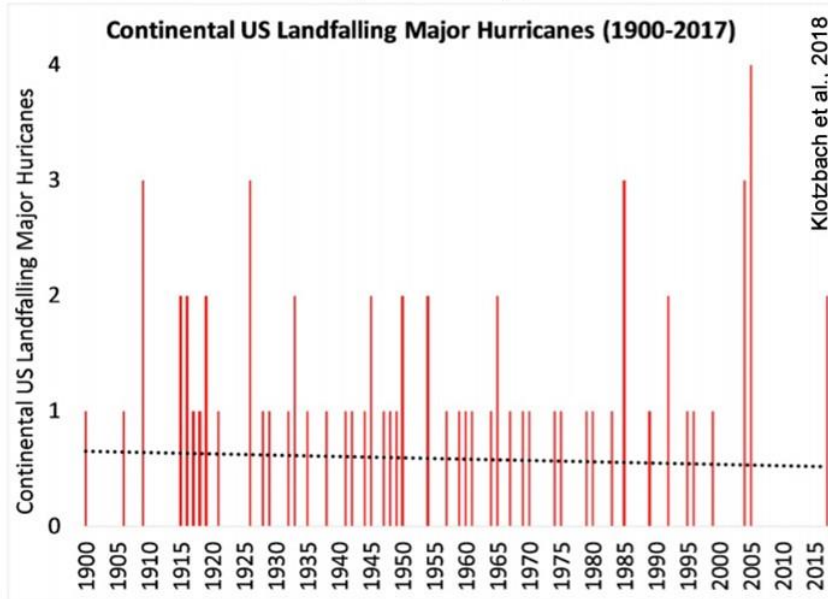
The storm frequency and intensity debates continue running up against the following two charts that show the frequency of U.S. landfalling hurricanes and major hurricanes. These charts show the landfalling storms in each category annually from 1900 to 2017. The dotted line in each chart shows the trendline for that storm dataset. Both charts show declining trend lines.

Exhibit 7. Historical Data Shows Decline In Hurricanes And Landfalling Hurricanes



Declining Frequency and Intensity

U.S. Landfalling Hurricanes, 1900-2017



Source: Klotzbach, Colorado State University

Because the charts ended in 2017, some point to the following photo from the annual hurricane forecasting conference held earlier this year in which it was pointed out that there have been more Category 4 and 5 storms since 2017 than there had been from 1963-2016. What we found, however, was that if you go back another decade, we would be adding another 33 major hurricanes to the count. So, cherry-picking the starting date for comparison? The additional storms might have changed the conclusion of that slide.

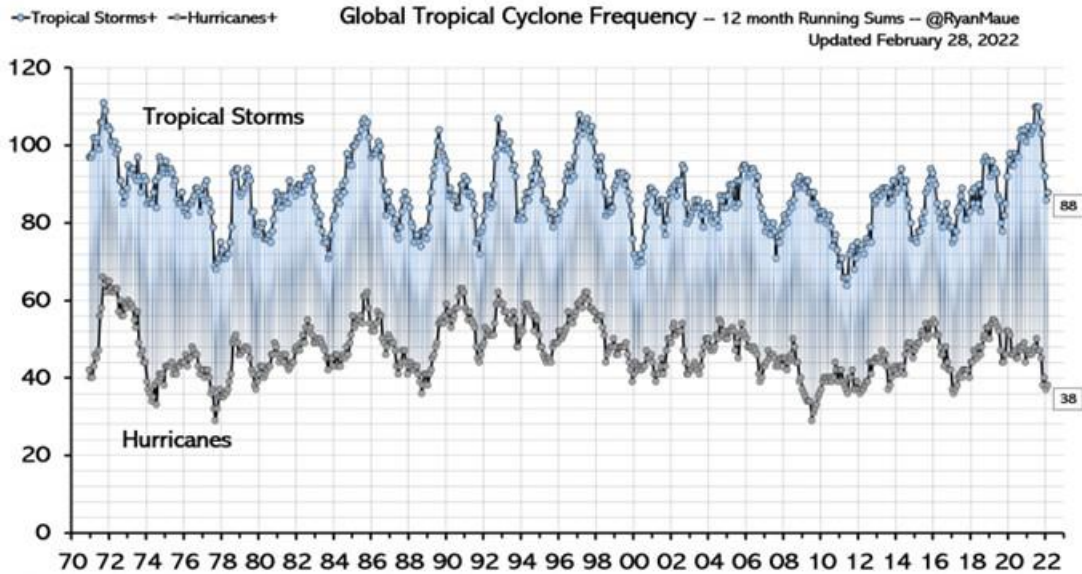
Exhibit 8. NOAA Makes Case For Worsening Hurricane Environment



Source: Craig Setzer photo

The following chart constructed by noted meteorologist Ryan Maue shows the history of tropical storms and hurricanes for 1970-2022. This covers the era with the best tracking systems available. The data shows no discernable trend in the frequency of storms or hurricanes.

Exhibit 9. Atlantic Basin Tropical Storm Data Shows No Discernible Trends

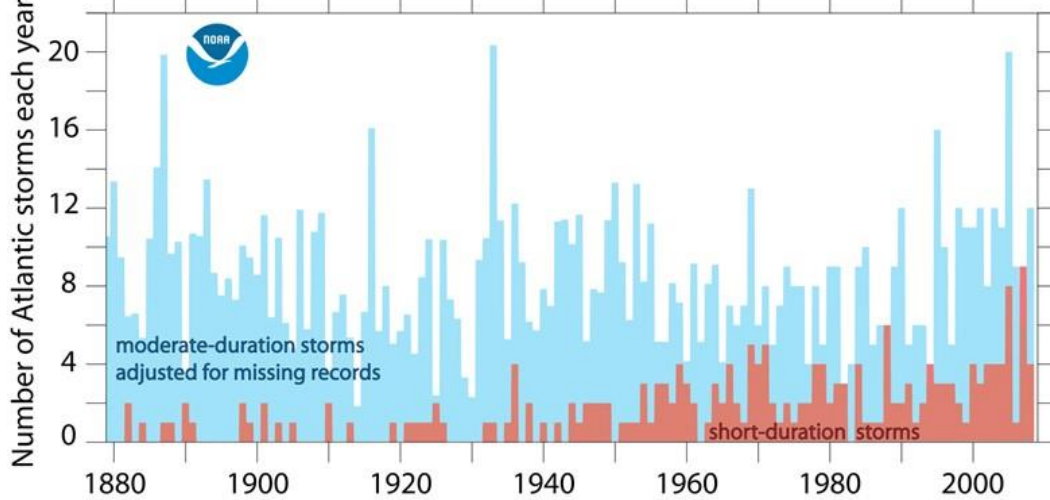


Source: Ryan Maue

An interesting chart from 2009 from the National Oceanic and Atmospheric Administration (NOAA) shows the number of Atlantic basin tropical storms annually over recorded history. The database has been adjusted to reflect the estimated missing storms that would have been known if we had aircraft and satellite monitoring available, which only started in the 1950s. The

significance of this chart is the increase in the number of short-duration storms in the satellite monitoring era. We attribute the increase to NOAA's improved ability to identify and track tropical storms earlier and over a wider geography. This duration distinction partly stimulated a research effort last year to focus on other ways to monitor tropical storm activity and determine if there were any trends of note.

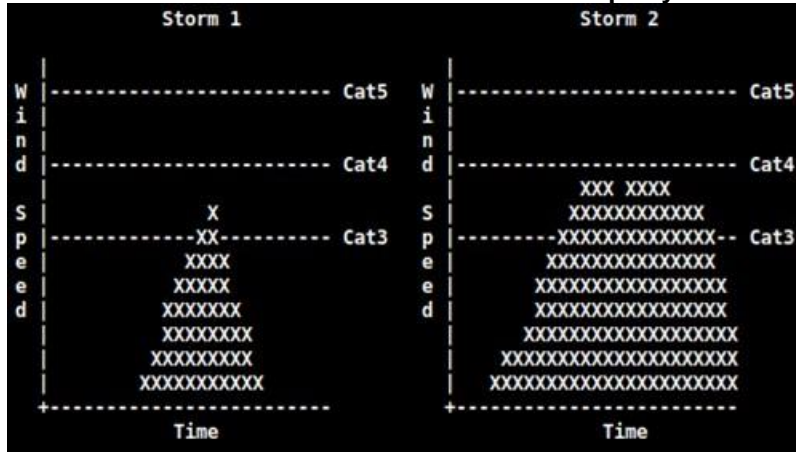
Exhibit 10. Growing Number Of Short-Duration Storms Distorting Tropical Storm Data



Source: NOAA

Researcher Zoe Phin asked the question about counting hurricanes. Should a storm that was barely a Category 3 be considered comparable to one that remained a Category 3 storm for an extended period? She showed the following chart to demonstrate her point. Under numerical counts of tropical storms and hurricanes, each storm is considered equivalent. Maybe the storm that lasted longer should receive greater weight in tropical storm analyses.

Exhibit 11. Should These Storms Be Treated Equally?

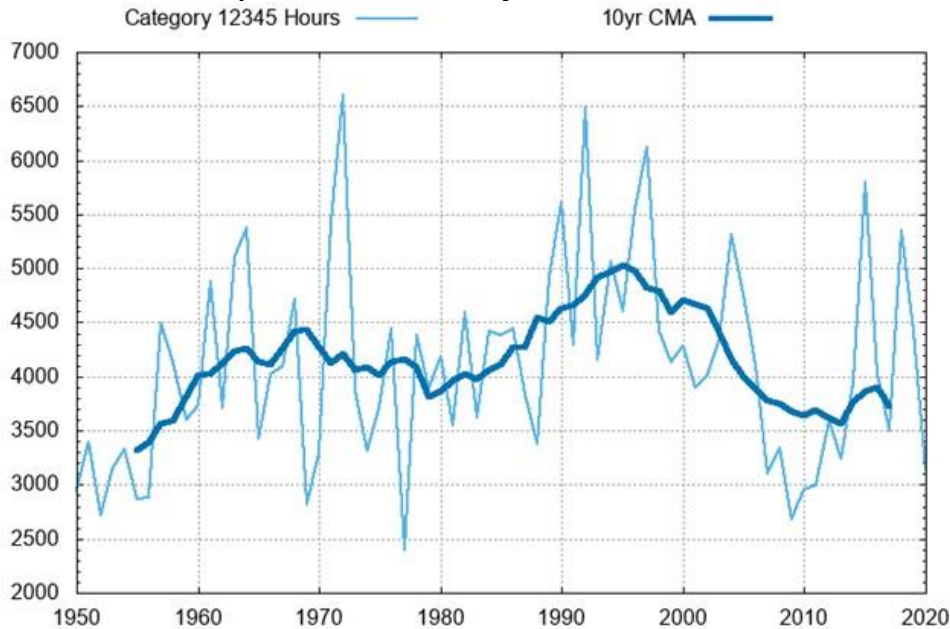


Source: Zoe Phin

In consideration of this difference, Phin decided to examine the hours of storms by category over our aircraft and satellite tracking history. Her initial chart is shown below and reflects the annual

number of hours recorded for all hurricanes along with the 10-Year Centered Moving Average (10yr CMA) to reflect the trend in storm hours.

Exhibit 12. More Tropical Storms Recently Have Had Fewer Hours

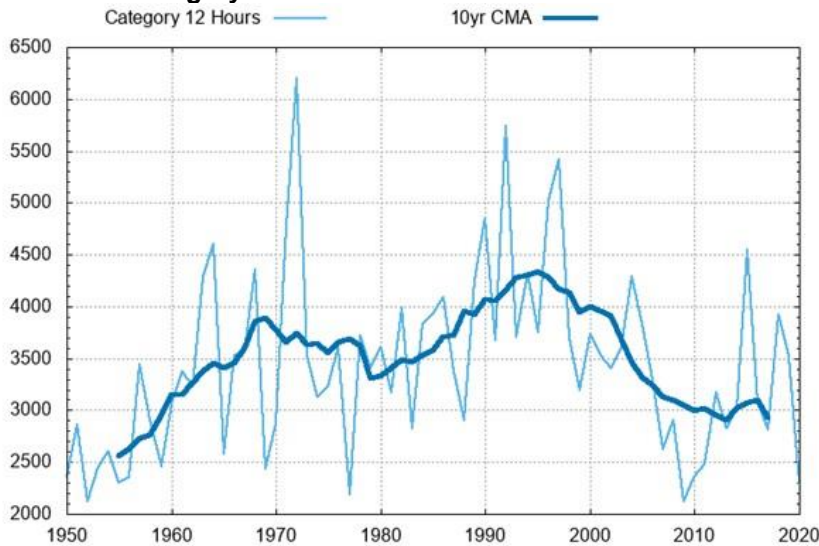


Source: Zoe Phin

As the above chart shows, from the mid-1950s to the late 1960s, the 10yr CMA rose, but then declined until the end of the 1970s. At that point, the trend began climbing, reaching a peak in the mid-1990s. The decline from that peak ended in the early 2010s and increased but then declined. Until we have a few more years of data, it will be hard to plot the more recent trend, but given what the annual data shows, we would expect a further decline. Importantly, the current low level of storm hours is comparable to the late 1950s and the late 1970s lows.

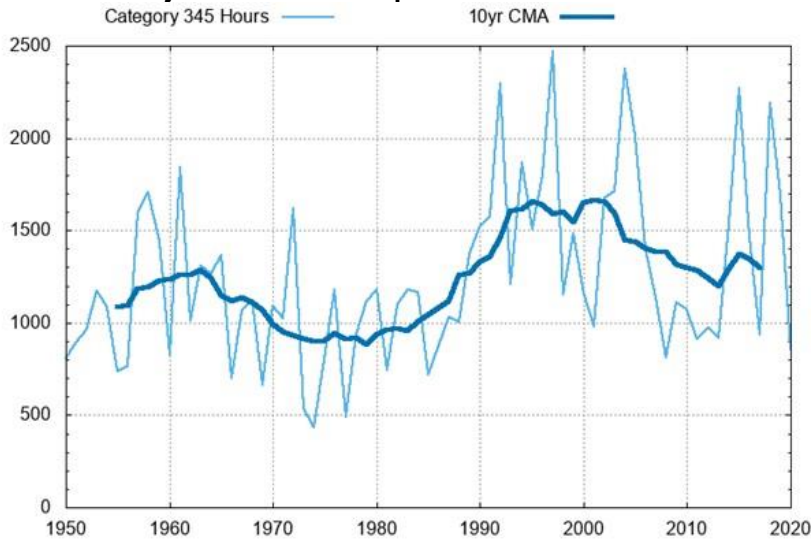
Instead of showing Phin’s charts for each category of hurricane, we have decided to show her two hybrid charts that aggregate the hours for Categories 1 and 2 and Categories 3, 4, and 5. The two charts are below.

Exhibit 13. Category 1 & 2 Hurricane Hours Now Match The Late 1950s



Source: Zoe Phin

Exhibit 14. Major Storm Hours Up From 1970s Low But Down From 1990s High

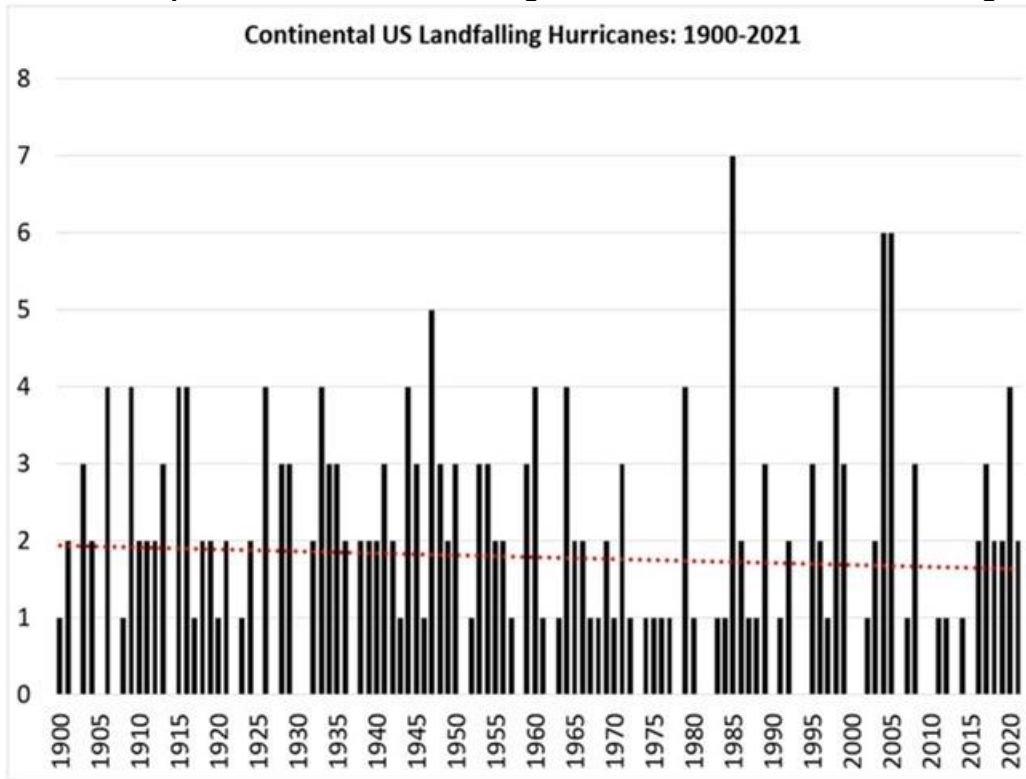


Source: Zoe Phin

Besides there being many more storm hours for the Category 1 and 2 storms, which likely reflects NOAA’s chart of the growth in short-duration storms, the decline since the mid-1990s has been more pronounced than for the rest of the universe of hurricanes. However, both charts show declines in storm hours during that more recent period.

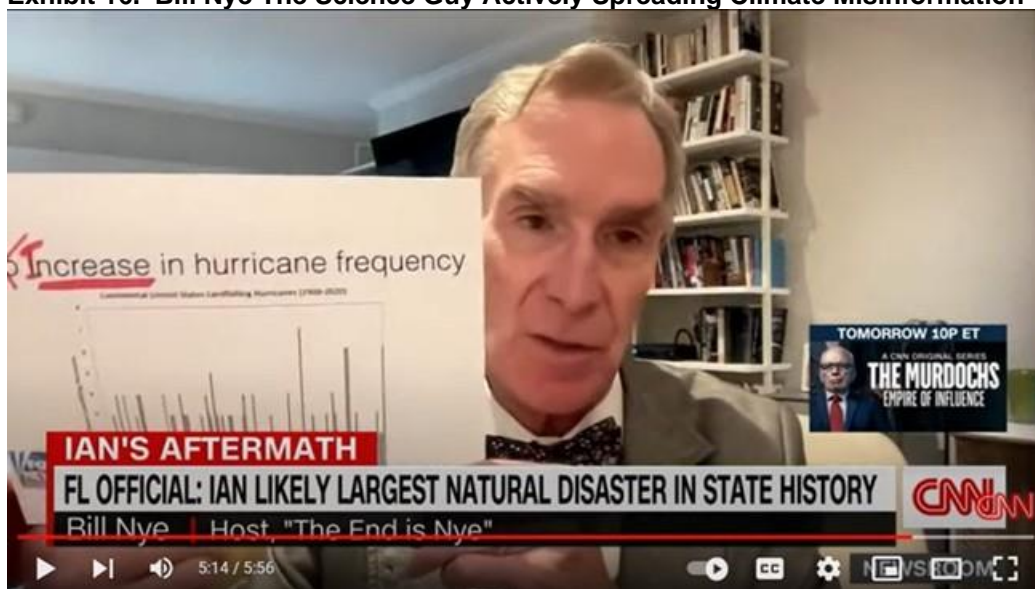
At the end of last week, Roger Pielke, Jr., an expert in climate disaster analysis delivered a talk in which he showed the following chart of U.S. landfalling hurricanes 1900-2021, which is an updated version of Exhibit 7. The chart extends the hurricane landfalling dataset through 2021 and confirms that the historical declining trend previously noted has continued.

Exhibit 15. Updated Hurricane Landfalling Chart Confirms Historical Declining Trend



Source: Roger Pielke, Jr.

Pielke’s chart was used by Bill Nye, The Science Guy, in an interview on CNN discussing Hurricane Ian. Note in the picture below that the word “No” of “No increase in hurricane frequency.” which is the title of Pielke’s chart, is crossed out and the word “increase” is highlighted. This is an outright distortion of the data and misinformation. Nye claimed falsely that the chart refers only to “cherry-picked” East Coast landfalls. This is wrong, and the data refutes Nye’s “increase” claim. Nye is a mechanical engineer, not a climate or atmospheric scientist, or someone recognized by the U.N. Intergovernmental Panel on Climate Change as a hurricane expert. He is a well-known television personality who is respected for his simple explanations of scientific phenomena. In this case, Nye is spreading misinformation and should be called out.

Exhibit 16. Bill Nye The Science Guy Actively Spreading Climate Misinformation

Source: *CNN*

As with every weather-related analysis, it is dangerous to project the future from current weather events. As Bastardi likes to remind his listeners, Mother Nature is in firm control of our weather, and she often throws us curveballs.

What Environmentalists Do Not Know About Petroleum

A recent opinion column in *The Wall Street Journal* caught our attention for pointing out the fallacy of the “keep it in the ground” environmental movement’s push against fossil fuels. If you read most of the social media comment threads about climate change, the environmentalists argue we should be banning internal combustion engine vehicles because they emit carbon dioxide. They also want all fossil fuel-generating power plants to be shuttered and replaced by wind and solar - and occasionally someone suggests maybe we will need to allow a few nuclear plants to continue to operate – all in the name of eliminating CO₂.

The fallacy was teased in the title of the article. It stated: “You Can’t Build Roads Without Oil.” The sub-heading asked: “Where does the Biden administration think asphalt comes from?” A good question. An even better question would be to inquire about what else comes from petroleum that is critical for the operation of our society and economy and cannot be replaced with substitutes. By ignoring such issues, the environmentalists are handing our future to those few Malthusians amongst us who believe in fewer people and a pre-industrial lifestyle. Or maybe the environmentalists are just ignorant of the issue and have failed to consider the future world to which they suggest condemning the world’s population.

The Wall Street Journal opinion article was authored by Jacob R. Borden, an associate professor of chemical and bioprocess engineering at Trine University, a private university in Angola, Indiana. Professor Borden cited the Infrastructure Investment and Jobs Act of 2021, which provides \$110 billion to states for building and repairing roads and bridges. He then points out that Federal Highway Administration statistics note that 94% of U.S. road miles are paved with

asphalt, which comes from “the bottom of the bottom of the oil barrel.” With society and the economy prizing the lighter petroleum products – gasoline, diesel, and jet fuel – derived from a barrel of crude oil, the bottom portion has always presented a challenge for refineries because its value is small.

Borden points out that 70% of the oil barrel is refined for products used in combustion, leaving 30% at the barrel seeking alternative markets, such as the asphalt (where much of the sulfur from refining crude oil is buried) used to construct roads. Another important product coming from that share of the barrel is petroleum coke, which is the main source for the anodes used in aluminum smelting. Approximately 40 pounds of coke are needed for every 100 pounds of aluminum. Based on a 2018 study by mining and metals business intelligence firm CRU, plug-in hybrid and full battery electric vehicles use 25-27% more aluminum than the typical internal combustion engine vehicle today. Based on the actual and projected growth of electric vehicles in the global vehicle fleet, more aluminum will be necessary for the future meaning more petroleum coke will be required.

Then there are the BTX petroleum distillates – benzene, toluene, and xylene – that provide the raw materials for products including dyes, synthetic detergents, and for making the polymers, plastics, resins, and solvents used in thousands of products critical for our economy and everyday life. Even sulfuric acid has its origins in the sulfur that is removed from petroleum during the refining process. Products such as the insulation covering electrical wires and cellphones, as well as medical products such as catheters, IV bags, and pill casings are all derived from petroleum. Virtually, all our clothing, except for jeans and 100% wool and cotton clothing, has some synthetic materials that depend on petroleum.

Exhibit 17. Petroleum’s Role In Pharmaceutical Industry

PHARMACEUTICAL GRADE PLASTICS
ARE USED IN:

- Plastic bottles and vials
- Hearing aids
- Sterile plastic bandages
- Modern casts
- High-pressure balloons
- Substrates in urine tests
- Disposable syringes, gloves, and masks
- Hospital bags and tubing (i.e., for dialysis or IV)
- Artificial limbs and joints
- Hand sanitizers and soaps

The infographic includes a photograph of various pharmaceutical supplies at the bottom: a syringe, a pair of scissors, a container of white pills, a graduated cylinder, a blister pack, and a white plastic bottle.

Source: context.capp.ca

Another very interesting market dependent on petroleum and which has made major contributions to enhancing society, lengthening lifespans, and improving health are the drugs from the pharmaceutical industry. Few people realize how key petroleum is to the pills they ingest every day to ease headaches, lower blood pressure, and treat infections among other uses. Wait a minute. Do you mean every pill we take comes from petroleum? Ugh!

According to *petroleum.co.uk* and based on 2015 data, it is estimated industrialized nations currently consume petrochemical products at a rate of 3.5 gallons of oil per day per person. The website states: "That means that, excluding fuel oil, modern life results in each citizen of an industrial nation using over 1,200 gallons of oil per year." Our guess is this relationship has remained static during the past half dozen years. But the website goes on to highlight the alternative uses of petroleum, primarily in petrochemicals.

An important demand sector for petroleum is agriculture, which is increasingly being targeted by environmentalists who want to ban the use of nitrogen-based fertilizers. Such a ban was tried in Sri Lanka, which led to food shortages that sparked riots that resulted in the overthrow of the government that instituted the fertilizer ban.

The reality is that feeding our growing population requires using chemical fertilizers derived from the methane in natural gas but also diesel fuel to power farm machinery and food processing plants besides transportation to get the food products to market. Oil is also important in creating the pesticides that ensure healthy crops.

Besides plastics that populate our lives, transportation runs on tires. Up until 1910, tires were made from natural elastomers obtained from rubber tree plants. World War II saw restricted access to natural rubber from Asia and South America and forced the development of synthetic rubber, which is primarily a product of butadiene.

Mineral oil and petrolatum are petroleum byproducts used in many creams and topical pharmaceuticals. Tars that are used for psoriasis and dandruff control come from petroleum. But the most surprising petroleum contribution is the role it plays in creating pharmaceuticals.

Pharmaceuticals are typically large organic molecules, and petroleum is derived from organic matter, so it contains organic molecules that are broken apart and reassembled during the refining process. Drugs are constructed by starting with small organic molecules and linking them together as the product is developed. Linking these small molecules together is normally done in a solution, but since organic molecules are not water soluble, they are linked in organic solvents such as methanol, ethyl acetate, heptane, toluene, etc., derived from petroleum.

Professor Borden ended his opinion article with the following:

Humanity can't be separated from its hubris, and that's not all bad. Hubris, and hydrocarbons, took us to the moon and back. But it's beyond hubris to believe that modern marvels that pass as everyday objects, developed with the guide of an invisible hand, can seamlessly be replaced through collective will alone.

Therein lies the fallacy of ending our use of fossil fuels, especially petroleum. Energy professor Vaclav Smil has authored numerous books detailing how embedded petroleum is in our modern lives, which will make the transition to a decarbonized economy a multi-decade journey. In the introduction to his most recent book, [How the World Really Works](#), Smil wrote:

The gap between wishful thinking and reality is vast, but in a democratic society no contest of ideas and proposals can proceed in rational ways without all sides sharing at least a modicum of relevant information about the real world, rather than trotting out their biases and advancing claims disconnected from physical possibilities.

In other words, environmentalists fighting to ban oil and gas need to learn about the 30% of the barrel they ignore when they espouse that the world can live and function exclusively on electricity generated by renewables. Replacing the organic properties of petroleum is a life-threatening void in the hubris of environmentalists.

Contact PPHB:

1885 St. James Place, Suite 900
Houston, Texas 77056
Main Tel: (713) 621-8100
Main Fax: (713) 621-8166
www.pphb.com

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