PPHB

# 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

**May 25, 2021**

## Hitting The Road For Our Annual Trip To Rhode Island

The route to Rhode Island via Cleveland was upended by the I-40 bridge closure. We experienced excitement in Arkansas, moderate truck traffic, dead deer, and congestion in NYC.

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## China Looks To Dominate EVs As It Has With Solar

Chinese EV companies are building massive assembly plants with the aim of dominating the global industry. A forecast shows China meeting over half of world demand by end of 2020s.

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## Claiming "The Devil Made Me Do It" Defense Won't Work

A regulatory filing for a new solar farm shows perverse state mandate for clean energy. Xcel says solar not least costly option, gas was, but closing coal plant early helps meet mandate.

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## Issues Surrounding Wind Power Are Gaining Attention

Wind energy, especially offshore, taking center stage in U.S. power future. Americans are pushing back, and developments in Europe are highlighting wind energy's vulnerabilities.

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# Hitting The Road For Our Annual Trip To Rhode Island

It is that time of the year when the Brooks family heads north for the summer. This year involved a significant alteration to our traditional route. From Houston, we went via Cleveland to visit our married granddaughter and her husband, and to see a business friend of many years, before heading to Rhode Island. Planning for the trip started several months ago and involved gathering routing information from AAA. The recommended route was straight forward – head through East Texas, across Arkansas, cross the Mississippi at Memphis and on to Nashville before turning north to Louisville, Columbus and eventually Cleveland. Then came the shocking news that inspectors had found a major crack in a support beam in the I-40 bridge across the Mississippi, necessitating shutting down this main crossing point. On the day they shut the bridge, inspectors also shuttered the nearby I-55 bridge to inspect it. Fortunately, it was closed for only a few hours. As you can imagine, East/West road traffic in the middle of the country has been disrupted with no timetable for it returning to normal.

**Exhibit 1. Disrupter Of East/West Travel And Commerce, Including On Mississippi River**

**Source:** ***freightwaves.com***

We started checking alternative routes, and a quick trip to the local AAA office two days before leaving was an interesting experience. The lady at the counter knew nothing of the bridge closure! Fortunately, another lady there was aware of it, because she had just re-routed another AAA member heading to Ohio. That customer elected to go I-10 to I-12 and I-59 north. We discussed that option, knowing there is substantial road construction on I-10 and the road is not particularly good in places. The discussion shifted to I-20, which takes you through Shreveport and across the Mississippi at Vicksburg. That road is much better than I-10 according to the AAA representative, but it adds distance and time to our original route. Frankly, we were surprised AAA had not sent out information to its employees about the bridge closure and recommended alternative routes.

Even with the I-20 route mapped, we continued to check alternatives. The traffic app Waze suggested a shorter and quicker route through Indianapolis. That became our plan. More

importantly, we wondered what other I-40 travelers were planning, which convinced us to head out as early on Sunday as we could. Thus, we stayed only briefly at the college graduation reception for another granddaughter, before hitting the highway at 2 pm. Despite horrific rains, made our way through East Texas to Lufkin where the rain stopped. We experienced a few showers in Marshall but it was dry from Texarkana onward. Since it was a Sunday, there was not as much traffic, especially trucks.

As we entered Arkansas, we saw our first electronic sign warning about the I-40 bridge closure and the need to find an alternate route. Having eaten Mucho Nachos and cake at the graduation party, we skipped dinner, so had more travel time. As we neared the Memphis bridge, we transitioned from I-40 to I-55 heading north. We spent the night in Blytheville, just south of the Missouri state line. There was no problem getting a hotel room, and the hotel was certainly far from full. What we did not expect was the excitement accompanying our arrival.

There was a Shell gas station next door to the hotel. As we wanted to fill up to enable a quick getaway in the morning, we pulled in. The store was closed. The gas pumps were working so we filled up. As we were entering the hotel parking lot, two police cars with their lights on came racing down the feeder road from opposite directions. My wife wondered whether we were in trouble for having used the gas pumps. After registering at the hotel, we emerged from the lobby to see 10-12 police cars, trucks, rescue truck taking over the feeder road and adjacent highway. A sea of blue emergency lights was illuminating the area, as were all the car headlights. It was quite a scene. There was no accident, but we heard and saw at least one or possibly two K-9 units, so we assumed they were apprehending people involved in either a robbery or drug bust. We did see the police take one person to a patrol car for questioning. By then, we were confident we were not in trouble for using the closed station's gas pumps.

On the way up, we noticed that the East Texas truck stop was about 2/3rd full, which was about the same for those in Arkansas. The last Arkansas truck stop we saw, however, was full and beginning to overflow. We also found numerous trucks making the same detour from I-40 to I-55 to avoid the bridge.

Gasoline prices were in the $2.50-$2.80 range, although we saw one highway sign for gasoline at $3.09 a gallon. It was strange seeing an Arkansas farmer ploughing a field in the dark, illuminated by a lightbar aimed on his trailing plough and two headlights on his tractor piercing the darkness. We assumed he was behind in his planting work.

Last fall, there were only grab and go breakfasts at hotels, if they offered any food at all. This time, the Hampton Inn was serving an extended breakfast menu, although it was more limited than normal, and all portions were individually wrapped. It was nice, however, to sit down for breakfast with multiple choices.

Day two saw the weather vacillate from rain to sun to clouds to sun to rain to eventually sun for the final half of the day. The topography in Arkansas and Missouri was very flat with large farms with acres of fields. Everyone had massive irrigation systems on wheels that can range over the farmland delivering water to crops. It was evident farmers were preparing the systems for this summer. Some fields had yet to be planted, while other had crops at various heights, reflecting the difference in planting times.

Truck traffic was heavier on day two, especially in Illinois and Indiana, but it seemed to thin out once we entered Ohio. Since this was a new route, we lack knowledge of normal patterns against which to measure what we experienced. Importantly, we have no perspective of whether the volume of truck traffic was influenced (plus or minus) by the I-40 bridge closure. We tended

to doubt there was much impact. The truck stops along the route were about 80%-90% full, surprisingly even at mid-day. Trucker driving and rest rules are certainly impacting the use of truck rest stops.

In assessing the volume of truck traffic, we wondered whether the shortages of reported truck drivers were impacting the traffic, or whether supply chain issues related to the pandemic and associated spot shortages of goods and raw materials were impacting the number of trucks. Loads of trucks were billboards advertising to hire local and OTR (over the road) truck drivers. We read where the gas station operator Pilot was so short of drivers when the Colonial pipeline restarted that it was offering $5,000 sign-on bonuses to newly hired drivers. We also noticed Ohio state police were very active, but 100% targeting trucks. Illinois and Indiana police were visible, but not active. We did not see any police in Texas or Arkansas, which may have been due to it being Sunday.

Gasoline prices were higher than the prior day, primarily in the $2.80-$3.00 a gallon range. When we stopped for lunch at McDonald's in Marshall, Illinois, they had hand-written want ads in their windows next to the entry doors. It was evident there was a shortage of workers, and we were not allowed to eat inside. We ate dinner that night at a Cracker Barrel in Ohio, where there were no lines, the place was about 65% full, but it was loud as people were obviously enjoying themselves on a Monday evening. It was a welcome sight and sound.

After two days visiting in Cleveland, we headed for Rhode Island. We made very good progress on a sunny day. Traffic was not heavy, and at times it looked like a 50/50 split between trucks and cars. That split was particularly noticeable in Pennsylvania where we could often see long stretches of highway. But we also found it interesting how many groups of nearly 100% cars or trucks we saw – it was if neither group wanted to mingle. Gasoline prices continued climbing the further east we traveled. They were well above $3.00 per gallon, as we paid $3.19 in Pennsylvania and $3.25 in Connecticut.

On the traffic front, we found the New York metropolitan area to be a disaster. It started in New Jersey and extended all the way through New York and up to New Haven, Connecticut. We were surprised by the magnitude of congestion, which added two hours to our ETA, especially as we saw no construction slowing traffic. It suggests that region's economy is really rebounding, something seemingly not acknowledged by the media, and even the region's political leaders. Maybe they do not like the idea of people getting out and moving about.

Once again, a McDonald's lunch-stop only allowed carryout. The place was quite busy but seemed well-staffed with no help wanted signs evident. The restaurant had a second parking lot, down a level from where the building was. We noticed it had an area with several picnic tables that families with small children were using as they enjoyed the warm, sunny weather.

Except for the last portion of the trip, the entire journey was not particularly challenging. We saw little construction that created traffic delays. The two accidents we encountered were spectacular. One came immediately at the end of a construction area that had traffic down to two lanes, so everyone had to navigate a one-lane exit. The other accident involved an 18-wheel truck that ran way up a hill. We cannot image how fast he had to be going when he went off the road. Workers and emergency personnel were working to empty the bags of material it was carrying (we did not know what it was), but they were repackaging the load on pallets and wrapping them in plastic. In Pennsylvania, we were intrigued by the highway signs ahead of a lane closure. The signs first said: Use both lanes up to the merger point. At that point, the signs said: Merger point. Take your turn. How to create civility on the highways.

We do think that there was less truck traffic on this trip than experienced in the past, which we attribute to the state of supply chains. Although customer demand is evident, the inability to produce goods and get them to market is what is likely impacting the truck traffic. Fortunately, we were far enough removed from the Colonial pipeline fallout, that gasoline availability was not an issue. What was disappointing was the number of dead deer along the highway. We seemed to only see them in Indiana and Ohio. There was an occasional one in Pennsylvania. We stopped counting when we approached a dozen and a half. We are not sure why such carnage, but maybe this is normal at this time of year in these states. Again, since this was outside of our normal route, we have no basis to judge whether this is normal or extraordinary.

We expect a more relaxed summer as Rhode Island fully opened May 21st – no masks required for those vaccinated. As we went shopping at Walmart last Friday – reopening day - we were not surprised by the overwhelming number of shoppers wearing masks. Since we were not wearing masks, we got a few stares. Cleveland was a mixed bag. Wearing a mask was the default option if there was no sign telling customers to mask up. Maybe before long we will be back to pre-pandemic lifestyles. That will be a shock – but a pleasant one.

## China Looks To Dominate EVs As It Has With Solar

A recent *New York Times* article focused on how China's electric vehicle (EV) industry is building a big lead in factories for assembling them. In fact, the new factories will soon lift China's manufacturing capacity to eight million units per year, more than Europe and North America combined. All these new EV factories suggest that EVs remain a key part of China's industrial growth strategy, which is to dominate the clean energy business. Given China's dominance in the rare earth minerals supply necessary for the batteries to power EVs, it already has a head start on achieving this dominance.

To better appreciate China's EV strategy, a quick review of what happened with solar panels will provide perspective. For an industry essentially invented by the United States, with the assistance of Germany, China's solar panel industry was kickstarted on its road to dominance, something that required less than two decades. A 2016 article in *Climate Wire* tracked the history of the industry.

Solar cell technology, or photovoltaic (PV) technology began during the Industrial Revolution. In 1839, a French physicist demonstrated the photovoltaic effect, or the ability of a solar cell to convert sunlight into electricity. Some 40 years later, an American inventor created the first solar rooftop array in New York City. It was not until 1905 that Albert Einstein wrote a paper explaining the photoelectric effect, for which he won the Nobel Prize in physics in 1921.

The modern PV cell was developed by Bell Laboratories in 1954, but it was not commercial. However, the U.S. military and space programs funded further development, and incorporated solar panels in early satellites launched in the late 1950s. The commercialization of solar technology was pushed by the Solar Energy Research, Development and Demonstration Act of 1974, in response to the Arab oil embargo. The bill provided government support to commercialize solar panels with a mandate for the installation of them on government buildings. Many people may remember President Jimmy Carter having a solar array installed on the roof of the White House in 1979, hoping to interest Americans in installing them on their homes. A tax credit was offered to help defray the expense, which survived the Congressional effort to eliminate all energy credits that were perceived as being directed toward the wealthy who could afford to install energy saving equipment. In the intervening years, the residential solar tax credit

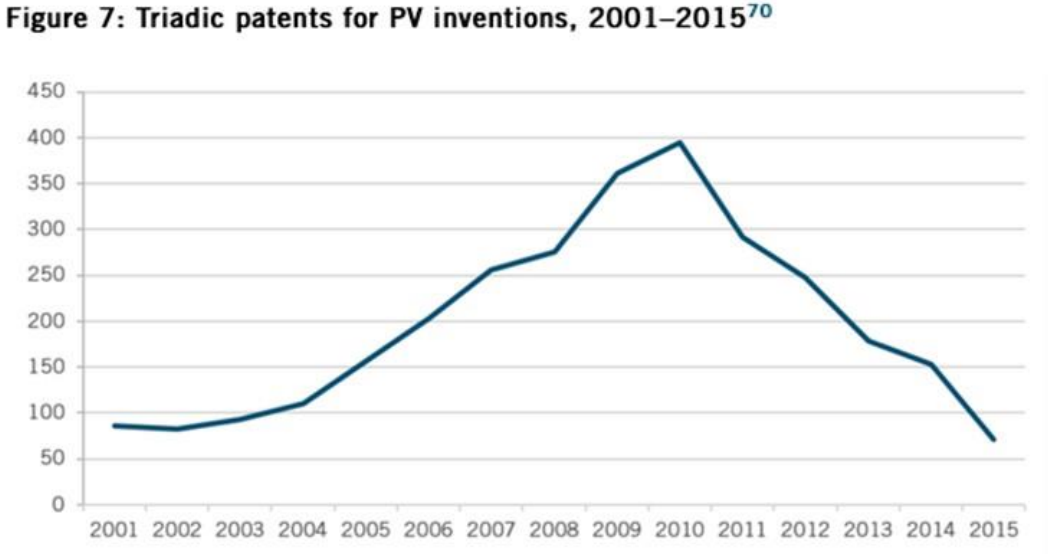
was phased out, but the commercial one was extended numerous times until it became permanent in 1992.

From the 1950s to 1990s, the United States dominated the solar industry. In the late 1990s, the German government was overwhelmed in response to a proposed rooftop solar program. As a result, it agreed to provide the capital, technology, and experts to help China make solar panels to meet Germany's demand. Up until now, China had mostly dabbled in solar energy, but only as a source of electricity to help poor rural areas away from its power grid. Chinese manufacturers became intrigued about manufacturing solar panels for Germany, which was further stoked by demand from Spain and Italy that were also embarking on rooftop solar array efforts. The mushrooming demand spurred Chinese companies to hire more solar experts, begin shopping for machinery and polysilicon supplies to meet the expected surge in orders. They bought solar companies, while also inviting others to move to China to capitalize on the country's cheap, skilled labor. The Chinese government offered tax credits rather than charging them taxes in the early years.

Solar was identified by the Chinese government as a "strategic industry," and was provided with substantial financial aid for building manufacturing plants. With the wind behind its back, the Chinese solar manufacturing industry built so much capacity that it was producing two panels for every one ordered – the classic glut. This caused the government in 2013 to follow Germany's lead and develop its own "feed-in tariff" that spurred domestic demand for rooftop solar arrays. In two years, China's domestic market passed Germany to become the largest in the world. In 2016, the article pointed out, China installed 20 gigawatts (GW) of solar capacity in the first half of the year, which compared to the entire U.S. capacity of about 31 GW.

Other things happened as China targeted growing its solar panel business. With cheap energy and labor (reportedly from ethnic minorities employed as slaves), pricing was destroyed. With collapsing prices, all research and development activity for improving panels ceased. This is easily demonstrated by the rapid fall in the number of new solar panel patents. Thus, today's solar panels are very much like those developed by the Bell Laboratories.

**Exhibit 2. Patents For Solar Panels Peaked In 2010, Stopping Technological Advances**




**Source: Michael Shellenberger**

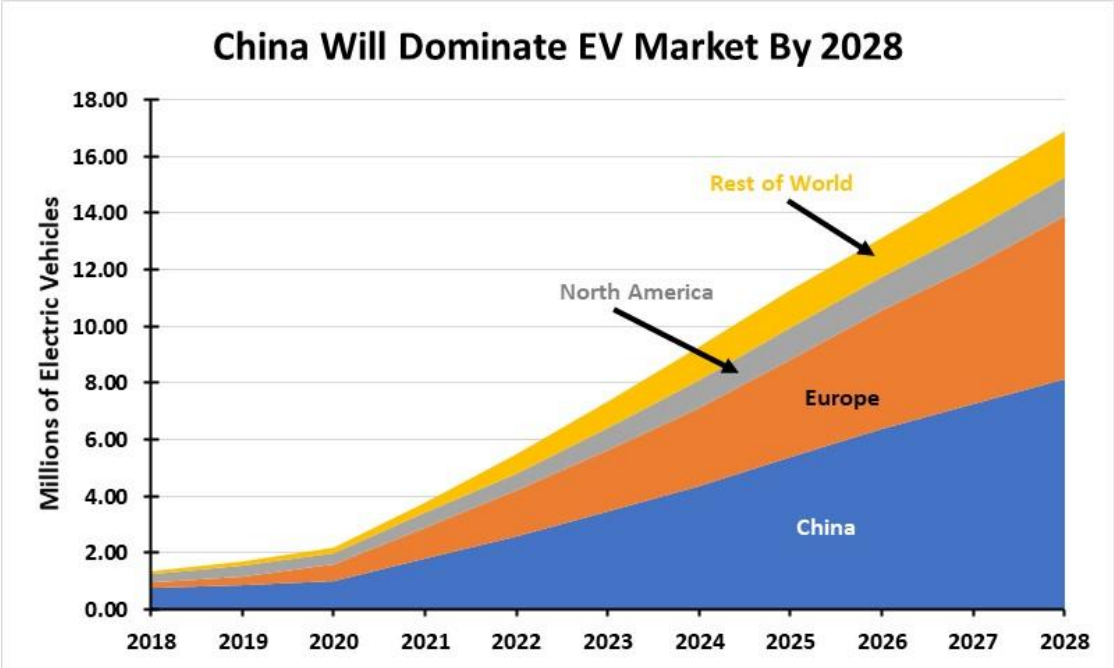
By 2016, eight of the top ten solar companies were Chinese. There were no European companies, its most successful one in Norway having been acquired by a Chinese company. The U.S. had one of the top ten companies. With solar panel prices falling to very low levels, technology was sacrificed for scale. The industry needed manufacturing scale to achieve the lowest cost to promote sales and generate profits. With many in the solar panel industry saying that China's efforts to dominate the market limited technological progress and left customers to purchase less efficient panels than might otherwise have existed by now. Might the same fate await the global EV industry? On the surface, it would appear a repeat of the solar panel industry evolution is a distinct possibility. Whether it happens or not remains to be seen, and likely depends on what new EV technologies might emerge and whether scale will drive down costs to make EVs competitive with internal combustion engine (ICE) vehicles. So far, the growth of the EV industry has depended on government support and mandates.

Mandates to ban the sale of new gasoline- and diesel-powered vehicles by certain dates in the future is a driving force for automobile manufacturers to fully-embrace EVs. Incentives and subsidies to help finance the purchase of new EVs reflects the reality that they are not cost-competitive with ICE vehicles yet. While shoveling money to buyers seems to be the approach of the Biden administration, there does not seem to be an effort to restrict these financial incentives elsewhere in the world. Even China has been an active participant in the use of subsidies to spur the sale of EVs.

As China pushes ahead with promoting its EV industry, a portion of the manufacturing capacity being built today is by start-up companies. They are counting on the government's efforts at stimulating a domestic EV industry. The Chinese government has backed a nationwide rollout of over 800,000 public charging stations. That is almost twice the world's existing charging stations. In many western countries, EV owners live in single-family homes where they can charge their EVs, avoiding the need to access public charging stations. However, the lack of widescale public charging networks adds to buyer range anxiety, i.e., finding a charging station when needed during trips. For those EV buyers living in apartments, finding charging stations is often a hassle.

Based on the announced new EV plants, including those of established global car companies such as Volkswagen, General Motors, Ford and Tesla, China's manufacturing capacity will grow rapidly. According to a forecast by LMC Automotive, China will be assembling over eight million EVs a year by 2028, compared to one million last year. Europe will be building over 5.7 million EVs, while North America will yet to have hit 1.5 million. If the LMC Automotive forecast proves accurate, it calls into question the highly aggressive forecasts of others calling for a radical transformation of the U.S. auto fleet by 2030.

**Exhibit 3. A Forecast Of EV Sales By Geography Demonstrates China's Market Power**




**Source: LMC Automotive, PPHB**

It is interesting that Mary Barra, the CEO of General Motors, who has been highly supportive of the Biden administration's push for more EVs, is now asking the government to change the tax subsidy program for EVs. She recently told CNBC that GM should not be penalized for having launched EVs before every other automaker other than Tesla. "That tax credit of $7,500 is significant in a purchase decision," she said. "We'd like to see that [cap] lifted and let the marketplace decide and not penalize first movers." After having pledged $27 billion in EV and autonomous driving development along with plans to launch 30 new EV models globally through 2025, with two-thirds of which are targeted for North America, Ms. Barra is looking for buyer support from the U.S. government. There is a reason for Ms. Barra's plea, which is an understanding of how the U.S. tax subsidy plan may change.

The Biden administration has proposed $174 billion for EVs in its Infrastructure bill, with $100 billion for customer rebates and $15 billion for building charging stations. What we do know is that the current subsidy plan's mechanics will be changed under the Biden administration's proposal. At the present time, EV subsidies are $7,500 per vehicle for the first 200,000 units sold by a car manufacturer. Once that target is hit, the subsidy is cut in half - $3,750 - for the next two quarters' EV sales, and then reduced again by half to $1,875 per vehicle for the following two quarters before ending.

The subsidy is a tax credit for the buyer, which means for him to utilize its full value, he needs to have an income tax liability of at least $7,500. Importantly, that liability needs to exist in the year he buys his EV, since any unused tax credit does not carry over to another tax-year. The Biden administration is proposing shifting the subsidy into a reduction in the sale price, i.e., the subsidy would go to the auto manufacturer who would then lower the EV's price. This is a way of getting the automobile unions on board in supporting EVs since they only need two-thirds the number of workers necessary to build ICE vehicles. We suspect some of the subsidy given to auto companies will need to be allocated to support the unemployed union workers and retrain them. Ms. Barra must lobby to get the current subsidy rules changed so GM will not be left out of the

new plan, which would put GM EVs at a distinct disadvantage relative to other auto companies receiving subsidies.

If we assume the subsidy amount remains at $7,500 per vehicle (we heard rumblings of it being increased to $10,000), the Biden administration funding would support 13.3 million EV sales. Making the subsidy a part of the sale transaction would open the EV market to a wider buying public. This mechanism would significantly close the cost gap between EVs and comparable ICE vehicles. However, when the subsidies end, buyers would face a significant "sticker shock." An interesting aside, is what the subsidy and its eventual ending would mean for inflation calculations. If the subsidy is used to reduce the "manufacturer's recommended sale price" (MSRP), it would dampen consumer inflation initially, but then would exacerbate it when the subsidy ends.

Assuming all the LMC Automotive forecast for EVs in North American are in the United States, the subsidies would support car purchases into the early 2030s. If the subsidies are scaled down per the current program, then EV subsidies would be available for some vehicle purchases into the mid and possibly latter 2030s. This conjures up economist Milton Friedman's observation that "Nothing is so permanent than a temporary government program."

The EV market is facing other headwinds that have received little attention. We were struck by the results of a California study showing that one in five initial EV purchases were replaced with an ICE vehicle. The explanation given was that people found the charging hassle too great. A follow-up article by a *Bloomberg* automotive analyst pointed out that it took three minutes to fill up a Ford Mustang giving the car 300 miles of driving range. A comparable electric Mustang Mach-E, after charging for one hour on a household outlet, only gained three miles of range. That is because the outlet only operates with about 120 volts of power. A high-powered specialty connection provides 240 volts and would cut down charging time appreciably. That connection requires purchasing a 240-volt charger, which, according to *fixr.com*, could cost between $1,000 and $2,500, with a national average of $1,200. A Tesla can be charged on a "Supercharger" with 480 volts, allowing for a fully charged vehicle in a little over an hour.

If 20% of buyers reject the EV concept, how quickly can they be enticed back as an EV-buyer? Never? Maybe after the memory of their charging frustrations fade? Will that also require that they invest in a Level 2 charger to get more power from their household outlet? The answer might be that they will buy an EV when it is their only choice for a new vehicle, and no one will sell them their used ICE vehicle. Welcome to the 2030s version of Cuba's Havana.

Another EV issue to surface recently is their impact on jobs. The topic arose during a talk by Daimler AG's CEO Ola Källenius at a mobility conference in London. "We have to have an honest conversation about jobs," he told the audience. He was referring to the European Union's raising its target for cuts in net greenhouse gas emissions to 55% by 2030 from 1990 levels. This is an increase from the prior 40% target. In July, Europe's automakers are to find out what their contribution to the $CO_2$ reduction is expected to be. Joerg Hofmann, president of IG Metall, warned that Germany's car industry faces an "employment fiasco" unless there is increased investment in new battery technologies.

These comments came after a survey by the Ifo institute showed the transition from ICE vehicles to EVs could cost the car manufacturing industry some 100,000 jobs by 2025 if companies fail to reskill their workers. The industry is likely to create more jobs in areas like software engineering, but the labor force issue needs to be handled in a "socially responsible way," said Mr. Källenius. This employment challenge has been pointed out as an issue for the U.S. auto industry, too, as many automobile parts manufacturing businesses will see their markets shrink or disappear

entirely. Estimates are that the number of workers involved in building EVs is one-third less than needed for an ICE vehicle. There is also the issue of the long-term impact on the vehicle maintenance business, as EVs do not require frequent services.

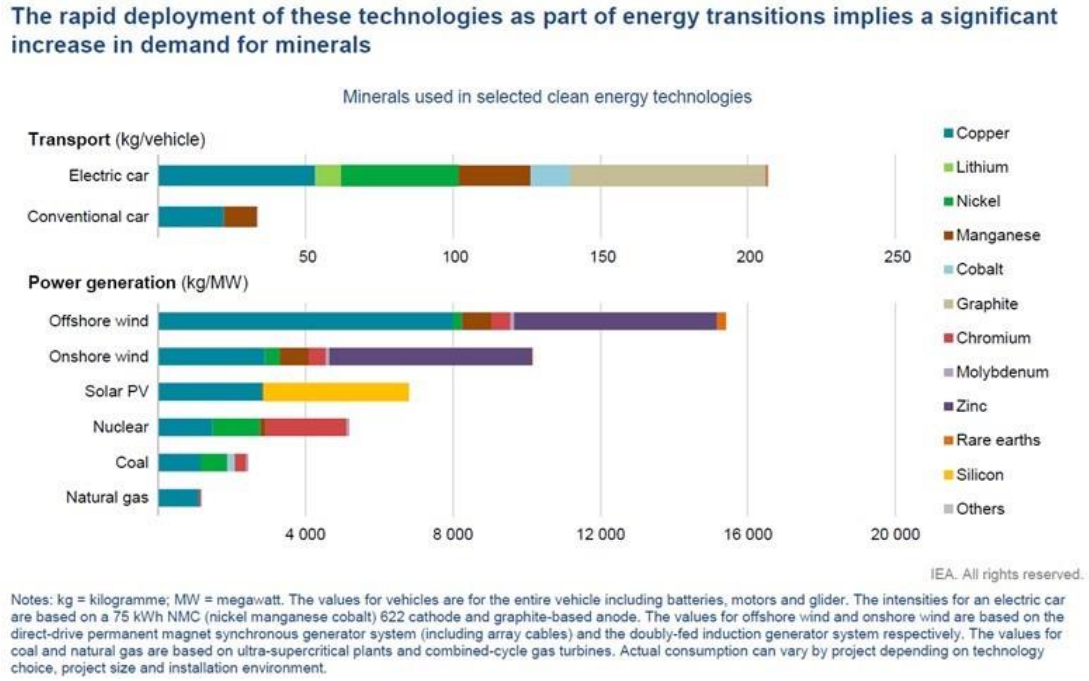
Further challenging the view about the transition of the personal vehicle market to EVs was a recent report by the International Energy Agency (IEA) about "The Role of Critical Minerals in Clean Energy Transitions." The challenges outlined in the report are used to promote the role the IEA wants to play in the energy transition, since the organization was established to help western economies navigate the upheavals within the oil industry in response to the 1973 Arab oil embargo. Reading the 287-page report leaves one with the realization that people promoting clean energy have little appreciation for the demands for minerals critical for the technology to facilitate the shift, nor the time necessary to develop the required supplies.

The IEA highlights the magnitude of the minerals' challenge due to demand growth parameters and the time necessary for developing new supplies. On demand, the IEA noted:

> In climate-driven scenarios, mineral demand for use in EVs and battery storage is a major force, growing at least thirty times to 2040. Lithium sees the fastest growth, with demand growing by over 40 times in the SDS [Sustainable Development Scenario] by 2040, followed by graphite, cobalt, and nickel (around 20-25 times). The expansion of electricity networks means that copper demand for power lines more than doubles over the same period.

A chart from the report shows the demand for critical minerals in an EV versus an ICE vehicle. Not only is the demand for EV minerals dramatically higher, the list of other minerals necessary is long. The chart shows the demand for many other renewable energy sources, but they are not the subject of this article.

**Exhibit 4. EV And Renewables Industry Challenged By Rare Earth Minerals Shortages**

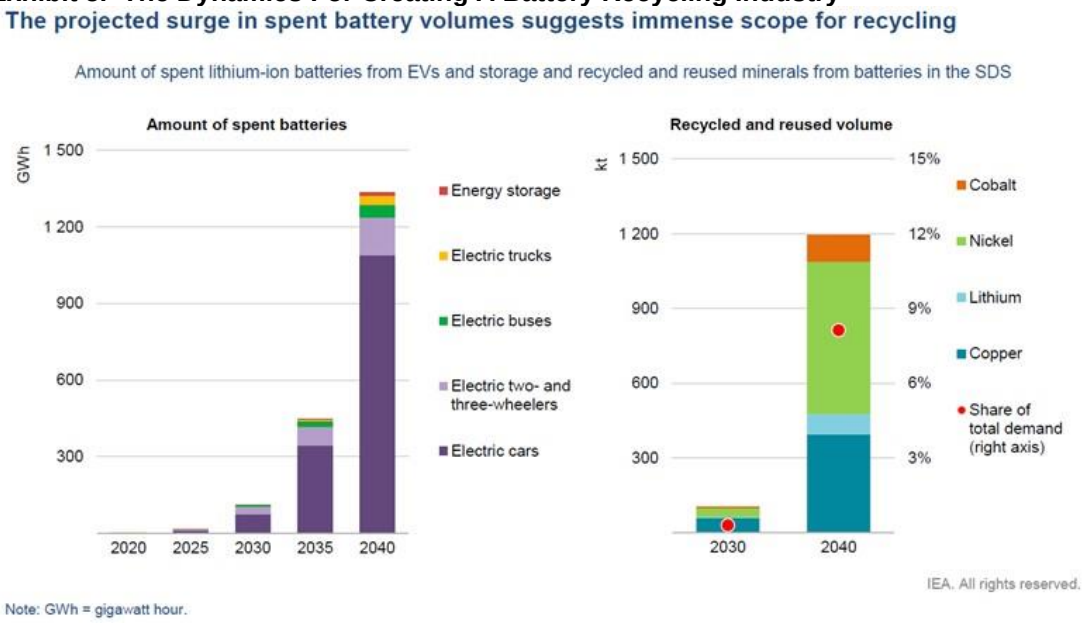



Notes: kg = kilogramme; MW = megawatt. The values for vehicles are for the entire vehicle including batteries, motors and glider. The intensities for an electric car are based on a 75 kWh NMC (nickel manganese cobalt) 622 cathode and graphite-based anode. The values for offshore wind and onshore wind are based on the direct-drive permanent magnet synchronous generator system (including array cables) and the doubly-fed induction generator system respectively. The values for coal and natural gas are based on ultra-supercritical plants and combined-cycle gas turbines. Actual consumption can vary by project depending on technology choice, project size and installation environment.

**Source: IEA**

Where will these critical minerals come from? The IEA highlights the fact that the concentration of these minerals is in fewer countries than for oil and gas. While the idea of the world's transportation industry trading one cartel for another has not attracted a lot of attention, the risk exists until a more diverse supply chain is developed. Currently, China dominates the lithium industry, not just due to it being a large producer, but rather because it has the lion's share of the processing capacity necessary to turn raw ore into refined lithium carbonate. The greater problem, as the IEA notes, is the time required to develop new supplies. The IEA wrote: "Our analysis suggests that it has taken on average over 16 years to move mining projects from discovery to first production." Putting that into perspective means new mineral capacity begun today would not be available until the mid-2030s! What does that do to the timing of the energy transition?

**Exhibit 5. The Dynamics For Creating A Battery Recycling Industry**




**Source: IEA**

A possible supply alternative according to the IEA is recycled and reused volumes of minerals. A chart from the IEA report shows the opportunity available from recycling, but even with dramatic increases in total volumes, this potential supply source would represent about 8% of demand in the SDS. The more dramatic chart shows the growth in spent batteries coming from EVs by 2040. The escalating volumes starting in 2035 reflect the replacement and repowering of the EV fleet from the 2020s. As there is virtually no lithium-ion battery recycling industry now, the volume of spent batteries highlights both an opportunity and a challenge for a new industry.

Is Toyota the skunk at the EV picnic? The company has always promoted its hydrogen fuel-cell technology as the optimal net-zero solution. This technology has been hampered by the cost of hydrogen and the resulting problem in developing an infrastructure for refueling, much like developing an EV charging capacity. But that is not what makes Toyota the possible skunk. It is that the company has been the leader in hybrid (battery and gasoline engine) vehicle technology. Recently, company executives talked about Toyota's vision for its future and, by definition, that for the automobile industry. Hybrid vehicles have greater fuel efficiency and fewer emissions, but they address the range anxiety EV buyers must overcome and the time for refueling challenge.

James Kuffner, Toyota's chief digital officer, commented on the problem of charging EVs. "The goal is not electric vehicles, the goal is carbon neutrality, and even if we have the best technology, if it's not chosen by customers, it will not have the impact of reducing emissions." This puts the issue squarely on the table. But it also highlights Toyota's assessment of the state of the EV industry and its path forward, regardless of the political push to ban ICE vehicles.

Jun Nagata, a Toyota executive, told a press conference: "It you take a snapshot of 2030, the price of battery EVs and the provision of infrastructure around the globe probably won't have advanced all that much. Hybrids and plug-in hybrids will be easier for customers to buy." These two Toyota executives seem to have focused on how best to realistically address the carbon emissions in the personal transportation sector. It boils down to the old marketing philosophy – give the customer what he wants. That is a vehicle that reduces his carbon footprint, but which also is easy to operate and refuel.

The most telling point to come from the press conference was that even with a hybrid-focused plan, Toyota will need to multiply by 30 times its current battery capacity if it is to meet its 2030 sales targets. This will require increased investment in battery plants, and the development of a minerals supply chain to feed them. China was reluctant to promote hybrid vehicles (forcing Toyota to introduce a battery-powered vehicle to sell cars in China), wanting instead to target the EV market. As it recognizes the financial challenges of this strategy, it will be interesting to see when China begins promoting more hybrid vehicles in its quest to dominate that segment of the automobile industry.

## Claiming "The Devil Made Me Do It" Defense Won't Work

Eve was the first to claim "the devil made me do it" defense, when explaining why she ate from the apple in the Garden of Eden in the Book of Genesis. A variation of this defense is often employed by children when something goes wrong. For us, the comedian Flip Wilson, a regular on the Ed Sullivan show Sunday nights in the late 1960s and early 1970s, often used that line. You can check out online a skit of him tell the story of the devil, the reverend, his wife, and the dress. All of this popped into our head as we read the filing for a solar power project by Xcel Energy, operating as Northern States Power (NSP) in North Dakota and Minnesota.

We often do not find out the true motivation for utility capital spending decisions. But sometimes the truth comes out in a regulatory filing, which seldom receive scrutiny from the media. As a result, companies escape without having to explain to the public their actions. Meeting state clean energy mandates often overrides the obligation to choose the least-costly renewable energy projects. In the Xcel case, Minnesota's mandate is forcing the premature closure of coal-generating plants to be replaced by solar facilities. But Xcel has been forced to admit that a new combined-cycle natural gas plant would be the cheaper option for ratepayers. Moreover, Xcel's analysis does not even address the magnitude of the additional costs necessary to integrate more renewable power into the company's electricity supply.

Xcel provides power to customers in both North Dakota and Minnesota, therefore, the solar plant to be constructed in Becker, Minnesota needs the approval of both state utility commissions. With respect to North Dakota, Xcel filed an Application for an Advance Determination of Prudence (ADP), which is essentially a request to approve the project with an adjustment for cost determination based on that state's requirements.

**Exhibit 6. Two Perfectly Good Coal Plants Victimized For Clean Energy Mandate**

**Source:** ***mprnews.org***

First, a few details about the project. Xcel is proposing to build two solar photovoltaic projects to replace two coal-fired generators at its Sherburne County Generating Station site (Sherco Units 1 and 2). Each unit is rated for 680 megawatts (MW) of capacity. These units were put into service in 1976 and 1977, and are to be retired in 2026 and 2023, respectively. These generating units will be retired roughly ten years ahead of their original retirement dates. The 876-MW Unit 3 generating plant is only 59% owned by Xcel, which is probably why it is not being included in the planned transformation of the generating site. The three units have a combined generating capacity of 2,238 MW, making it the largest power generating site in Minnesota. The BNSF Railway delivers between 20,000 and 30,000 tons of coal from the Powder River Basin of Montana and Wyoming in up to three 115-car trains per day. The three generating units employ a daily workforce of 350.

Xcel is planning to acquire a 230 MW solar site under development by NG Renewables to the west of the generating plant, and to develop its own 230 MW project to the east. A total of 3,480 acres of land is being acquired. This agricultural land currently is used for hay/pastures, row crops and irrigated farmland. Presumably, all the land will be covered with solar panels. The project will develop two collector substations and two 345 kV (thousand volt) generator-tie lines to connect the solar panels with the existing plants' substation and transmission lines.

As part of the project, when Unit 2 is retired in 2023, nearly 680 MW of interconnection capacity will be freed up. Presumably, another 680 MW of interconnection capacity will be freed up when Unit 1 is retired in 2026. Under Minnesota power regulations, this interconnection capacity can be retained for up to three years before being lost if not utilized. Xcel, in its filing, estimated that the value of the interconnection capacity is worth between $140 million and $350 million, which we assume reflects the value of one to two units.

There are several excerpts from the North Dakota Public Service Commission filing that are very telling about the economics of solar and fossil fuels and the motivation for renewable energy projects. The first deals with the fact that other than being driven by the requirement to meet increased clean energy mandates in Minnesota, the proposed solar project would not be necessary, or at least not needed for many more years.

> In our following resource planning cycle (2016-2030), the Company similarly identified a capacity shortage on the NSP System in the mid-2020s, noting deficits of 1,341 MW in 2025 and 1,936 MW in 2026. In the Supplement to our 2016-2030 IRP, we noted that this capacity need arising in 2024 and expanding significantly in 2025 and 2026 was caused primarily by the Company's plan to cease coal operations at Sherco Units 1 and 2 in 2026 and 2023, respectively, along with other changes to our generating resources.

In other words, if they did not shut down these generating units, there would be no capacity shortage. Xcel further acknowledges that the motivation for the solar project is driven by Minnesota's clean energy policy that prefers the use of renewable energy resources, regardless of the cost/benefit analysis. The investment is also driven by a desire to help the economy recover from Covid-19, which will be over well before these plants are built.

> The Company is pursuing Sherco Solar to fill this capacity need consistent with the selection of solar resources pursuant to our most recent IRP Preferred Plan, which is a Minnesota-based resource planning analysis. Further, **development of solar resources at the Sherco site in Becker, Minnesota advances Minnesota state clean energy policy goals by meeting the state's preference for renewable energy resources, and helping meet the state's greenhouse gas emissions targets**, Renewable Energy Standard (RES), and Solar Energy Standard (SES). Additionally, the Sherco Solar Project was initially proposed in response to the Minnesota Public Utilities Commission's (MPUC) investigation to identify investments that utilities could undertake to support economic relief and recovery in the wake of the COVID-19 pandemic. **Xcel Energy thus fully acknowledges that this resource addition is driven by Minnesota policy priorities**. (emphasis added)

Xcel also admits that this is not the cheapest power generation source.

> The Company further recognizes that the selection of a solar resource to meet this capacity need is not consistent with North Dakota planning priorities. **Specifically, when externality values are excluded from the modeling, as required under North Dakota law, Sherco Solar is not the least cost option for filling the identified capacity need in 2026**. Rather, the "North Dakota Plan" resource planning analysis in our most recent IRP selected a dispatchable resource, modeled as a greenfield combustion turbine (CT), to meet the identified capacity need. (emphasis added)

In effect, the filing is requesting approval of Xcel's plan to model a hypothetical power generation plant's costs for determining what to charge North Dakota ratepayers versus what the actual solar plant costs will be, which will be assigned to Minnesota ratepayers. Because Xcel knows that the costs are disproportionately weighted against Minnesota ratepayers, it is assigning all the benefits from clean energy projects such as renewable energy certificates generated from the clean power produced and then sold to companies needing emission credit offsets to them. Xcel is forced to prepare its economic analysis using bid numbers for the solar plants, but theoretical numbers produced from methodologies designed to estimate costs using other technologies and pricing estimates.

> In the Company's Preferred Plan in our most recent IRP, the planning model selected a 500 MW solar resource as the optimal resource to add in 2025 to fill a capacity need in 2026. **However, under North Dakota planning assumptions which prohibit consideration of externality values, the model selected 374 MW of firm dispatchable capacity as the optimal resource to fill this identified need**. To reflect the costs of this North Dakota modeled resource and maintain the NSP System structure, the Company proposes to use a proxy pricing mechanism to ensure North Dakota rates are not adversely impacted by the energy preferences of another state but rather reflect North Dakota law and policy priorities. (emphasis added)

Not surprisingly, all the analysis of the cost of the respective plants – solar versus combustion turbine – and the rates and returns were filed separately under seal of trade secrets. Thus, we have no way of assessing how close or far apart are the economics of the respective technologies. One cannot even be assured that the solar plant, even with the externalities assigned, is the cheapest option in Minnesota. In fact, we would wager it is not. This solar project is being dictated by the requirement to meet Minnesota's clean energy mandate, even though it will increase the state's ratepayers bills when there was no need other than to fight greenhouse gas emissions, which will probably accomplish little in that battle. After reading these filings, is there any wonder why the economic claims about clean energy are questioned?

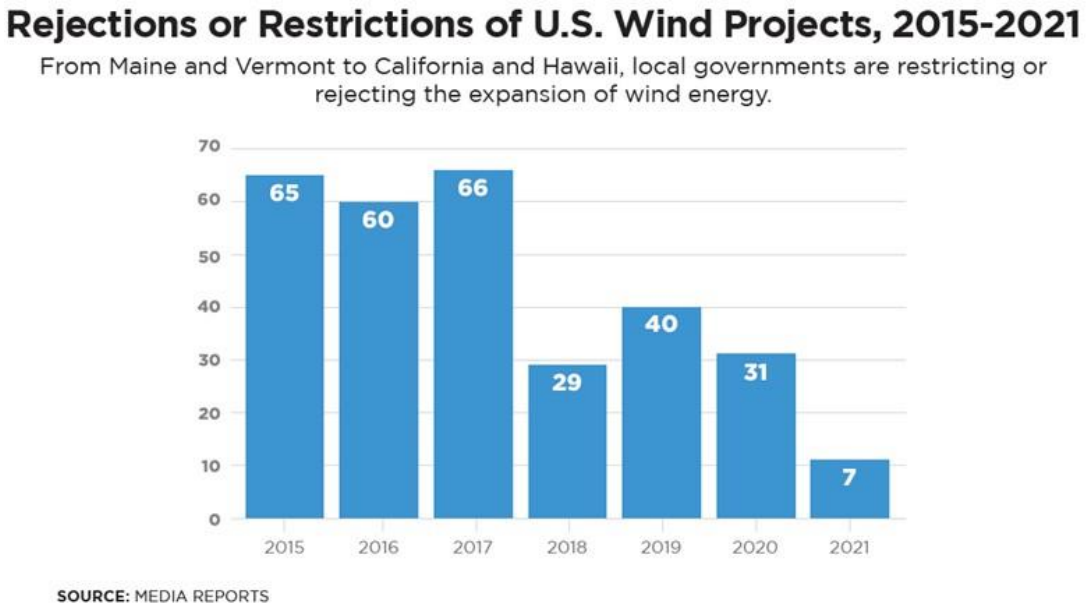
## Issues Surrounding Wind Power Are Gaining Attention

Solving climate change necessitates abandoning fossil fuel generated power and replacing it with power from renewable sources – preferably power coming from wind turbines or solar arrays – at least according to climate activists, and now the International Energy Agency (IEA). Wind energy is gaining attention because offshore wind is a key energy source in transitioning the United States economy to net zero carbon emissions. Onshore wind will play a supporting role in the electrification of America's energy market, but its contribution will wane as offshore wind resources are developed.

Decarbonizing the economy requires electrifying everything, and then getting all the power from clean energy sources. This is an attractive proposition on paper, but the reality of towering wind turbines and acres of solar panels in communities has the public less than enthralled. For neighboring residents, wind turbines can mean constant noise disturbances and vibrations that make sleeping difficult, as well as causing other health issues. This is in addition to the visual pollution from hundreds-of-feet-tall steel towers with whirling blades capturing the breeze to turn into electricity.

According to energy writer Robert Bryce who tracks wind energy intensely, since 2015, about 300 local government entities from Vermont to Hawaii have rejected or restricted wind projects. This figure comes from a database on wind project challenges – National Renewable Energy Rejection Database – being updated regularly by Center of the American Experiment. The database contains links to additional information about the challenges such as local newspaper articles or court judgments. A chart shows the number of challenges each year. There has been a decline in the past three years, for which there is no single explanation. Quite possibly wind farm developers have become more selective in where they decide to locate turbines, or maybe communities have become more tolerant.

**Exhibit 7. The Public Is Speaking About Its Feelings Toward Wind Turbines**




**Source: Robert Bryce**

The rejections and restrictions are usually in response to neighbors fighting the adverse health impacts from living adjacent to wind turbines. The primary complaint is from noise, which can lead to sleep deprivation. Although associated vibrations can also create health problems, this is seldom pointed to as a problem. In some cases, complaints arise from the visual "flicker" effect caused by the rotating blades. This is separate from the visual pollution issue, which upsets most people. Having to look at towering steel poles supporting the rotating blades is not a pretty picture. Visual pollution complaints come from homeowners who paid substantial money to secure those attractive vistas, only to have them obscured by an array of wind turbines disrupting the views.

As we are following numerous wind farm initiatives around the country, both onshore and offshore, we notice a growing number of concerns leading to likely additional rejections. For example, an item from *The Grundy Register* (Grundy Center, Iowa) published on May 5, 2021, said the Board of Supervisors of Grundy County scheduled a vote for May 10th on a wind farm moratorium dealing with a proposed wind farm for the northeast corner of the county. The item noted: "with all of the feedback received thus far opposing it vehemently." That sounded like an upcoming rejection, which became a fact a few days later.

The heavy hand of government promoting wind energy is also being smacked down. The State of Illinois General Assembly is considering legislation to remove a county board's ability to create its own ordinances concerning wind farms, and that any county with such a zoning ordinance must comply with the statewide statute within 30 days of the bill's passage. The state zoning ordinance would control all setback requirements, blade tip height limitations and sound limitations. It would limit all home rule powers. If enacted, local residents would be powerless to establish rules for wind farms that are acceptable to them if their rules clashed with the statewide rules. Such a restriction is likely to prompt lawsuits over the state's actions.

A major problem for wind energy is its intermittency. A wind watch newsletter reported that a letter to *The Herald* in Scotland commented on Renewable UK shouting about wind energy

setting a record on May 3rd for the country by generating 17.6 gigawatts (GW) of output briefly, nearly half its total demand. The wind farms have a theoretical output of 19.5 GW. Thus, the achievement was extraordinary. As the U.K. grid operator National Grid ISO reported, at 3:30 pm that cool and blustery Monday onshore and offshore wind produced 48.5% of the electricity for England, Scotland, and Wales. Natural gas accounted for 21.7%, nuclear 12.0% and biomass 6.1% of the electricity supply at that time. Renewables overall performance was certainly helped by that Monday being a Bank Holiday when electricity demand is lower.

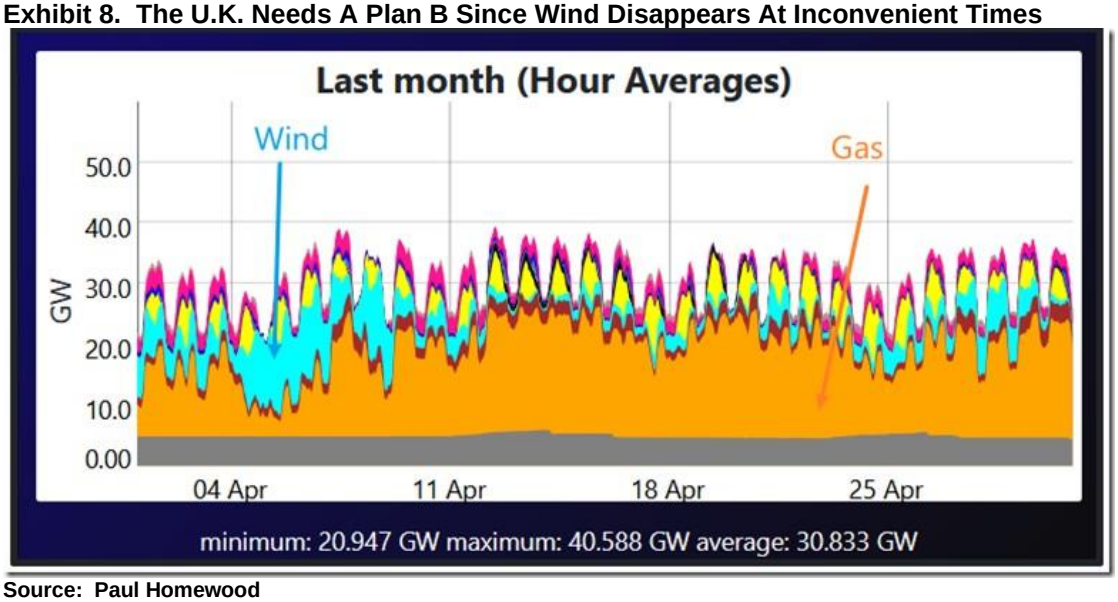
The electricity mix was slightly different for all of May 3rd. Wind's share for the full day was down to 35.2%, natural gas' share increased to 30.4%, while the nuclear share was up to 14.9%. Interestingly, imported power accounted for 8.3% of the day's electricity supply, a surprising result given the holiday-reduced electricity consumption. Renewable biomass represented 7.2% of the power mix, followed by solar at 2.8% and hydropower at 1.2%. Coal was the final power source representing just 0.1% of total electricity supply, which was welcomed by environmentalists.

The problem with the hype over the success of wind energy that day, as the Scottish letter writer pointed out, was that for the prior three days the output of the metered wind farms "flatlined below 2GW." The letter writer also pointed out that in a world of 100% renewable energy, U.K. residents would have experienced rolling blackouts if other power sources failed to step up!

Intermittency continues to haunt wind energy, as policymakers here and overseas push this supply source as the solution for climate change. In the U.K., wind has become the primary renewable energy source, as the government strives to reduce its carbon emissions. With residents beginning to push back on new onshore wind farms, the U.K.'s offshore wind industry has benefited. That is, of course, other than relying on imported power from the continent.

A problem for the U.K. was that during the month of April, wind power disappeared, just as it had for those three days prior to the Bank Holiday. A chart showing the hourly averages of electricity by fuel source for April clearly demonstrates how wind disappeared after April 9th and did not return until the end of the month. The chart brings back memories of the power supply mix chart for Texas during the few days before the arrival of the polar vortex and during the days of bitter cold temperatures that contributed to the major power crisis. In Texas, wind has become a major power source (23% in 2020, passing coal to become the second leading source of electricity). However, it disappeared, underperforming ERCOT's expectations, immediately prior to the collapse of gas supply and the localized blackouts.

**Exhibit 8. The U.K. Needs A Plan B Since Wind Disappears At Inconvenient Times**




**Source: Paul Homewood**

The weather in April in the U.K. is often dominated by high pressure that stifles the wind. This April, wind only contributed 11% to the U.K.'s electricity supply, averaging 3.4GW per day. If one includes embedded wind power, which is not included in the chart, total wind power would be about 4.4GW. For much of April, wind power was much lower, at times contributing less than 1 GW. With current wind power capacity at 25 GW, for all of April, wind accounted for about 17% of capacity, about half its average level.

Even if the U.K. had the 40 GW of offshore wind capacity planned to be installed by 2030, it would have only generated about 9 GW of power. That would still leave the U.K. heavily dependent on natural gas, nuclear, and imported power. This latter supply source has suddenly become vulnerable and may force the U.K. to reassess its future energy strategy. What is the problem?

As part of its Brexit negotiations, the U.K. and European countries agreed to various policies covering trade and business relationships between the two parties. Relations with France have been in a downswing, as French President Emmanuel Macron threatened to block Covid-19 vaccine exports to the U.K. amid his own government's sluggish pandemic response. Previously, President Macron had threatened to block U.K. financial firms from operating in Europe if the U.K. did not grant French fishermen access to British waters. This threat escalated to a possible cutoff of electricity supplies to Jersey, the largest and southernmost of the U.K. Channel Islands located in the English Channel lying close to France's Normandy coast. Jersey receives 95% of its electricity from France via three subsea cables from the Normandy coast. That dependency is now a significant risk.

**Exhibit 9. Electricity Supply As A Political Weapon Is Suddenly Emerging As A Risk**

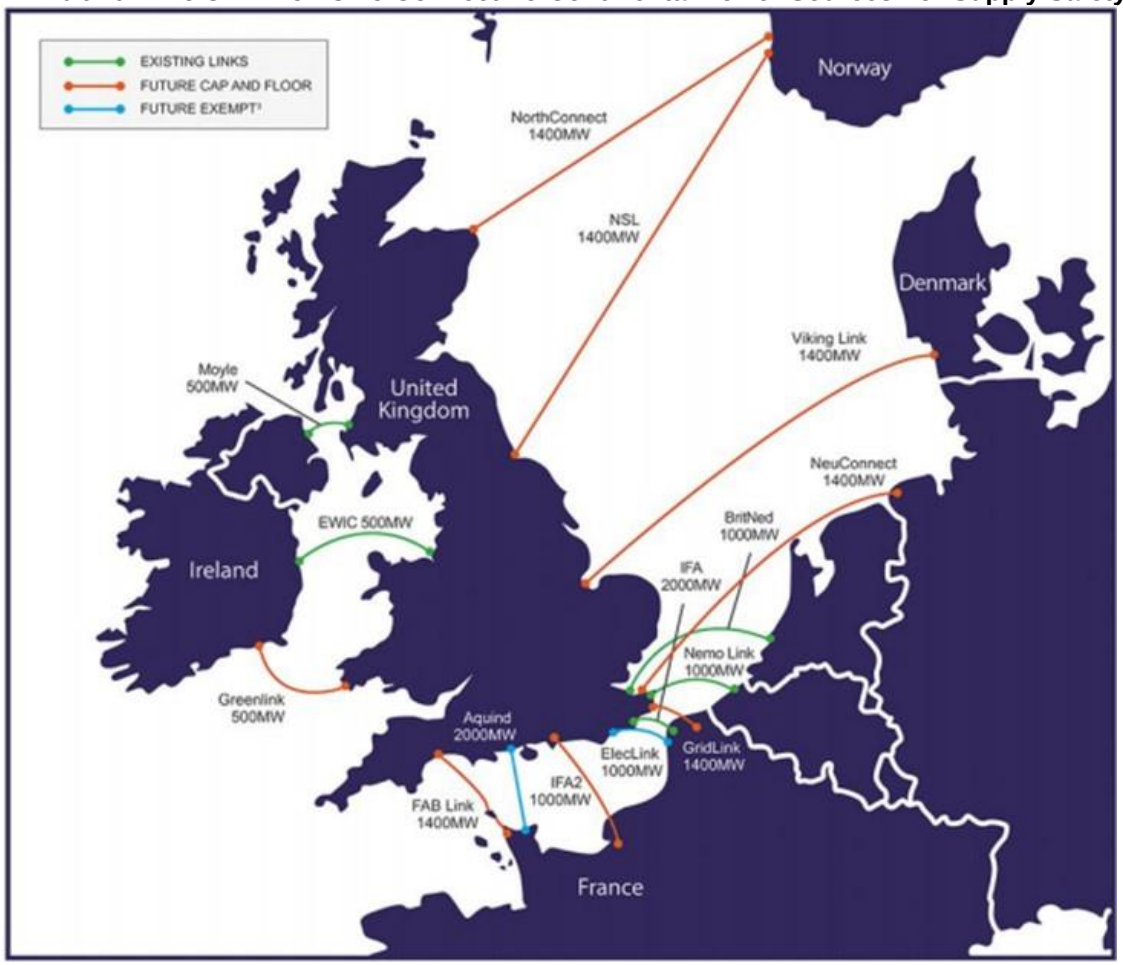

**Source:** ***offshorecompany.com***

The political tensions between the two countries have escalated, possibly due to the upcoming regional elections in France and the weak political position of President Macron. The island's officials want papers from French fishing vessels demonstrating their prior operating experience in local waters before granting licenses to fish in Jersey waters. A fleet of French fishing vessels, backed by French naval vessels, threatened to enter Jersey waters, and blockade the harbor of Saint Helier, until two British naval vessels confronted and headed off the French fleet. This confrontation is reminiscent of the Cod Wars of the 1970s when British naval ships intercepted Icelander vessels attempting to disrupt British fishing vessels operating off the coast of Iceland.

With the U.K. shifting by leaps and bounds toward more renewable power generation capacity, the country is working equally as hard to expand power interconnections with its neighbors. It currently has four major cables connecting with Belgium, France, the Netherlands, and the Republic of Ireland receiving up to 7% of the U.K.'s power needs. These interconnections also provide an export outlet for surplus renewable energy generated in the U.K. There are 10 more interconnection lines planned, which could push the total interconnection capacity up to 25% of U.K. annual electricity consumption. One interconnector just constructed is the 149-mile line from Lovedean in Hampshire, England, to Normandy, adding an additional 1.2% of capacity to the U.K.'s net import capacity. This line cost €1.1 ($1.3) billion. The proposed new interconnector

cables are in orange and blue on the accompanying map, those in green are existing interconnector lines.

**Exhibit 10. The U.K. Works To Connect To Continental Power Sources For Supply Safety**




**Source:** ***BBC***

The question for U.K. energy planners is whether relying on Europe and Scandinavia for up to a quarter of the country's power supply is a risky proposition? What is Plan B if this power supply is unavailable, or worse, used as a political weapon, as it seems in the Jersey situation? While there is sufficient surplus electricity in the region allowing for moving supplies around to help various countries balance their power needs, what happens in the future when everyone is relying 100% on renewable energy? In such a scenario, it is not inconceivable for all countries to have power surpluses and power shortages at similar times. There may be some small imbalances due to time zone differences, or differing weather patterns across the region, but their magnitudes will not prevent power shortages.

What is known, however, is that everywhere renewable energy has been hailed for its market dominance, fossil fuels are needed to provide power when the wind ceases and the sun disappears. We see this problem growing in the U.S. A study reported that between 2015 and 2020, the number of blackouts annually in the United States doubled. There are other studies of earlier periods showing similar increasing trends in the number of power blackout experienced.

Some of the outages are attributed to the age of the nation's electricity grid, while others attribute it to extreme weather events, outside of tornadoes, hurricanes, and floods. Because virtually every country's electricity grid is aging, the rise in blackouts is not unexpected. What will become more likely is that the increased reliance on intermittent renewable power, without adequate storage backups that can provide power for extended time periods, will contribute to increased numbers of blackouts. The experiences of California and Texas clearly show the human suffering and economic costs of blackouts. This problem needs to be addressed before we allow renewables to grow to levels that ensure blackouts become a fabric of our lives.

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