SPECIAL REPORT

# How the Palisades Nuclear Plant Worked

*And Why Wind and Solar Can Never Replace It or Fossil Fuels*

By Shawn Connors

*"You don't need to challenge the data to invalidate it. You merely need to read the data. It will invalidate itself."*

**— Al Lewis**

We are in an era of suspended reality. Here's a dose of sanity.

Michigan will require an additional 209,000 more acres of surface area for mainly wind turbines by 2035. Or so "they" say. That figure is to get Michigan to its 60 percent zero-carbon renewable energy goals by 2035. According to Dan Scripps, Chairman of the Michigan Public Service Commission, the state currently uses 17,000 acres for wind and solar. It turns out that the state could permit a half-percent of Michigan's acreage for wind and solar projects under the new energy laws. Michigan has 96,713 square miles of land. A half-percent of that is 483 square miles (309,120 acres). Looks like the state is prepared to Big Foot (overrule local communities) for an additional 100,000 acres more than they say they need, if necessary.

**Note:** My back-of-the-envelope calculations for what Michigan would need to meet its 2035 clean energy benchmark goals dwarf all state estimates that the media has repeated. In this report, however, I am using the state's own data and known energy statistics to display the futility of the state's new clean energy laws.

The US Department of Energy report, "On The Path to 100% Clean Electricity" states, "Rapid decarbonization of the power sector is a critical strategy for meeting the nation's climate goals of reducing economy-wide greenhouse gases by 50-52% below 2005 levels in 2030, on the way to net-zero economy-wide greenhouse gas (GHG) emissions by no later than 2050." Michigan's Governor Gretchen Whitmer is aggressively pushing those federal mandates on a state level. See my LinkedIn article, "Re-Power Palisades to Keep the Lights on in Michigan." Spoiler alert: I call those energy laws the Michigan Blackout Bundle (MBB).

## How about a head check before industrializing rural Michigan and some of the Great Lakes?

Michigan's politicians underestimate the surface area needed to turn the state into an energy Shangri-La. James Hilton introduced that Eden-like fictional place in a 1933 novel called "Lost Horizon." I can't make this up. And the politicians are not underestimating surface area requirements by just a little bit. How do I know? Physics. One of the many attributes of the laws of physics is that they're in the public domain. You'd think they were top secret by the number of times energy policymakers and regulators ignore them.

The Michigan politicians plan to transition to wind and solar energy between now and 2040 — and be at a 60% clean energy metric by 2035 — as they diminish coal and natural gas use. Under that scenario (using their own numbers), the actual surface area required would be more like 1.2 million acres (equal to 8 percent of Lake Michigan). Before I explain more, let's look at how physics worked in real life at the Palisades nuclear plant.

## The Physics Behind Palisades

First, it's important to point out the difference between power and energy: They are two different things. Here's a good example posted on Byju's website, "Power is something like the strength of a weightlifter, whereas energy is said to measure how long he or she can sustain that power output." Imagine asking someone how much they can bench press, and they say, "10 reps." That's what it sounds like to an engineer when we mix up these terms. The correct answer should have been the capacity, i.e., 100 pounds (power). The reps are work (energy). As you read through this report, power will use MW (power), and energy will be in MWh (energy). The h stands for hours and is duration.

The Palisades nuclear plant was turned off in May 2022; and with it, about 800 megawatts of 24/7 electrical generation stopped being fed into the MISO grid (MISO is the grid operator that gets electricity to Michigan homes and businesses, plus 14 other states in the Midwest, spanning from north to south). That was 5 percent of all Michigan's electrical power. And it was all CO2-free. If you think CO2 is a deadly planet killer, that should be a good thing. See this 2022 petition letter to Governor Whitmer that explains why Palisades needed to stay open.

In defense of Governor Whitmer, she now favors re-powering Palisades. She has advocated for it, directing up to $300 million in state funds to make it happen and asked the US Department of Energy to make a $1.5 billion loan to Holtec, the current owner of Palisades. Holtec would use that money to upgrade and refuel the plant. And Governor Whitmer did come off the bench to save Palisades in the months before it closed down. We'll take that leadership without too much grumbling about, "Where the hell have you been?"

Guess what replaced Palisades' power production? Palisades' closure increased Michigan's coal and natural gas dependency.

Palisades put out enough power to supply about 650,000 (mostly) Michigan homes and businesses with energy. To understand the importance of Palisades in meeting Michigan's energy needs, some easy-to-understand basics of physics will need to be brilliantly and briefly explained.

**The First Law of Thermodynamics:** Energy in the universe can't be created or destroyed. The amount of energy in the universe remains the same. The energy just changes its state. The trapped energy in the uranium atom (which was tightly bonded together from a supernova millions of years ago) is released inside the nuclear reactor core when a neutron splits it. That energy is changed into heat, then into steam, then into kinetic energy (spinning turbines), and then sent down high-voltage lines as electrical energy.

**The Second Law of Thermodynamics:** We cannot have a regular, repeating process (think of a loop) that converts heat (power) 100 percent efficiently into work (flowing electricity). That means we lose a lot of energy while changing from heat to steam to create kinetic energy that changes into electricity. Then, we lose more of it when we transmit it over distances.

## How those laws worked inside Palisades' reactor

A megawatt of thermal power is abbreviated as MWth. All the energy we consume has to start somewhere as thermal power. Scorching hot. A megawatt of electrical energy is abbreviated MWe. We must get from MWth to MWe (then down stepped to kWh) to consume the energy at home.

The Palisades' Westinghouse 425-ton pressurized water reactor (PWR) produced around 2,550 MWth inside its core. That thermal power was changed (via heat exchange) into about 800 MWe. So, changing from 2,550 MWth to 800 MWe caused about a 70-percent energy loss. That's consistent with what the literature says. See Lehigh University Environmental Initiative for a good schematic of this process.

Energy density is the total amount of energy in a unit of volume. Uranium, the nuclear fuel that powered Palisades, held enough energy in a pencil eraser tip-size pellet to equal one ton of coal. According to the Nuclear Regulatory Commission (NRC), a reactor like the one at Palisades may contain up to 10 million uranium pellets. That's why nuclear fuels are about 8,000 times more efficient than fossil fuels. That density allows us to create more heat and more power. Palisades got through the gauntlet of the Second Law of Thermodynamics with enough power left to give the end users a reliable stream of electricity.

## Palisades was a workhorse.

According to Wikipedia, in its last full year of operation (2021), Palisades put out its 800 MWe, 24/7 (no matter the weather) without a pause. Palisades didn't have to re-fuel that year. Palisades' capacity factor was 99.2 percent in 2021.

According to Statista, in 2022, all US nuclear power plants had an average capacity factor of 92.6 percent. That is the percentage of the total time the reactor operates at full power. For example, as a fleet, each of the 92 US nuclear reactors in 2021 worked 338 days out of every 365. There are 54 nuclear plants — 32 have two or more reactors. The Palisades nuclear plant has one reactor.

Let's establish how many homes one MW can power for the purposes of this report. According to the Nuclear Regulatory Commission (NRC), one MW of electricity can power 400 to 900 homes. According to the Michigan Environment Watch reporting at Michigan Bridge, Palisades produced enough power for 800,000 Michigan homes. That sounds high to me. Considering more electric vehicles, warmer summers, and growing demand for energy, let's say Palisades provided power for 650,000 homes. That means one MW can power 812.5 homes. Hold that thought; we'll come back to that formula.

## Quick thoughts:

**a. Density:** The denser a fuel, the more power we can produce from a smaller footprint. Then, the closer we can get to the source where the heat or electricity is turned into work, the more efficient the whole process is.

**b. Capacity definitions:** According to the Office of Nuclear Energy, "nameplate capacity" measures the maximum level a power plant can supply at a given time under certain conditions. How much power the plant produces when operating is called "net capacity."

The media usually uses the nameplate capacity of a wind turbine(s) and refers to it simply as "capacity."

**IMPORTANT** (emphasis is mine): According to Wind Energy Basics, a wind turbine's nameplate capacity (rated capacity) is the amount of power the turbine would produce if it ran 100 percent of the time at optimal wind speeds.

**Question:** How often do optimal wind speeds occur in nature? Answer: For wind turbines and solar panels, almost NEVER. We can only catch so much wind and sunshine in a tech-net. But nuclear reactors deliver very close to their plate capacity. Palisades' nuclear reactor nameplate capacity is 805 MWe. It delivered 798 MWe, 24/7 in 2021.

**c. Average net capacity** (33 percent): The University of Michigan Center for Sustainable Systems Factsheets states, "Capacity factor of land based wind in the U.S. ranges from 21 percent to 52 percent and averages 35 percent." That's a big spread. For this report, let's set the average net capacity for a Michigan wind turbine at 33 percent (winters are rough in Michigan).

**d. Weather dependent:** Wind (motion) energy and solar (radiant) energy must be captured and turned into electrical power in real-time. Fossil fuels and nuclear fuel do not depend on the weather. Thus, their net capacity is irrelevant regarding the issue of reliability. As mentioned earlier, nuclear fuels have a net capacity of more than 90 percent. And fossil fuels, on average, have a net capacity of 50 percent. Those fuels are available anytime we want them. That availability is called dispatchable.

**e. Different meanings:** The Second Law of Thermodynamics, and density, and capacity are three different things. I think of the Second Law as a measure of natural entropy affecting everything. It's the physics of what's going on as energy changes states. Density is the amount of energy in a volume of fuel; Density = Mass/Volume (d=M/S). And capacity is a measure of the efficiency of the machine that produces power from the fuel.
Why was Palisades shut down in 2022?

An entire report could be written on that subject. Read more about how US electrical grid regulation and politics caused that in Meredith Angwin's brilliant book, "Shorting the Grid". In short, Palisades was shut down for economic reasons unrelated to the plant's performance metrics. No operational or safety issues would have required it to be retired.

## What replaced Palisades' power output?

Kara Cook, Chief of Staff with the Michigan Department of Environment, Great Lakes, and Energy, reported that Palisades' power generation was mainly replaced with natural gas. More coal was involved here, but I'll cede the point. She has gone on record as favoring the re-powering of Palisades. In an article in the Homeland Security News Wire, Chief Cook said, "This is really important to us not only from a climate perspective, but also the economic impact on the region."

## Why not just switch to wind and solar after Palisades closed?

Why did the powers-that-be use natural gas to replace Palisades' power instead of wind turbines? Because Palisades produced more power in 2021 than all wind turbines and solar panels in Michigan combined. Michigan's wind and solar fleet could not put out that power level reliably 24/7. But natural gas or coal could. And did.

If the state's politicians had insisted (via law) that Palisades' power vacuum had to be replaced with just wind and solar, there would have been controlled, rolling blackouts across Michigan (also called load shedding). And the MISO grid would have become stressed. Politicians do not like to face their constituents when electrical blackouts occur. Diablo Canyon's nuclear plant in California recently got a five-year reprieve mainly because politicians knew without its power production, blackouts would dramatically increase in California. Physics at work again.

## Wind and solar require 24/7 backup.

Many people outside the energy industry don't realize that all wind turbines and solar farms must have natural gas plants spinning all the time to back them up. When the wind dies down or the night comes, a new power source must fill that void within seconds. Coal plants can back up wind and solar, too, but Michigan is taking 6,000 MWe of coal offline by 2035.

## Wind/solar & the Second Law of Thermodynamics & Orange Orchards

All electrical generation starts with heat. The sun is a nuclear fusion reactor for wind and solar. The heat from the sun comes to Earth as solar radiation. According to NASA, averaged over an entire year, 342 watts of solar energy fall on every square meter (about 11 square feet) of Earth's surface during the day (342 Wh). According to Solar.com, solar panels convert about 23 percent of that energy into electricity. So, each 11-square-foot piece of land via solar panels will produce 78 Wh when it's sunny. Let's say that an 11-square-foot area could keep one 75-watt light bulb burning. That will require a lot of land if we're going to power civilization with it. This leads to discussions like, "So Hank, what would you take for your entire orange orchard?" Interestingly, solar development often reports the plate capacity power of a solar farm but never the total acreage it covers or what productive use of the land it is replacing.

The sun creates atmospheric and surface heat as its energy hits our planet. That atmospheric heat also makes wind. So, wind is solar energy, too.

Here is where the Second Law of Thermodynamics starts working against wind and solar. The sun is 93 million miles away (149 million kilometers). It would take 19 years to get there in a jet. But a photon of light makes the trip in eight minutes and 20 seconds. That's a long time in the world of physics. When solar radiation hits our atmosphere, humidity and $CO_2$ absorb about a third of that energy, diluting it further before it reaches the surface. We lose a lot of solar energy in that long transmission. If we like to be alive, that is a good thing. By the way, the sun's photons also hit Earth's atmospheric nitrogen molecules, which creates naturally occurring tritium — don't even get me started.

All our energy comes from the universe around us. Even the energy we consume. Here is an excerpt from my "Quick Read Nuclear Energy Guide," which is available as a free PDF.

The calories you use as fuel were collected from the sun's energy and condensed by plants, or even more condensed by animals eating the plants. You then consume the plants or the animals (or animal products) to get a more condensed form of calories.

Fossil fuels are condensed solar energy, too. They are the compressed remains of biological life, although there is a theory that some oil or natural gas may be produced via heat from the Earth's core to the surface. Decaying potassium, uranium, and thorium make up the Earth's core. The Earth's core is a nuclear reactor that makes life possible. Look at the new book, "EARTH is a Nuclear Planet: The Environmental Case for Nuclear Power" by Mike Conley & Tim Maloney, in cooperation with Generation Atomic.

The energy released in ancient supernovas arrived here millions of years ago (thankfully) as densely packed uranium and thorium. Those elements arrived on Earth as meteorites, comets, and fast-moving space debris. One golf ball size of thorium or tennis ball size of uranium can power a high-energy individual's entire lifetime.

## Nets & can openers

Think of wind turbines and solar panels as big collection nets, pulling diluted energy from the atmosphere. Whereas nuclear reactors are more like high-tech can openers. That's because nature (via supernovas) has already collected massive amounts of energy and put it in a small, hard-to-open canister (the elements of uranium and thorium). We can also make plutonium from those elements, but that's another story.
Trains, ships, trucks & pipes — Yikes!

Maybe you've seen big oil or natural gas tankers at sea or an oil or natural gas pipeline being installed for miles at a time. Perhaps you had to wait at a railroad crossing while hundreds of cars brimming with coal went by. Or you saw truckloads full of coal being transported down a road. And don't forget the gasoline trucks ubiquitously filling up the tanks at the local gas station. Or the propane trucks making home deliveries. Agricultural and biomass commodities, which are also condensed energy forms, might also be in some of those vehicles.

Why are they moving all that stuff around? Everywhere? All over the Earth? Let's go back to the First Law of Thermodynamics. We know energy doesn't go away; it just changes states. It turns out it's better to transport it as a solid or liquid while moving it closer to where it's needed. Then, change its state or burn it once it is delivered to its destination. We have a lot of control over where we can put and store those fuel shipments.

What all those transportation systems have in common is they are, in fact, transmitting energy. When that fuel is converted into heat, or heat then into electricity, it's close to where it's needed to mitigate the Second Law of Thermodynamics. The longer energy has to be transmitted, the more we lose it.

Suppose we want to power a state or a country with primarily wind and solar energy. In that case, all that transmission has to go from trucks, trains, and ships into high-voltage transmission lines because that is the only way we can transmit electricity. And the government now wants to electrify everything. We'll need tens of thousands of wind turbines and solar panels to produce the power production loss from not using fossil fuels, and then thousands of miles of new high-voltage transmission lines to get the energy where it needs to be. It's not going to happen.

Wind turbines and solar panels collect their energy from the atmosphere and convert it from DC power to AC for transmission, then transmit it, boost it, and re-transmit it thousands of miles. Battery storage will not create power; batteries will just store it. And it will be another heavy Second Law of Thermodynamic tax on that loop. Power production and electricity transmission in a wind- and solar-dominated world would look more like the 19th century than the 21st century.

## Back to Michigan — the winter, windless, watt-less land

Here's a quotation from a Michigan Bridge article, "There are 1,658 turbines across the state churning out 3,527 megawatts, enough to light at least 1.4 million Michigan homes…" Let's examine the data:

**a.** A quick division of 3,527 MW / 1,658 turbines tells us each unit in this fleet averages 2.12 MWs. That sounds about right.

**b.** But according to the spreadsheet for the Michigan Utility-Scale Wind Farms located on the Michigan Public Service Commission (MPSC) website, where this data seems to have originated, the 1,658 turbines and the 3,527 MWs they produce are totals. Below that line are "operational totals." There are 1,509 turbines, producing 3,102 megawatts. The 2 MW per wind turbine still holds. That operational number is more realistic. The footnotes say, "…includes all wind farms operational, planned or under contract with an MPSC-rated-regulated electric provider. Additional wind farms are included as MPSC Staff becomes aware of the project."

**c.** At "least 1.4 million" Michigan homes powered by wind turbines sounds like a wild guess. They must not know for sure. But we can help. Electrons are fuel source agnostic (just like energy policymakers in China, India, and Indonesia). So, let's go back to our universal formula (for this report): 1MW = electricity for 812.5 Michigan homes. So let's take 3,102 MW X 812.5 = 2,520,375 homes powered. Can that be right? There are more than 3,849,000 residences in Michigan, according to the ATTOM data solutions. That means wind turbines alone fully power 65 percent of all Michigan homes.

**d.** Now, let's compare Palisades. 800 MW X 812.5 = 650,000 homes powered. That means all the wind turbines in Michigan would power six times more homes than Palisades if it were in operation. Nah, come on!

**e.** Let's make sense of this, finally. Remember net capacity? How much electricity is actually produced compared with plate capacity? In 2021, Palisades ran at 99 percent net capacity. Let's see what happens if we take our 33 percent net capacity average for wind turbines.

**f.** 3,102 MW plate capacity X .33 = 1,023.6 MW X 812.5 homes = 831,187 homes powered by wind turbines. Not the "at least 1.4 million homes reported."

**g.** What's going on? As usual, only plate capacity is considered when referring to wind power. That comment, "at least 1.4 million homes," is a little over half (55.5 percent) of the 2,520,375 homes that would have actually been powered by 3,102 MW (see c., above). As is true in almost all reporting on wind and solar, the nameplate capacity is used instead of the net capacity. Because of that lack of discipline, the actual electrical contribution can be whatever you want it to be. But in this case, we gave one MW a standard value (812.5) and got a better idea of what was happening.

The bottom line is that officials indirectly (and probably unknowingly) infer a more significant contribution to energy security than is being delivered by wind and solar. In this case, the data presented assumes 1.4 million homes or more are being powered by wind (no idea where that number comes from), when actually 831,187 homes are. All the while, natural gas turbines are spinning in backup mode to fill power dips and meet peak demand times.

**Note:** You can use an online calculator to compare MWh to kWh if you don't want to get a headache. If you'd like a quick tutorial on the hierarchy of electrical output, see my LinkedIn post.

## Is decarbonizing Michigan's grid possible by 2040? Yes or no?

Let's say we came into $1 million and wanted to invest it. A Certified Financial Planner gives us a list of five questions to evaluate our investment ideas. A list comprising over 150 years of lessons learned and the ideas of the greatest thinkers in personal finance. If the answer is NO to any of the five questions, the investment will end up losing all our money. Just one NO and the investment is not viable.

Now imagine Michigan officials used a physics checklist of five questions. All the lessons learned in power generation in the last 150 years and the inclusion of advice from some of the best physicists and engineers. The same rules apply. They would have to answer NO on all five questions as they looked at the idea of decarbonizing the electrical grid by replacing fossil fuels with wind/solar and nuclear. Nuclear power can replace fossil fuels, but not by 2040.

Here are a few categories that could generate those five questions. Energy-transmission losses... Intermittency and unpredictability... Grid-infrastructure build-outs... Redundancy... Upfront material and rare-earth requirements... Backend-toxicity issues... Foreign-dependent supply chain... Short operational lifespan... Fragility... Grid damage... Loss of subsidies... No ability to produce thermopower... Community pushback... No baseline level storage capacity...

## Here's a sample question.

**Q.** Can we build out the Michigan electrical grid enough to deliver 60 percent clean energy to all end users by 2035?

**A.** NO.

Robert Bryce has written a couple of excellent articles on why this issue alone makes the transition to a grid powered by wind and solar a physics impossibility. His Substack posts are free. See “Out of Transmission Revisited.” He says, “The ‘energy transition’ depends on massive expansions of our high-voltage transmission grid. But capacity additions are falling, and per-mile costs and utility product costs are soaring.”

According to the Oxford Languages Dictionary, Intermittent is defined as occurring at irregular intervals, not continuous or steady.

Power fluctuations from wind and solar are hard on grid equipment and managers. Sonal Patel of POWER Magazine recently posted this warning from MISO, Michigan’s grid operator, “MISO Warns ‘Immediate and Serious Challenges’ Are Threatening Reliability.” Emmit Penny, Editor in Chief of Grid Brief, also posted a letter from the President of MISO, John Bear, on the same subject. In that letter, Bear says, “… the transition that is underway to get to a decarbonized end state is posing material, adverse challenges to electric reliability… key risk is that many existing ‘dispatchable’ resources that can be turned on and off and adjusted as needed are being replaced with dependent resources such as wind and solar that have materially different characteristics and capabilities.”
We’ve been warned!

## About that 209,000 acres Michigan is going to need.

Let’s assume that 209,000-acre area is a 50/50 split between wind and solar, even though wind makes up 65 percent of Michigan’s renewable mix. According to the World Economic Forum, wind requires more surface area than solar panels.

**Note:** I have attempted to locate, without success, the documentation used for the widely reported 209,000-acre estimate. Email and phone inquiries to the Michigan Public Service Commission at the time of this posting have not been returned. If new information is presented, I will share it in the next post.

**1.** Now multiply 3 X 209,000 to match the dispatchable (24/7) power lost from fossil fuel power production. Remember, wind and solar only have a 33-percent net capacity factor. That gets us to 627,000 acres. Of course, we’ll want to spread those acres all over the MISO grid (maybe the entire country) so wind turbines and solar panels are not subject to the same weather patterns. And that might not work, either. According to the Pacific Northwest National Laboratory (PNNL), “When we have a completely decarbonized grid and depend heavily on solar and wind, energy draughts could have a huge amount of impact on the grid.”

Regardless of where the surface area is made available, the net effect stays the same, as the other states in the grid reciprocate with industrializing their countryside, too.

**Note:** A more extended grid means we’ll lose a lot of power during long transmission routes. But let’s not assign any land mass to all those new transmission line rights-of-way to keep things simple.

**2.** Michigan also requires 2,500 MW of energy storage to exist by 2030 to start backing up wind and solar instead of using fossil fuels. Read the Energy Storage Roadmap for Michigan. But let’s be more optimistic (and kind) and say baseline capacity batteries appear. Assume they can hold a 12-hour energy supply for the whole state of Michigan.

Let's also assume they're affordable and reliable and use so little land that we don't need to calculate surface area. Do I think that's going to happen? Not a chance. But play along.

**3.** Are you ahead of me on this? Every wind turbine and solar panel contributing electricity to the grid now must be duplicated. Why duplicate wind turbines? Because around 2035, there will be hardly any fossil fuel power plants to back up the intermittent wind and solar farms; our new, totally amazing batteries will do that. But as one wind turbine gives the grid power, a second device must charge the batteries. Of course, there will be statistical and geographic considerations. But on average, that's what must happen.

**4.** So, multiply 627,000 acres X 2. That gets us to 1,254,000 acres. Who knows how much surface area someone can project if we add surface area for transmission and a hundred other things? Take all of Michigan's surface area, and it still will not work.

## Summary

Nobody can defy the laws of physics. Physics will have the last word, no matter our dreams and wishes. No amount of surface area will suffice if we think we can walk down the ladder of fuel density instead of up it.

My examples in this article were focused on the 209,000-surface area estimate based on Michigan's clean energy goals. I didn't apply Michigan's total projected energy needs, which could double by 2040, and extrapolate to wind and solar because it would be an insane exercise. I don't think the state of Michigan is projecting that new energy demand accurately into its calculations either. That assumes any calculations at all are being done.
Nuclear energy fuels will eventually displace fossil fuels simply because they're denser, more efficient fuels. But it will take decades, maybe a couple of hundred years. Most people don't think of the amount of heat process industry uses as part of total energy consumption. A chemical or cement plant uses the heat from fossil fuel combustion directly. There is no need to convert it into electricity. Wind and solar cannot produce thermo power. Only nuclear power can replace fossil fuel thermopower on Earth.
The world needs a lot more nuclear energy, fast. The COP 28 goal of tripling nuclear energy production (in about 25 countries) by 2040 isn't enough to even tread water. Even meeting COP's 3X goal for nuclear energy growth would produce a smaller total percentage in 2050 than now. We need to see gigawatt scale and small nuclear reactors being deployed everywhere. Now.

In terms of a multi-generational time span, I do not believe climate change is a risk to the planet. But if I am wrong about that, the forced transition to wind and solar energy is creating more problems and certainly much more CO2 emissions than if there was no transition or care about CO2 at all.

## I support the re-powering of Palisades in Michigan for these four reasons.

**1.** The re-powering of Palisades will help stabilize the MISO grid and provide reliable and affordable energy to Michigan's hard-working people and businesses. They deserve that.

**2.** Holtec, the current Palisades owner, plans to site two of its Small Modular Reactors on the same site in the early 2030s. The SMR-300 is a miniature, modern version of sorts of Palisades' current reactor. Thus, Palisades may be the first site in the US to deploy smaller reactors, turning itself into a model for the industry and an inspirational concept that anyone can grasp.

**3.** When it comes to Michigan and national energy policy, Palisades is a fresh breath of common sense with bi-partisan support. When the planets align in a way that we can remind ourselves we have issues that we can work on together, we should exploit that potential promise.

**4.** If we can't get the public to believe we still need fossil fuels, we'll hear much more about nuclear energy becoming a silver bullet for a climate change solution. I don't want to see that unrealistic pressure put on the nuclear industry. We'll have to greatly exceed the COP's 3X growth pledge if nuclear is going to be a bigger percentage of total power production in the world. Even then, nuclear energy will not come close to replacing fossil fuels. Nuclear must coexist with fossil fuels for a long time to come.

If we're going to avoid a global energy scarcity crisis, we will have to acknowledge the laws of physics. The sooner, the better.

Shawn Connors is a former small business owner from Kalamazoo, Michigan, and the author of the non-fiction "Quick Read Nuclear Energy Guide," available as a free PDF at http://tinyurl.com/3npubnzb, and the novel "Chain Reaction, A Story About Power in the Age of Climate Change."