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The PJM Grid in Peril: What Will Keep the Lights On?

Summary

The PJM electric grid system is like a favorite sweater, wearable with just a few loose threads. With a little careful work and attention, it will continue to provide the comfort and security we need. Instead, government policy makers in Washington and across the states are pulling at those loose threads, threatening to unravel the entire network.

Among the findings:

- **Fossil Fuels and Nuclear Power Dominate:** Together, they provide nearly all the power (92%) on the PJM grid.[1]
- **Limited Renewable Energy Production:** Most of the PJM states produce little wind and solar power, less than 5%.
- **Reliance on a Just Few States:** Most PJM states already don't generate enough electricity to meet their own demand and must rely on other states like Pennsylvania.
- **Government Policies Increasing Risk:** Despite the growing reliance on electricity, government policies are pushing to close fossil fuel plants at the same time many states are requiring 50% or more of their power consumption to come from renewables.
- **Potential Supply Shortage by 2030:** The combination of the growing demand for electricity, the closing of fossil fuel generating plants, and insufficient new reliable generation is "nearly certain" to lead to a supply shortage by 2030, if not sooner, according to PJM.[2] "That math is not good," PJM says.
- **Pennsylvania's Critical Role**: Pennsylvania is the keystone that makes PJM work. Gov. Shapiro's electricity proposals threaten to further disrupt the PJM grid, which supplies power to 65 million people and more than 20% of the U.S. economy.

The PJM electric grid system is the complex machine that makes modern life possible for 65 million people and more than 20% of the nation's economy. Like a favorite sweater, it will continue to provide comfort and security for decades to come with a little care and attention. But pull on the wrong loose threads, and things can unravel very quickly.

And pulling on those loose threads is exactly what policymakers in Washington and in state capitals across the region seem intent on doing.

Pennsylvania is at the heart of the issue, because without Pennsylvania and the electricity it provides to its neighboring states, PJM doesn't work.

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[1] https://pjm.com/-/media/committees-groups/committees/mc/2024/20240819-web/item-05a---2---market-operations-report-appendix.ashx

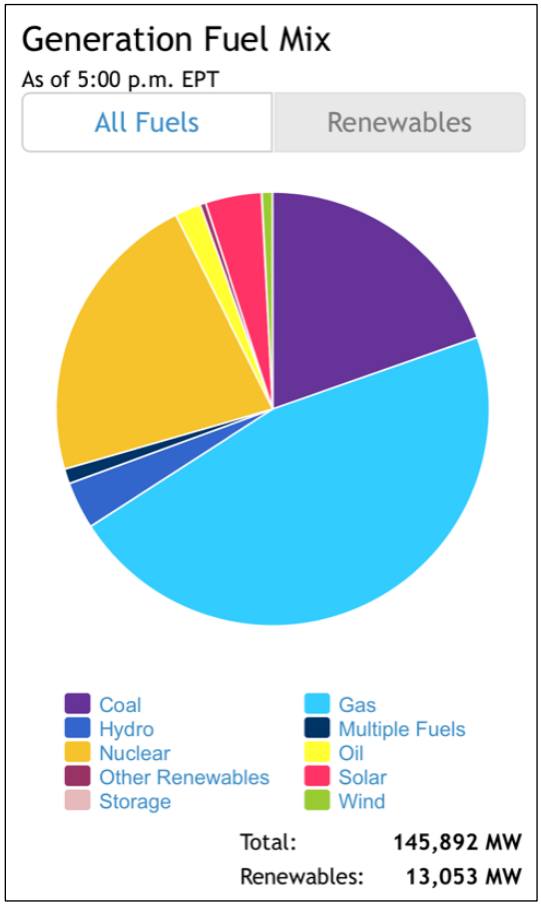
[2] https://www.pjm.com/-/media/about-pjm/ensuring-a-reliable-energy-transition/fact-sheet-for-policymakers.ashx

PJM Interconnection has issued warning after warning that we're heading toward a crisis of too much demand and not enough supply. But no one seems to be listening. "The math is not good," PJM said in a fact sheet prepared for policymakers.[3]

What is PJM and Why Should We Care?

PJM acts as a kind of air traffic control for electricity across 13 states and the District of Columbia. On a moment-by-moment basis, it looks at how much electricity is needed, where it can be produced, and ensures there are enough electrons on the right wires to get where they need to go so your local utility can deliver it to your door.

Have you ever turned on your A/C and your lights dim for a moment? That's because somewhere in the system – in your house, in your neighborhood, in your region – there's not enough electricity to meet the demand. It's PJM's job to exactly match supply and demand at every second of every day.



PJM generation mix at 5 p.m. Eastern on June 20, 2024. Source: PJM.com

To understand how quickly that network could unravel, we first need to understand how PJM, the largest grid in the country, currently gets its power. Let's look at what was happening when Summer 2024 arrived at 4:51 p.m. Eastern Time on June 20.

It was a very warm day across much of the eastern U.S., with a high temperature of 91 degrees in Pittsburgh. At 5 p.m., demand on the PJM system was 145,892 megawatts, just shy of the peak demand from the previous summer.

And what was keeping the lights on, the factories working, and the air conditioning humming?

Fossil fuels.

Together, natural gas, coal, and oil produced about two-thirds of the electricity needed.

Wind and solar provided 5%. Coal by itself produced about four times as much electricity on that hot, sunny day as wind and solar combined.

And yet, the fossil fuels that make up the backbone of PJM's generation are being targeted for elimination over the next 10 to 20 years.

[3]https://www.pjm.com/-/media/about-pjm/ensuring-a-reliable-energy-transition/fact-sheet-for-policymakers.ashx

Most of the states in PJM already don't produce enough electricity to keep their own lights on. At the same time, they're pushing policies to eliminate the sources that do provide the bulk of their electricity.

Pushing For Change

The Biden administration, harnessing the full force of the federal government, has set a goal of eliminating all carbon emissions from the U.S. electric power sector by 2035.[4] That would require a seismic shift in just 11 years.

In 2023, the U.S. power sector produced about 41% of its electricity from carbon-free sources, primarily nuclear power plants and hydroelectric dams.[5] Together, the power industry's carbon-free sources of nuclear, hydro, and renewables[6] actually produced slightly *less* electricity in 2023 than in 2022 because of a drop-off in hydro power.

The latest blow to the PJM grid came in April, when new EPA greenhouse gas regulations for existing coal-fired and new natural gas-fired power plants were finalized. The new regulations, being challenged in court, will ban all coal plants using existing standard technology by 2032.[7] Those plants accounted for 17% of the electricity produced in the U.S. last year.

The new regulations also prohibit construction of all new gas-fired baseload power plants using standard technology. Instead, it requires those new plants to capture the carbon emitted from the combustion and store it underground, a technology that has never been proven to work at scale for a natural gas-fired power plant.

It's not just the federal government that's pushing for change. Maryland and New Jersey, for instance, will require 50% of the electricity sold in their states to come from renewable sources, mostly wind, solar, or hydro, by 2030.[8] Carbon-free nuclear doesn't count.

There are a couple of challenges with that. First, neither state produces much electricity from renewables to begin with. For Maryland, it's less than 5%, according to data from the Energy Information Administration.[9] For New Jersey, it's about 2%.

Second, neither state produces enough electricity to provide power to their own residents and businesses. They need to get it from other states at the same time they are retiring their own fossil-fuel plants.

To make their renewable strategy work, lawmakers are counting on some folks somewhere in neighboring states building something to keep the lights on.

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[4] https://www.whitehouse.gov/climate/

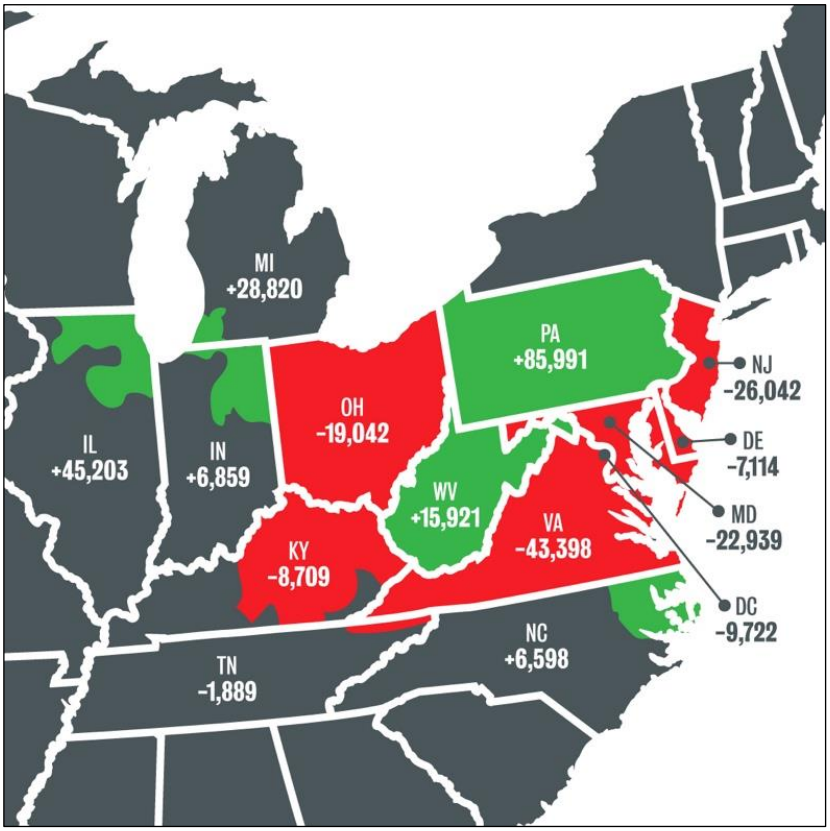
[5] https://www.eia.gov/electricity/monthly/archive/february2024.pdf

[6] The U.S. Energy Information Administration defines renewables as wind, solar, biomass, and geothermal.

[7] https://www.epa.gov/system/files/documents/2024-04/cps-111-fact-sheet-overview.pdf

[8] https://programs.dsireusa.org/system/program

[9] https://www.eia.gov/electricity/state/, State Electricity Profiles, Table 5



Pennsylvania is the largest net contributor to the PJM grid. Most of the states rely on their neighbors to keep their own lights on.

Source: PGH Works analysis of PJM 2023 Net Transfers, data, in gigawatt hours.

Maryland and New Jersey are not alone.

Most of the 13 states and District of Columbia in PJM are net importers – they don't produce enough power on their own and they rely on generation from their neighbors, like Pennsylvania, to keep their lights on. And many have existing regulations to push out fossil fuel generation and rely increasingly on renewables.

Yet most of them produce very little wind and solar power. Of the 14 members, 10 produce less than 5% of the electricity they use from wind and solar, with six of those producing less than 2%.

This comes at a time of growing demand for electricity from new uses, such as AI, and as traditional fossil fuel uses, such as cars and home heating, switch to electric.

If there isn't enough generation to meet demand, a grid operator's options are limited. It can ask for voluntary conservation measures. That's what happened on Christmas Eve 2022 when a brutal cold snap pushed demand to unexpected levels. PJM asked customers to lower their thermostats and skip using appliances to save energy.

Brownouts, reducing the normal flow of electricity, can happen automatically or can be activated as an emergency measure. The reduced flow can cause lights to dim or appliances to malfunction.

And in extreme cases, grid operators can activate rolling blackouts – deliberately shutting the power supply to different areas for some period of time so the grid doesn't go black for everyone.

If we maintain the current course, PJM said, it's a question of when, not if.

"At this pace, supply scarcity is nearly certain unless (fossil fuel) retirements slow or developers increase the speed of construction" of new generation, according to the PJM fact sheet for policymakers. That day will come by 2030, if not sooner, according to PJM.

PJM Warns of a Crisis in the Making

PJM has been sounding the alarm for several years, but policymakers continue to pull at the loose threads that will unravel the network.

PJM joined with other grid operators to try to educate the EPA on the impact that new greenhouse gas rules would have on grid reliability. The EPA agreed to temporarily hold off on any rules that would force the shutdown of the existing natural gas power plants that provide 40% of the country's electric power.

But the new rules that ban existing coal plants and limit development of new gas-fired plants were too much for PJM.

"We are seeing vastly increased demand as a result of new data center load, electrification of vehicles and increased electric heating load. The future demand for electricity cannot be met simply through renewables given their intermittent nature," PJM said in a May 8 statement. "The EPA has not sufficiently reconciled its compliance dates with the need for generation to meet dramatically increasing load demands on the system."

A "fact sheet for policymakers" that PJM released earlier this year puts it this way:

> *Demand on the system, or load, is increasing. In recent years, demand projections had remained relatively flat within PJM. But due to the rise in electrification (e.g., the steady growth of electric vehicles and electric heaters in buildings) and the rapid proliferation of energy-intensive data centers, PJM is now forecasting significant long-term and medium-term load increases – more than 40,000 MW (megawatts) in the next 15 years.*
>
> *At the same time, supply is decreasing. PJM sees significant generator retirements on the horizon due primarily to federal and state policies prompting the shutdown of fossil fuel resources earlier than their useful economic life; PJM expects to lose at least 40,000 MW of generation from retirements by 2030.*
>
> *That's 40,000 MW in load growth by 2039 and the loss of 40,000 MW of generation through retirements by 2030. The math is not good.*

PJM – and the 65 million customers it serves – got a taste of that new math last month. PJM held its capacity auction for 2025-26, a kind of insurance payment to generators to be on standby in case they're needed. The price paid at auction was nearly 10 times higher than the price paid in the same auction last year.

And two sub-zones within PJM, stretching across portions of Maryland, Virginia, and North Carolina, could not secure enough commitments to create a sufficient margin of safety.[10]

"The significantly higher prices in this auction confirm our concerns that the supply/demand balance is tightening across the (PJM grid)," said Manu Asthana, PJM's president and CEO.

Customers will pay the price, literally,

The Maryland Office of People's Counsel, the government agency which looks out for the interests of the state's residential utility customers, released a report this month on the impact the price spike will have:

- Customers across PJM will end up paying $12.2 billion more for the capacity guarantee from June 1, 2025, to May 31, 2026, than they are paying this year.
- Most Maryland residential customers will see their monthly electric bill jump by double-digits, some by as much as 24%, starting next year.

These warnings from the operator of the country's largest electric grid, coupled with an unprecedented price spike necessary to secure sufficient supply, would seem like a major story during this time of the country's energy transition. Apparently not in the country's most prestigious newsrooms.

The New York Times has written nothing about PJM's concerns about the EPA rules, nor about the results of last month's capacity auction. Neither has the Washington Post, the largest newspaper within the PJM service territory. Give *The Wall Street Journal* credit, though. It wrote about the surprising capacity auction, in a column about the impact it will have on energy company stock prices.

Pennsylvania, the Keystone State

Pennsylvania, the "P" in PJM, is literally the keystone that makes the PJM grid work. It is the country's largest exporter of electricity. Its contribution to the grid in 2023, for instance, covered the combined shortfalls in Virginia, Ohio, and Maryland.

The state is a leader in producing carbon-free electricity – only four other states produce more power from carbon-free sources. That's because Pennsylvania produces more nuclear power than every state except Illinois.

Carbon emissions from the state's electricity industry are down 40% from their peak in 2008, according to EIA data.[11] Even so, the state's power industry still produces a lot of carbon emissions because it produces a lot of electricity. Pennsylvania's power industry is #3 in carbon emissions behind Texas and Florida.

[10] https://www.pjm.com/-/media/about-pjm/newsroom/2024-releases/20240730-pjm-capacity-auction-procures-sufficient-resources-to-meet-rto-reliability-requirement.ashx

[11] https://www.eia.gov/environment/emissions/state/

Natural gas and nuclear energy combine to account for 86% of Pennsylvania's electric generation in 2022, according to the latest data available from the U.S. Energy Information Administration.[12] Add in coal's 10% share and that covers nearly every electron.

Wind accounted for 1.5% of Pennsylvania's generation. Solar provided just one-tenth of 1%.

This mix may surprise those who are aware of Pennsylvania's long-standing Alternative Energy Portfolio Standard. Passed in 2004, it requires that 18% of the power sold to Pennsylvania customers be wind, solar or other types of non-traditional generation.

Several factors account for the seeming contradiction. The law permits utilities and suppliers to purchase credits from out-of-state generators to cover some of their obligations. About 40% of the AEPS compliance credits in 2023 were purchased from out of state, according to the most recent analysis of the program produced by the PA Public Utilities Commission.[13]

Also, unlike some states, Pennsylvania has an *alternative* energy standard, not a *renewable* energy standard. This was done so that electric generators could be part of an effort to clean up some of the state's legacy environmental problems, such as waste coal piles.

In fact, about half of the AEPS credits last year involved generation from carbon-producing sources, including the burning of municipal waste, methane produced from rotting garbage at landfills, and wood chips.

Pennsylvania generates roughly one-third of the electricity produced in PJM, which means it directly powers about 7% of the country's GDP. As such, what happens in Pennsylvania will have an impact far beyond our borders.

Gov. Shapiro has proposed sweeping new energy legislation that would reshape Pennsylvania's power generation sector. The proposals could disrupt PJM operations in two ways:

- Charging a tax on Pennsylvania's fossil fuel plants based on their generation, making them more expensive to operate.
- Requiring the sale of far more wind, solar, and other alternative-energy generated power to Pennsylvania customers.

PACER

The proposed Pennsylvania Climate Emissions Reduction Act (PACER) would tax the state's fossil-fuel power plants based on their production. The purpose is to discourage carbon emissions and to raise money to finance new power projects with lower carbon emissions. The immediate impact would be to make the fossil-fuel plants more expensive to run, potentially reducing their production or pushing them into early retirement.

[12] https://www.eia.gov/electricity/state/, State Electricity Profiles, Table 5

[13] https://www.puc.pa.gov/filing-resources/reports/alternative-energy-portfolio-standards-aeps-reports/

When the Wolf administration modeled the impact of a similar tax that would be charged under the banner of the Regional Greenhouse Gas Initiative, it showed the tax would cut production of Pennsylvania electricity and raise wholesale electricity costs. It also showed the tax would not cut emissions in PJM, because production would go to other states like Ohio and West Virginia.

The Shapiro administration has not publicly released any modeling analyzing the impact of PACER on production or cost or emissions reductions.

PRESS

The proposed Pennsylvania Reliable Energy Sustainability Standards Act would replace the existing Alternative Energy Portfolio Standard. The new PRESS standard would de-emphasize some of the carbon-producing fuels now eligible, such as waste coal and garbage.

And it would impose a much greater requirement on the sale of wind, solar, and other non-carbon electricity to Pennsylvania consumers than the current AEPS. It would require that 35% of the power sold in Pennsylvania in 2035 come from a Tier I group that includes wind; solar; geothermal; advanced nuclear reactors; and methane from landfills and coal mines that is otherwise escaping untouched into the atmosphere.

Right now, just under 7% of the electricity sold in the state meets the proposed new Tier I definition. To comply with the proposed legislation, that total would have to double by June 1, 2026, and jump fivefold by 2035 to 35%.

By 2030, 10% of those Tier I sources would have to be located within Pennsylvania. If wind and solar are primarily used to satisfy that requirement, that would mean wind and solar production, which was 1.6% of Pennsylvania generation in 2022, would have to increase by 600% over the next six years.

The bulk of Tier I requirements could be satisfied by purchasing renewable generation from other states. That is exactly what other states, such as Maryland and New Jersey, are counting on as well – someone somewhere else is going to do it.

Except that's not happening.

PJM said it has authorized 38,000 megawatts worth of new projects to connect to the grid, mostly wind and solar. They're just not getting built. PJM said the reasons include a lack of financing, supply chain issues, and permitting delays.

"If this sluggish pace of development continues, PJM projects a shortfall in supply by the end of this decade – or sooner," PJM stated in its fact sheet for policymakers.

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APPENDIX I
Generation from PJM States

This table shows the 2022 electricity generation mix for the 13 states plus the District of Columbia who make up the PJM Interconnection grid.[14] **Note:** These totals are for the entire state, not just the portion that lies within PJM. Generation is in megawatt hours.

For Pennsylvania and other exporting states, the percentages reflect total *production*. For importing states, the percentage reflects total *consumption*. For instance, Washington DC imports nearly all of its power. Of what little it does produce, about half comes from natural gas. The percentage listed for gas (0.7%) reflects the percentage of how much DC produces of its own consumption.

	Megawatt Hours	Wind	Solar	Nuclear	Coal	Gas	Imports	Exports
PA	239,261,130	1.5%	0.1%	31.8%	10.0%	54.4%		80,244,671
IMPORTING STATES								
DE	5,308,370	0.0%	0.5%	0.0%	0.8%	36.7%	59.0% 7,646,965	
IN	98,054,905	8.9%	1.0%	0.0%	45.8%	28.6%	12.7% 14,249,888	
KY	69,147,329	0.0%	0.1%	0.0%	59.1%	21.2%	13.2% 10,493,632	
MD	37,139,365	0.8%	1.1%	23.5%	7.4%	22.1%	41.1% 25,917,994	
NJ	65,060,636	0.0%	1.9%	35.5%	0.6%	41.8%	18.5% 14,793,004	
NC	134,257,088	0.4%	7.6%	28.7%	9.9%	39.2%	9.5% 14,086,682	
OH	135,810,459	2.0%	0.6%	10.6%	27.1%	43.5%	14.3% 22,662,582	
TN	78,036,045	0.0%	0.6%	32.5%	14.5%	15.1%	28.8% 31,615,476	
VA	89,477,325	0.0%	3.3%	19.9%	2.4%	34.5%	36.8% 52,122,698	
Wash DC	160,237	0.0%	0.2%	0.0%	0.0%	0.7%	98.5% 10,755,941	
ADDITIONAL EXPORTING STATES								
IL	185,223,322	12.7%	0.8%	53.4%	21.9%	10.7%		38,506,667
MI	117,497,052	7.8%	0.7%	22.1%	29.3%	35.1%		10,804,598
WV	56,665,360	3.5%	0.0%	0.0%	89.5%	3.7%		21,414,372

[14] https://www.eia.gov/electricity/state/, Table 5 Generation, Table 10 Source-Disposition

APPENDIX II
Renewable/Alternative Fuel Standards in PJM States

This graphic summarizes the renewable and alternative fuel portfolio standards that are currently in place in PJM states. The boxes in the lower right for NJ, MD, and VA reflect offshore wind targets.

The graphic is taken from a presentation that PJM made to the Pennsylvania House Environmental Resources & Energy Committee on June 24, 2024.

