SOLAR POWER: INCREASING RELIABILITY, LOWERING COST

HOW ADDING SOLAR POWER IN OHIO CAN STRENGTHEN THE GRID AND LOWER ELECTRICITY COSTS FOR ALL OHIOANS

GRANGE SOLAR

Contact Us
grange@openroadrenewables.com
www.grangesolarproject.com

SOLAR POWER AND GRID RELIABILITY

A diverse power grid is a more reliable power grid. This means that as Ohio adds more renewable energy to a grid that is primarily based on fossil fuels and nuclear power, we will see an increase in grid reliability, even when adding variable sources of power like wind and solar.

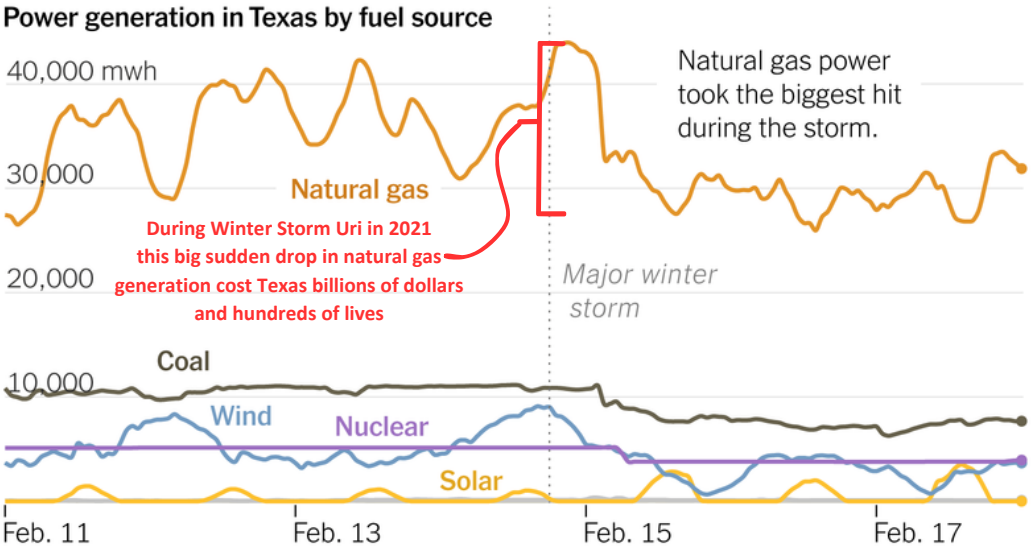
Diversity in the geographic location of generators also helps make the grid more stable. The idea is simple: If a power source at one location is not generating electricity at a given time, the odds are that sources at other locations will be.

Numerous countries already get over 50% of their electricity from wind and solar with grid reliability that is even better than in the U.S.

Renewables are often criticized for being "variable," but their variability is predictable. Fossil fuel resources, in contrast, often have unexpected outages, which pose a greater risk to the grid. Grid operators know when the sun will set — but they do not know when a critical component might break at a gas or coal power plant, or when severe weather or a global crisis will suddenly impact fossil fuel supplies.

"While Texas had largely succeeded with that integration of wind in previous years with intelligent forecasting, the Texas freeze revealed that assumptions about the reliability of firm baseload power fueled by natural gas were too optimistic."

Cascading risks: Understanding the 2021 winter blackout in Texas Energy Research & Social Science, V.77 July, 2021



MORE SOLAR, LOWER COSTS

How Solar Power Helps Reduce Consumer Costs

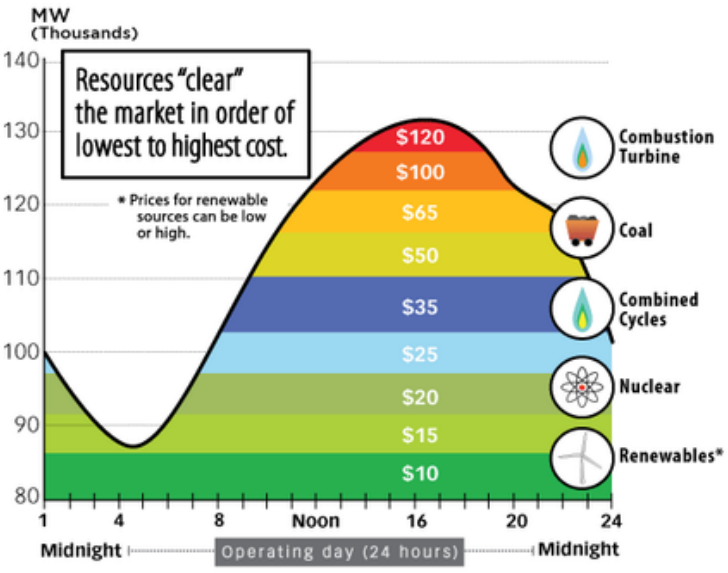
Ohio's grid operator, PJM, forecasts power demand daily and schedules generators to meet that forecasted electricity demand each day for the following day. Certain power generators (eg. fast-starting gas, oil-fired generators, hydroelectric plants, and increasingly battery storage facilities) that meet electricity demand at peak usage times of the day tend to provide the most expensive power.

PJM accepts offers from the lowest- to highest-priced generator until it meets the forecasted demand for electricity for each hour of every day. As more wind and solar are added to the grid, the $0 fuel cost means that renewables are almost always scheduled in the fuel mix during hours that they are expected to run.

Solar in particular produces power during some of the most expensive hours of the year (ex. on a hot July afternoon) which means that during those hours PJM can avoid the need to schedule a very expensive gas or oil peaking plant, which saves consumers money! (see below figure)

Did you know?

Renewables saved Texans nearly $1 billion per month in 2022 and a total of $28 billion over the last 12 years by offsetting more expensive generation, especially during peak hours.



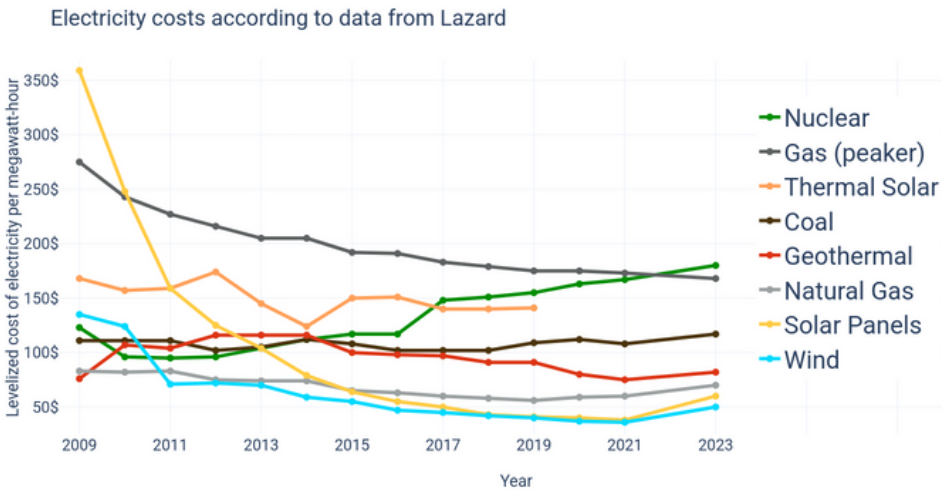
SOLAR POWER COST DECLINES

The cost of producing electricity is largely a function of three factors:

1. the upfront cost of the power plant
2. the ongoing cost of the fuel
3. ongoing operating & maintenance costs

Since the cost of solar continues to steeply decline over time, sunshine is free, and operating and maintenance costs are relatively low, this means that the solar resource (eg. amount of sunlight per average day in kilowatt-hours per square meter (kWh/m2 per day) largely determines the cost of solar-powered electricity.

Ohio's average solar resource is 4.65 kWh/m2 per day, higher than that of Germany, which gets over 12% of its power from solar and has an average solar resource of less than 4 kWh/m2 per day.



According to financial advisory firm Lazard's "Levelized Cost of Energy Analysis" in 2023, solar power costs have declined more than 80% over the last decade, and solar facilities can now produce power cheaper than coal, nuclear, and gas peaker plants and are competitive with many baseload natural gas plants.

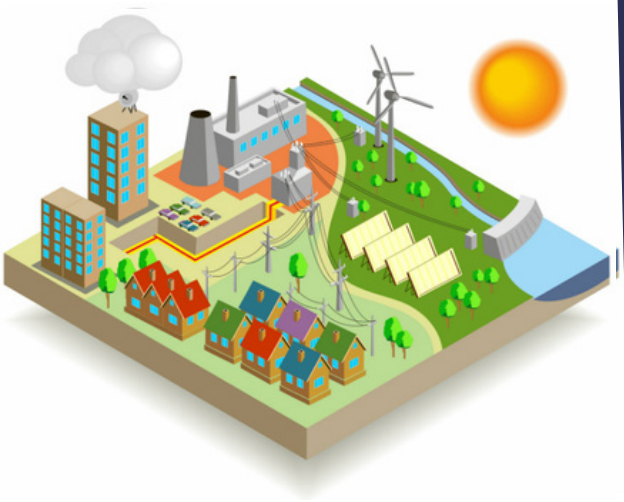
OHIO IMPORTS ELECTRICITY

The state of Ohio is 4th in the nation for electricity consumption but 10th in the nation for electricity production. That means that, as a net electricity importer, Ohio's homes and businesses send money out of state to pay for their electricity consumption.

Ohio imports over 20% of its power from other states and Canada via the regional grid. That means that increasing electricity production in-state, especially during peak demand hours, offsets electricity that is being imported from outside of Ohio, boosting our energy independence and helping keep more of Ohio's dollars in-state.

HOW POWER FLOWS

Imagine the electric grid as a giant water reservoir with water being added by a few individual sources and being removed by a great many users via many small pipes. The water being added at any location is most likely to flow first to the closest pipes, but will also mix with the rest of the water in the reservoir. This is true even if a user of water on one side of the reservoir is paying for water to be added on the opposite side of the reservoir.



Like the reservoir analogy, the power from new solar projects located in Ohio first go to meet demand in the surrounding local grid, even if those projects have power purchase agreements with buyers that are not adjacent to the facility.

FREQUENTLY ASKED QUESTIONS

Wasn't the Texas grid collapse in 2021 caused by freezing wind farms?
According to the Texas grid operator ERCOT, while all generation types including wind farms were impacted by the freeze, the biggest contributor to Texas's blackouts in 2021 were the combination of natural gas plant failures and frozen natural gas fuel supply at the gas wells and pipelines.

What is the significance of solar panel efficiency? And what is net capacity factor?
Commercial solar panels range between 18% and 23% efficiency, which is a measure of the amount of sunlight that hits a solar panel that is converted to electricity. The more efficient the solar panel, the less space required to produce power. The net capacity factor (NCF) refers to the % of a generator's rated capacity that actually produces power over a year. Solar farms in Ohio have a ~20% NCF. Gas peakers have NCFs ~10-15% or less. Solar projects in Ohio use between 5 and 7 acres per MW of capacity, which can produce enough electricity to power ~120 Ohio homes.

Will this project increase my electricity costs?
Solar produces power at peak demand hours, which means that the grid can avoid the need to use much more expensive peaking resources during those hours, which saves utilities (and consumers) a lot of money. Estimates in Texas show that solar and wind saved Texas consumers ~$1 billion per month in 2022!

How much energy does solar produce vs. corn ethanol per acre?
According to a 2023 study in Wisconsin, net energy production per acre of solar panels is 100 to 125 times the net energy production from ethanol derived from corn. That means that a single acre of solar can generate the same amount of energy as 100 acres of corn used to make ethanol.

Do I have to pay for upgrades made by the utility on account of this project?
No. Ohio is part of the PJM grid, and in PJM new projects entering the system pay for any upgrades required to connect to the grid. The high cost of upgrading the grid is a key reason why many projects that enter the PJM queue never come online.

Doesn't it take more energy to manufacture, install, and operate a solar facility than it ever produces?
No. The ratio of the net energy produced by any resource vs. the total energy it consumes is called the Energy Return on Investment (EROI). The EROI for solar PV is between 8 and 34 depending on the location and technology, which means that solar PV generators produce many times more energy than it takes to manufacture, install, and operate a solar facility.

Isn't solar only competitive because of government subsidies?
All our energy sources are subsidized, including solar. Solar projects receive a 30% up-front federal tax credit. In contrast, coal, gas, and nuclear, which have been subsidized for many more decades than solar, continue to receive a wide range of both up-front and annual subsidies at virtually every level of government, in addition to imposing pollution costs on society that shows up as a tax on all of our pocketbooks (eg. on our health care bills). In fact, unsubsidized solar today is competitive or cheaper than unsubsidized coal, gas, and nuclear!

RESOURCES

Three Myths About Renewable Energy and the Grid, Debunked: https://e360.yale.edu/features/three-myths-about-renewable-energy-and-the-grid-debunked

The Solution to Grid Reliability? Go Bigger and Bolder on Renewables and Energy Storage: https://rmi.org/the-solution-to-grid-reliability-go-bigger-and-bolder-on-renewables-and-energy-storage/

Texas winter 2021 near-collapse of the electric grid was largely a fossil fuel problem, not a renewable problem. Solar actually outperformed expectations while the natural gas system froze. https://www.youtube.com/watch?v=46PxZ6KyAXo

What Really Happened During the Texas Power Grid Outage? https://www.youtube.com/watch?v=08mwXICY4JM

Lazard Levelized Cost of Energy (v.16.0) https://www.lazard.com/media/2ozoovyg/lazards-lcoeplus-april-2023.pdf

Corn Ethanol vs. Solar Land Use Comparison - Clean Wisconsin https://www.cleanwisconsin.org/wp-content/uploads/2023/01/Corn-Ethanol-Vs.-Solar-Analysis-V3-9-compressed.pdf

What's in a megawatt? https://www.seia.org/initiatives/whats-megawatt

The Impact of Renewables in ERCOT, https://www.ideasmiths.net/wp-content/uploads/2022/10/IdeaSmiths_CFT_ERCOT_RE_FINAL.pdf

Energy Return on Energy Invested (ERoEI) for photovoltaic solar systems in regions of moderate insolation: A comprehensive response, https://www.nrel.gov/docs/fy17osti/67901.pdf

OPEN ROAD RENEWABLES

Contact Us
grange@openroadrenewables.com
www.grangesolarproject.com



QUESTIONS? WE WANT TO HEAR FROM YOU

- LEARN MORE ABOUT THE GRANGE SOLAR PROJECT
- REVIEW WELL-VETTED INFORMATION ABOUT SOLAR
- SCHEDULE A MEETING WITH OUR TEAM TO DISCUSS YOUR CONCERNS OR FEEDBACK
- DISCOVER HOW SOLAR CAN BENEFIT YOUR COMMUNITY
- GET INVOLVED!

GRANGE SOLAR

Contact Us
grange@openroadrenewables.com
www.grangesolarproject.com