NMA
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THE GRID RELIABILITY CRISIS COLLIDES WITH SURGING POWER DEMAND

There is a quiet revolution upending the trajectory of our energy future. For all the extraordinary challenges inherent with trying to stand up a renewables-dominant energy mix nearly overnight, perhaps none looms larger than the breakneck speed of electricity demand growth across the country.

Speculation about the impact that electrification, reindustrialization and big data might have on power demand is settling into a grim reality. In wildly different states with wildly different industries and economic engines, power demand is exploding, and the U.S. electricity grid and our power supply are woefully unprepared.

Surging new demand is colliding with policy-driven power plant closures and mounting challenges to bring new resources and enabling infrastructure to the grid. As coal plant retirements accelerate due to the U.S. Environmental Protection Agency's (EPA) regulatory agenda, new renewable energy and interstate transmission additions aren't materializing to reliably meet existing power demand, much less rapid demand growth. There is a widening gap growing between the power supply the nation needs and what it will soon have. Shortages are imminent.

THE ERA OF FLAT POWER DEMAND IS OVER

An era of predictable and relatively flat electricity demand has come to a sudden end. As T*he Washington Post* observed, with the title of a Mar. 7 front-page article, “Amid explosive demand, America is running out of power.”

The Washington Post
Democracy Dies in Darkness

BUSINESS

Amid explosive demand, America is running out of power

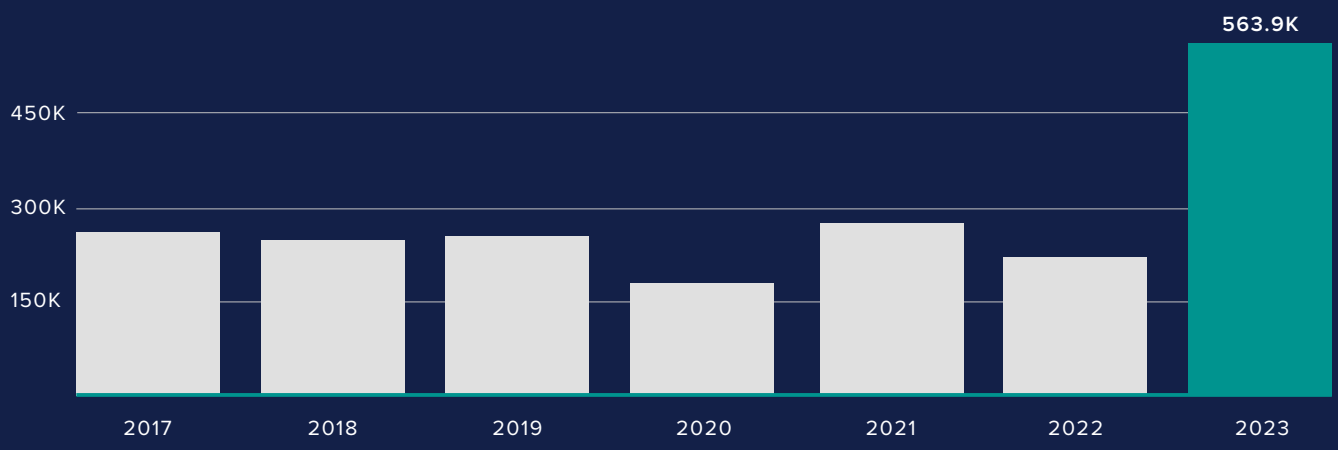
AI and the boom in clean-tech manufacturing are pushing America’s power grid to the brink. Utilities can’t keep up.

The North American Electric Reliability Corporation (NERC), which oversees the reliability of the nation’s grid, reported in December that “key measures of future electricity demand and energy needs are rising faster than at any time in recent years, adding to future resource adequacy concerns at a time of unprecedented transformation in the industry.”

NERC sees summer peak power demand rising by over 79 gigawatts (GW), and winter peak demand jumping nearly 91 GW in the next decade. The summer jump in peak demand alone is equivalent to adding the entire power generating capacity of the state of California.

PROJECTED NEW ENERGY DEMAND IN NORTH AMERICA DOUBLES

9-year growth forecast of demand for new electricity, in gigawatt hours



Data covers U.S., Canada and part of Baja California, Mexico.

Source: North American Electric Reliability Corp. Long Term Reliability Assessment

As staggering as these projections may be, they are likely an undercount – a snapshot of a moment – as grid operators and utilities announce startling upward demand revisions at a breakneck pace. As *The New York Times* reported, "over the past year, electric utilities have nearly doubled their forecasts of how much additional power they'll need by 2028."

PJM Interconnection, the operator of the nation's largest grid serving 65 million Americans, tripled its growth expectations this January for electricity use in its footprint over the next decade.

In Georgia, the latest projection of new electricity demand for the next decade is now 17 times what it was just last year.

New York's grid operator, the New York Independent System Operator, reported that electricity demand in the state will more than double by 2050 and that New York will need to more than triple installed generating capacity by 2040.

On the other side of the country, Pacific Gas & Electric in California expects electricity demand to rise 70% in the next 20 years. And in Texas, power demand is already surging. In the summer of 2023, power demand set 10 new records.

Across the country, for diverse reasons, grid operators and utilities see demand exploding.

MANUFACTURING, DATA CENTERS AND AI DEMAND DRIVING DEMAND

The reshoring of heavy industry and the emergence of new large-scale industrial sectors, including battery and semi-conductor manufacturing, are having a profound impact on power demand. According to a recent analysis, investments in U.S. industrial and manufacturing have totaled about $481 billion since 2021 with over 200 manufacturing facilities announced in 2023 alone.

But alongside what might be called traditional manufacturing, a new kind of heavy industry is driving power demand in unexpected ways. Big data, AI, cryptocurrency and the rapid growth of data centers are driving remarkable demand growth.

As *The Wall Street Journal* observed, "data centers are one of the biggest new power consumers, and demand from them could double by 2030. Some new data centers requesting grid connections are as large as 500 megawatts, as much as it takes to power hundreds of thousands of homes."

Dominion Energy, Virginia's largest utility and part of the PJM footprint, has connected 75 data centers since 2019 with electricity demand jumping 7% since then. Dominion says data center capacity could double in the next five years and it expects its electric demand to grow by about 85% over the next 15 years.

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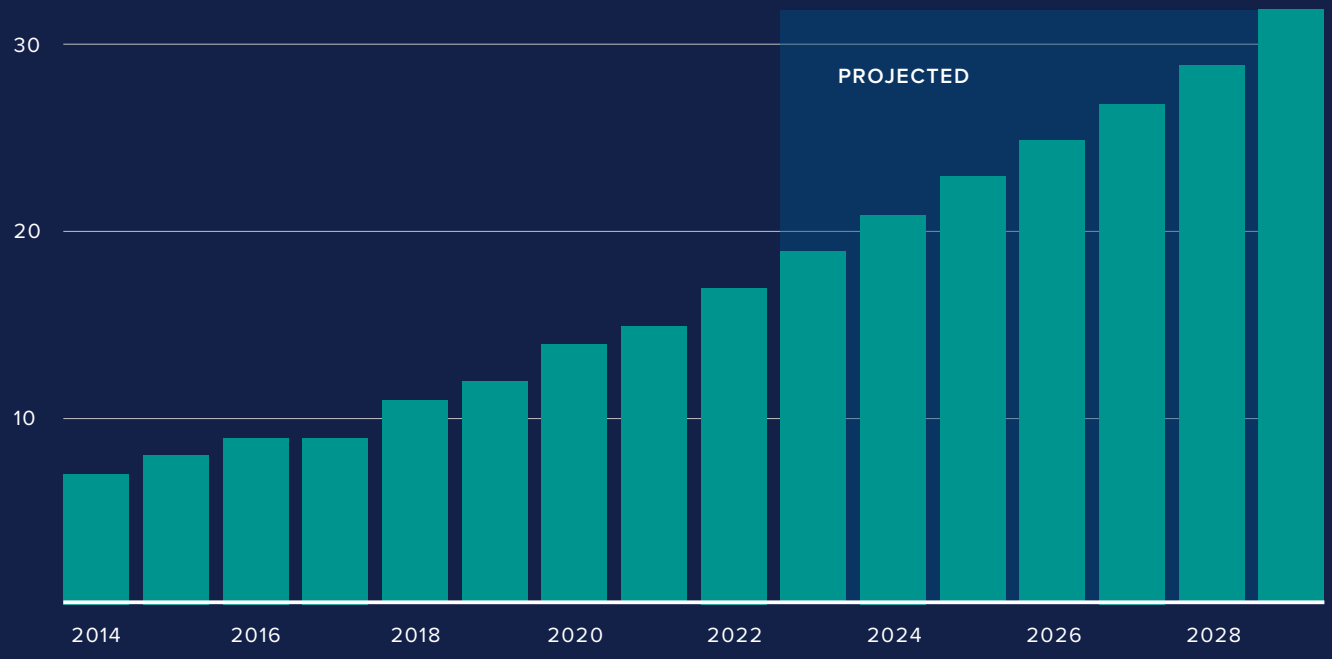
U.S. DATA CENTERS TAX THE POWER GRID

Data center energy demand, in gigawatts.

Each gigawatt is roughly the amount of power generated by a large nuclear plant.



Source: McKinsey and Company, January, 2023.

Deep Jariwala, a researcher at the University of Pennsylvania, explained that, as computing becomes more elaborate and data-intensive, "two things begin to scale up exponentially: the need for more memory storage and the need for more energy."

In 2018, computers consumed roughly 1-2% of the global electricity supply. In 2020, computing demand reached 4–6%. By 2030, computing is expected to consume 8-21% of global electricity. "It should be clear that we have an 800-pound gorilla in the room; our computers and other devices are becoming insatiable energy beasts," Jariwala said.

Consider the energy impact from cryptocurrency. According to the U.S. Energy Information Administration (EIA), power demand from crypto mining has grown dramatically. EIA estimates annual electricity use from cryptocurrency mining already represents from 0.6% to 2.3% of U.S. electricity consumption with the potential for demand to soar. The Electric Reliability Council of Texas alone, the primary grid operator for the state of Texas, has 41 GW of requests for new cryptocurrency mining capacity, the equivalent power demand of 40 large power plants.

RAPID ELECTRIFICATION OF TRANSPORTATION

The rise of EVs is already beginning to transform electricity demand across the country. In 2023, more than 1.4 million plug-in electric cars were sold in the U.S, a 50% jump year-over-year.

The Electric Power Research Institute estimates that EVs will boost the nation's overall use of electricity **between 8% and 13% by 2030 from 2021, using 7% to 11% of all U.S. electricity generation**.

PJM, which has tripled its load forecast for the next decade, sees power demand from EVs jumping from just 500 MW in its territory today to 13,530 MW by 2034. That amount of power demand is equivalent to the supply needed to power 10 million homes.

EV uptake – and EV power demand – will be shaped by consumer preference but also regulatory pressure. The EPA has finalized new tailpipe emission standards that would force a lightning-quick pivot. By 2032, meeting the new standards will mean nearly 70% of new car sales will be fully electric or plug-in hybrids. Electric vehicle uptake at this scale and pace will supercharge new power demand.

THE RETIREMENT RISK

While power demand soars, the very foundation of the nation's electricity supply is under siege. In December, NERC warned in its Long-Term Reliability Assessment that the planned retirement of **83 GW of fossil and nuclear generation** – a loss of generating capacity powering more than 62 million homes – over the next decade creates blackout risks for most of the country. The grid monitor also noted that another 30 GW of capacity is expected to close but the plans aren't yet final.

NERC cautioned that, "environmental regulations and energy policies that are overly rigid and lack provisions for electric grid reliability have the potential to influence generators to seek deactivation despite a projected resource adequacy or operating reliability risk."

Jim Robb, president and CEO of NERC, testified to Congress that the energy transition – particularly the retirement of essential capacity – is not happening responsibly. He said, "we must manage the pace of the transformation in an orderly way, which is currently not happening."

Federal Energy Regulatory Commission (FERC) Chairman Willie Phillips, appointed by President Biden, told Congress, "I am extremely concerned about the pace of retirements we are seeing of generators which are needed for reliability on our system. NERC and the grid operators have warned us about this."

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> – **CHAIRMAN WILLIE PHILLIPS, FEDERAL ENERGY REGULATORY COMMISSION**

FERC Commissioner Mark Christie observed power plants are being retired at a faster pace than they're being replaced. "The arithmetic doesn't work," he said. "This problem is coming. It's coming quickly. The red lights are flashing."

Christie added, "I think we need to listen to the engineers, not the lobbyists... All the experts are saying – who know how to operate a system, the people who actually know how to operate a system – are saying this is a huge and coming problem and I think we better be listening to them."

EPA PLOWS AHEAD

Despite a global energy crisis, escalating warnings over eroding grid reliability and new analysis forecasting surging electricity demand, EPA is not listening nor wavering from its plan to accelerate well-operating power plant retirements.

The EPA has made it abundantly clear it hopes to force the premature retirement of the majority of the nation's coal fleet by 2032. EPA's so-called Clean Power Plan (CPP) 2.0 – which requires fuel switching or the implementation of technology that hasn't been adequately demonstrated – is just one piece of a six-pronged effort to drive traditional power plant capacity off the grid. The cumulative impact of EPA's regulatory blitz represents a deeply dangerous threat to the nation's supply of power.

> "If some of these facilities decide that it's not worth investing in [control technologies] and you get an expedited retirement, that's the best tool for reducing greenhouse gas emissions."
>
> – MICHAEL REGAN, EPA ADMINISTRATOR

In early 2022, EPA Administrator Michael Regan explicitly stated that EPA's power plant strategy would be designed to give plant owners certainty about the full package of regulatory pressures their plants would face.

"By presenting all of those rules at the same time to the industry," Regan said, "the industry gets a chance to take a look at this suite of rules all at once and say, 'Is it worth doubling down in investments in this current facility? Or should we look at that cost and say now it's time to pivot." He added, "If some of these facilities decide that it's not worth investing in [control technologies] and you get an expedited retirement, that's the best tool for reducing greenhouse gas emissions."

EPA's strategy all along has been to force accelerated plant retirements. Despite overwhelming evidence that its path poses a dire threat to the nation's supply of power, EPA has not wavered from its mandate.

A PLEA TO CHANGE COURSE

Grid operators, utilities and electric co-ops, along with reliability regulators, are directly pointing to EPA's agenda as a grave threat. Consider the plea from the nation's largest grid operator, PJM Interconnection.

PJM projects a capacity shortage in just a few years as retirements far outpace the speed at which new, reliable capacity is coming online. PJM expects it will lose 40 GW of generating capacity by 2030 – 21% of the market's existing capacity – with only 31 GW of additions in the same period. To put that into perspective, that's the equivalent of losing the electricity needed to power 30 million homes. Even in the best

scenario, if all planned additions come online in time, it still leaves a deficit of generating capacity, and likely a significant deficit in dispatchable capacity needed to meet peak demand.

While these losses will be primarily from the closure of coal plants – plants that can provide electricity 24/7 and which are often called upon to ramp up during periods of peak demand – the additions will be largely from intermittent renewable capacity, which, by definition, is often unavailable when needed most.

Of the 40 GW of projected losses, PJM expects 25 GW to be pushed off the grid due to policy, namely EPA regulation and state-mandated clean energy targets. PJM believes three EPA rulemakings – not including the proposed CPP 2.0 – could force 10,500 MW of capacity off the grid.

Manu Asthana, President & CEO of PJM Interconnection, testified to Congress that, "we will need to slow down the retirement or restriction of existing generation until replacement capacity is deployed... frankly, we see this as the single largest risk in the energy transition."

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– **MANU ASTHANA, PRESIDENT & CEO OF PJM INTERCONNECTION**

THE GRID'S GAS PROBLEM

While the flexibility of the natural gas fleet is critically important to balancing the variability of renewable generation, a deeply valuable capability under most operating conditions, the gas system—from wellhead to power plant—has proven to be extraordinarily susceptible and unreliable during bitter cold.

Notably, it was the failure of the gas delivery system in Texas that precipitated the near collapse of the state's grid during winter storm Uri in February of 2021 that left millions in the dark and claimed the lives of 246 people.

During winter storm Elliot in December of 2022, the gas system was once again the leading culprit in a grid crisis that saw rolling blackouts in multiple Eastern states and nearly cost more than a million families in New York City their heating. An alarming 90.5 GW, or 13% of the generating capacity in the Eastern Interconnection — the grid system covering two-thirds of the U.S. — failed to run or operated at reduced capacity. Gas-fired capacity accounted for 63% of the outages.

Elliott was the fifth event in the past 11 years during which a large number of U.S. power plants failed during severe cold. The gas system was at the center of each failure.

So concerning was the Elliot-induced crisis and the failure of the gas system, a joint after action report from FERC and NERC prompted FERC Chairman Willie Phillips to call upon Congress to fix the gas system's regulatory "gap."

"We need someone who is directly responsible for the reliability of our natural gas systems and for enforcing reliability standards for the natural gas system," said Phillips.

As *E&E News* described, "essentially, there are no mandatory federal reliability standards for the entire natural gas system, from wellheads to pipelines to gas distribution lines. That's different from the electric grid and power plants, which are largely subject to such standards, even though both systems are increasingly interdependent."

The gas regulatory gap, and the vulnerability it has embedded in the U.S. energy system, has yet to be addressed.

REPLACEMENT CAPACITY NOT MATERIALIZING

The suspicion that the renewable energy and enabling infrastructure buildout couldn't keep pace with the Biden administration's goals has been replaced by sobering certainty.

Offshore wind projects are evaporating, transmission lines remain extraordinarily difficult to build, the nation's first planned small modular nuclear reactor project was cancelled and dozens of renewable-power developers are trying to rewrite contracts to recoup rising costs.

While additions are happening, they simply aren't coming close to the pace renewable boosters – and the Biden administration – envisioned. Higher interest rates, supply chain bottlenecks, labor challenges and ongoing permitting quagmires have left their mark.

WHERE'S THE TRANSMISSION?

Consider the transmission buildout, or the lack thereof. Despite the urgent need for more high-voltage interstate transmission, additions have in fact slowed. And the few success stories have also only underscored the challenges.

The SunZia transmission line has become emblematic of the challenges of delivering the nation's energy future. The project – a $10 billion effort essential to moving wind generation across several states – had been stuck in legal limbo and permitting purgatory for 17 years until it was finally approved last year. But now several Tribes and the Center for Biological Diversity have sued the Department of the Interior over the approval, claiming parts of the permitting process weren't thorough enough. In other words, after 17 years, not so fast.

Getting to the Biden administration's goal of a largely renewable, emissions-free grid by 2035 would require building 91,000 miles of new high voltage interregional transmission lines in just the next 11 years. The pace of the current buildout is a fraction of what is needed.

Nationwide, just 251 miles of high-voltage transmission lines were completed last year, a number that has steadily fallen for a decade.

Money is no silver bullet to meeting the challenge. According to EIA, transmission spending has increased steadily over the past 20 years but it's not going to long distance,

Emissions-free grid **by 2035** requires

91,000 MILES

OF NEW TRANSMISSION LINES

251 MILES

OF HIGH-VOLTAGE TRANSMISSION LINES WERE COMPLETED LAST YEAR

Most current funding goes to upkeep existing lines, not build new ones.

interstate projects identified as so important to connecting wind and solar power located in remote areas to urban and industrial demand centers.

The PJM grid is case in point. Spending on transmission in PJM has grown by 14% since 2014 but the vast majority is devoted towards maintaining existing lines. Spending on new transmission lines has plummeted 67% in the same period.

The National Renewable Energy Laboratory (NREL) also found that the largesse tucked into the Inflation Reduction Act and the Infrastructure Investment and Jobs Act could spur a surge in renewable power but that surge is dependent on fixing siting and overcoming permitting barriers. "Barriers to deployment, such as siting and permitting challenges, supply-chain constraints, and social acceptance of electricity infrastructure development, could significantly reduce the rate of clean electricity deployment," NREL observed.

RENEWABLE NIMBYISM

For all the hurdles to siting, permitting and financing new transmission infrastructure, siting and connecting renewable generation isn't proving any easier.

According to a recent survey from Lawrence Berkley National Laboratory, roughly one-third of utility-scale wind and solar siting applications submitted over the last five years were canceled, while about half of wind and solar projects experienced delays of six months or more.

As *The Wall Street Journal* found, "county-by-county battles are raging as wind and solar projects balloon in size, edge closer to cities and encounter mounting pushback.... Projects have slowed. Even in states with a long history of building renewables, developers don't know if they can get local permits or how long it might take."

For example, in Iowa, which has the second-highest installed wind power capacity in the country after Texas, *The Wall Street Journal* reported that, "16 of 99 counties had prohibitive rules or a ban against new projects, most of them approved in the previous four years. Between moratoriums and requirements for setbacks between turbines and things such as neighboring property lines, roads or buildings, developers won't even consider projects on around half to three quarters of land with good wind resources."

The Biden administration's flagship effort to jumpstart the nation's nascent offshore wind industry and commission 30 GW of capacity by 2030 is also unravelling.

Despite extraordinary incentives to support the offshore industry, supply chain challenges, inflationary pressure and high interest rates are sending even seasoned offshore companies for the exit.

Danish renewable energy developer Orsted, the world's leading offshore wind developer, recently lost a quarter of its market value after writing off $2.3 billion on three wind projects it's pursuing off the U.S. east coast.

A leading energy consultancy, ClearView Energy Partners, estimates that 30% of planned offshore wind capacity contracted through state procurements has been canceled with more cancellations likely.

The trend lines are troubling. We need an immediate and sharp energy policy reality check and rethink before it is too late.

POLICY RECOMMENDATIONS

BRING TRANSPARENCY TO THE CHALLENGE

Data on projected power demand as well as projected capacity losses due to forced retirements is balkanized and slow to materialize, providing an incomplete picture of on-the-ground reality in a moment of rapid change. This presents immense challenges for formulating policy to navigate the energy transition. A new, national effort to bring transparency and urgency to mapping the scale and accelerating speed of the nation's power needs should be a priority.

RECOGNIZE ON-THE-GROUND REALITY

The renewable and transmission infrastructure buildout is facing immense challenges. An honest assessment of these challenges – not dangerously optimistic modelling – of how quickly, affordably and effectively renewable capacity and enabling infrastructure can be added to the grid and meet peak power demand should be the foundation for any rules targeting the nation's existing fossil fuel generating capacity.

EMPOWER RELIABILITY REGULATORS

Despite years of warnings about rapidly deteriorating grid reliability and a host of threats to the nation's power supply, the EPA has effectively sidelined reliability regulators from the development of regulations that have a direct impact on grid reliability. A proposed legislative fix exists. The "Guaranteeing Reliable Infrastructure Development Act," or the "GRID Act," would ensure that federal agencies cannot finalize regulations that are likely to have a significant negative impact on the reliability and adequacy of the bulk-power system without considering and responding to input from FERC, NERC and other relevant electricity reliability organizations. This legislation is a commonsense fix to a glaring threat to the nation's reliable supply of power.

REINFORCE THE BRIDGE

With power demand soaring and the challenges to building and integrating renewable energy and its enabling infrastructure only growing, smart policy should recognize the need for a wider and potentially longer bridge to our energy future. This means recognizing the essential value of the dispatchable resources available today. Doing so includes ensuring environmental regulation doesn't jeopardize the capacity that is the nation's reliability backstop before reliable replacement capacity is built and connected to the grid. It also should include identifying and addressing electricity market failures eroding capacity reserve margins when the immense challenges facing the nation's power supply require a far larger – not smaller – insurance buffer.