S. HRG. 119–125

HEARING TO IDENTIFY CHALLENGES TO MEETING INCREASED ELECTRICITY DEMAND

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED NINETEENTH CONGRESS

FIRST SESSION

JULY 23, 2025

Printed for the use of the
Committee on Energy and Natural Resources

Available via the World Wide Web: http://www.govinfo.gov

U.S. GOVERNMENT PUBLISHING OFFICE
61–245 WASHINGTON : 2026

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HEARING TO IDENTIFY CHALLENGES TO MEETING INCREASED ELECTRICITY DEMAND

WEDNESDAY, JULY 23, 2025

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The Committee met, pursuant to notice, at 10:02 a.m. in Room SD–366, Dirksen Senate Office Building, Hon. Mike Lee, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. MIKE LEE, U.S. SENATOR FROM UTAH

The CHAIRMAN. The hearing will come to order.

Good morning and welcome to all of you. Today's hearing focuses on the challenges that America faces in meeting the increased demand for electricity, something that has gotten a lot of attention, with good reason. Demand has been trending upward in recent years, and some expect it could grow by 25 percent just in the next five years alone. Data centers supporting artificial intelligence, advanced manufacturing, and the planned retirement of current production sources are just a few of the causes creating this increased demand, and as more people are drawn toward electric cars, that could put additional demand in play, as well.

America needs to put more electrons on the grid, and we will be hearing from three witnesses to better understand these issues today, and we are very fortunate to have them. They are, first, Peter Huntsman, the Chairman and CEO of Huntsman Corporation; Jeff Tench, the Executive Vice President of Vantage Data Centers—welcome—and finally, Rob Gramlich, the President of Grid Strategies. Thanks to all of you for being here.

Now, let's begin with a simple fact. America's electricity demand is surging. It's not creeping up, it's surging. For decades, power demand in this country remained relatively flat—utilities planned for it, markets priced for it, regulators counted on it, but that era is over. We are now entering a new era of electrification—data centers, AI computing, manufacturing returning home, electric vehicles, all of it. Even conservative estimates suggest that we could see two to three percent annual growth compounded over the next decade. Now, that number, two to three percent, annually compounded—that might not sound like much, but it's like a two-way highway that was built decades ago that is now expected to carry rush hour traffic to and from a major city every day of the year—more cars, bigger trucks, constant congestion. And if the road hasn't changed, but everything around it has changed, that is going

to be an issue. Now, that is a fairly decent analogy, something to help understand our power grid and the challenges now facing it.

Now, here is the real problem. We have spent much of the last 20 years shutting down the generation that can actually meet that demand—coal plants retired, nuclear blocked, natural gas tied up in endless litigation. And we replaced a lot of that capacity with wind, solar, and batteries—resources that by design don't work all the time, but work roughly a third of the time. One-third of the time—that's not enough. Not enough to support the dispatchable baseload power that we got from the other sources I mentioned. These resources, being non-dispatchable, means that they cannot be dispatched at the exact moment that they are needed with the predictability and the reliability that is required. They do not provide baseload power and they do not build themselves. They require massive transmission overhauls, grid upgrades, and most importantly, in many circumstances, subsidies. So this isn't a free market. In many ways, it's a rigged one.

The Federal Government has been investing heavily in certain green energy technologies for decades, handing out tax credits like candy. So naturally, developers follow these credits, and why wouldn't they? But what is the result? Ninety-five percent of the projects waiting to connect to the grid happen to be wind, solar, and batteries, but only 10 percent of those ever make it online—onto the grid. Meanwhile, gas plants, nuclear reactors, geothermal, these things that can actually power a modern economy, providing predictable, reliable, affordable, clean baseload power, they get crowded out or delayed endlessly or blocked entirely. Why? Well, government red tape is responsible for a lot of it and activist-funded lawsuits also have a fair amount to do with it because a government that picks winners and losers—and consistently picks losers—creates a lot of this problem.

Now, look at what FERC tells us. According to FERC, between now and 2028, we are set to retire 24 gigawatts of coal-fired generation, just in the next three years alone, and replace it with just five gigawatts of gas-fired power. That math doesn't work—not in theory, not in practice, not now, not then, not anywhere, or at any time. The system was built for slow, steady growth. What we are facing now is a tidal wave. And if we don't change course, if we don't wake up to this reality, the lights are going out. We need utilities, developers, states, and Congress to start telling the truth about this. The grid is not ready. The system is not built for this. And the path that we are on will culminate, quite predictably, in rolling blackouts, rising prices, national vulnerability, and our inability to remain competitive in what many are describing as the AI global arms race.

In fact, on only July 7, the U.S. Energy Department warned that between the growth in demand and the retirement of some current sources, if we don't take steps to respond to the increased demand, the risk of blackouts in the United States will increase a hundredfold. I repeat, increasing 100 times what we currently face in terms of blackouts across the country. We currently experience annual outage hours in the single digits. And if we don't take effective steps, the estimate is more than 800 outage hours per year in the next five years. We cannot allow that to happen. We have too

much riding on that. It's time that we face the facts, and that's what this hearing is about.

The Chair now recognizes the Ranking Member, Senator Heinrich.

OPENING STATEMENT OF HON. MARTIN HEINRICH, U.S. SENATOR FROM NEW MEXICO

Senator HEINRICH. Thank you, Chairman Lee. Welcome to our witnesses, Mr. Gramlich, Mr. Huntsman, and Mr. Tench.

As we will discuss today, the scale and drivers of today's rising electricity demand are relatively unprecedented. It's not just that electricity demand is reaching record highs, it's that we are entering a new era of sustained load growth. The structural forces underlying today's load growth are converging—the growth of AI data centers, the electrification of vehicles, buildings, industry, as well as a resurgence in domestic manufacturing. And meeting this load growth will require structural changes to how we permit and build our energy infrastructure.

In his testimony, Mr. Tench states that Vantage would prefer to source power from the grid, but that the system is out of sync. From interconnection timelines that are too long, transmission lines that take too long to build, and permitting that is too fragmented, the challenges that Mr. Tench articulates are the same ones that this Committee has been trying to address for some time. As Mr. Tench notes in his testimony, no single business or technical workaround can substitute for a coordinated, modern, responsive grid. Fortunately, we sit on the Committee that can help make that happen. The urgency isn't just about maintaining our edge in AI innovation, it's about affordability. As Mr. Gramlich points out in his testimony today, electricity bills are becoming unaffordable for too many Americans, and recent actions by President Trump and by the "Big Bad Bill" will make this worse.

The reconciliation bill alone is estimated to increase annual energy costs more than $16 billion in 2030, and more than $33 billion by 2035. This is because, at a time when we need every single electron we can get, the reconciliation bill is causing many clean energy projects to be canceled. And the President's tariffs are driving up equipment costs, raising the cost of all energy generation resources—all of them. This is leading directly to Americans spending more on their utility bills. And on top of this, an aging electrical grid is causing many energy projects to be stalled for years in interconnection queues.

In June 2025, Grid Strategies released a study that found that investing in well-planned, high-capacity transmission could save U.S. households between $6.3 and $10.4 billion annually, and that is even after accounting for the cost of actually building those transmission lines. The amount of energy currently in U.S. interconnection queues substantially exceeds the existing electricity demands—if only the grid could integrate it. According to the Energy Information Administration (EIA), in 2024, the U.S. installed nearly 49 gigawatts of new grid capacity, 95 percent of which was for renewable resources. This year, the EIA estimates that developers will build 63 gigawatts of new capacity, including 32.5 gigawatts of new utility-scale solar, 7.7 gigawatts of wind power, 18.2 gigawatts

of energy storage, and just 4.4 gigawatts of natural gas-fired generation. Clean energy is the most affordable, and it's the fastest type of energy generation to deploy, outpacing natural gas, which is facing years-long backlogs in turbine availability. If you order a combined-cycle natural gas turbine today, you will be lucky if it puts its first electron on the grid before 2032.

Meanwhile, states like Texas and California are demonstrating that high levels of renewable energy do not compromise grid reliability. In fact, they improve it. After Texas added 9,600 megawatts of clean energy, including 5,400 megawatts of solar, 3,800 megawatts of energy storage, and 253 megawatts of wind, ERCOT CEO Pablo Vegas said that the risk of grid emergencies dropped to less than one percent. That is down from 16 percent the previous year. NERC's 2025 Summer Reliability Assessment confirmed this trend, showing that the risk of rolling blackouts in Texas fell from 15 percent to 3 percent as battery capacity came online.

I will close by saying that I am deeply disturbed by the recent Department of Interior policy that requires Secretary Doug Burgum to personally review and sign off on wind and solar projects on federal lands. This nakedly political decision will risk delaying new generation additions to the grid when we need them the most. And consequently, it will drive up cost. According to the Department of Energy, federal lands in the contiguous United States could support more than 7,700 gigawatts of renewable energy capacity. And with that said, I look forward to discussing how we can meet the rise in electricity demand and lower energy costs for households by integrating the most affordable and rapidly deployable energy resources today while also investing in long-term modernization.

Thank you, Chairman.

The CHAIRMAN. Thank you, Senator Heinrich.

We will now hear from each of our witnesses, giving you five minutes to make your opening statements.

We will hear first from Mr. Huntsman, then from Mr. Tench, and then from Mr. Gramlich.

Mr. Huntsman, you may proceed.

STATEMENT OF PETER HUNTSMAN, CHAIRMAN, PRESIDENT, AND CHIEF EXECUTIVE OFFICER, HUNTSMAN CORPORATION

Mr. HUNTSMAN. Thank you very much.

Chairman Lee, Ranking Member Heinrich, members of the Committee, my name is Peter Huntsman, and I am Chairman, President, and Chief Executive Officer of Huntsman Corporation. For the first time in a generation, America faces an increase in electricity demand that will have far-reaching consequences if not managed appropriately by elected officials in both parties at federal, state, and local levels. This may sound like hyperbole, but it is not. Look no further than Germany, the United Kingdom, and much of Europe and see how quickly great powers can implement policy to kill productive and thriving industries that form the backbone of modern economies. Just a decade ago, these nations were great industrial powerhouses. Today, they have the highest electricity prices in the industrialized world, shrinking economies, and fac-

tories are being shuttered almost daily. Sadly, I have experienced this firsthand, as our company has laid off thousands of employees in Europe. Facilities that were globally competitive just a few years ago are now closed and are no longer operating due to ruinous and unrealistic net-zero and decarbonization policies and the failed ideas that you can power a modern economy without developing oil and gas resources.

In the chemical industry, we use large amounts of energy and electricity, take molecules mostly derived from oil and gas, break them apart, and then put them back together to make the physical building blocks of virtually everything you see, touch, and consume in modern life. Our entire supply chain employs millions of Americans and is mostly domestic-based—from transportation, technology, food supplies, medical equipment, building materials, pharma, and textiles—none of this would be possible without the chemical industry. None of it. Technology companies perform similar functions, taking energy and electricity to create data that enables everyone of us to tap our mobile phones—by the way, another product that contains over 100 different chemicals to build—and access the world at our fingertips. Virtually every step in the tech world, from chip manufacturing to data generation, storage, transmission, computing, and consumer interface, uses petrochemicals and enormous amounts of electricity to not just maintain, but to grow this vital industry.

The advent of artificial intelligence is fast changing the face of modern society and global competitiveness. AI will bring an enormous wave of societal benefit, similar to every past industrial and technological advancement. However, it is simply impossible for this to happen in a society that does not have the basic hydrocarbons to both construct the physical materials needed to build and the electricity required to power this great advancement. The challenge before us today is real, but the opportunities are even greater. The United States has both the raw material and the technological base to not just compete, but to continue to lead. Our greatest challenge will be to balance the enormous demand for more electricity while being able to keep prices affordable and supplies reliable for both consumers and industry, especially those who do not benefit from trillion-dollar balance sheets.

If our growing demand for electricity being consumed by data centers and a growing tech industry are not met with additional reliable and affordable energy sources, we risk losing both our manufacturing and consumer affordability. It is simply impossible to build a modern industrial and technological economy on an energy base that is neither reliable nor affordable. We can talk all we want to about nuclear ambitions that are decades away or intermittent wind and solar dreams that are operable 25 to 40 percent of the time and require even greater investment and more reliable backup and unrealistic battery storage, but these dreams will never solve today's problems. The demand for power and raw materials is here today and growing tomorrow. If we continue to build out more tech industry consumption than production of electricity while at the same time prohibiting the reliable and affordable production of largely hydrocarbon-based energy sources, we will look

more like Europe and less like the continued model of growth that has made the United States the envy of the world.

Senators, now is the time for ambitious and bipartisan planning that will allow American industry, capital markets, and innovation to meet the needs of these exciting times and opportunities. Our company, our industry, and most importantly, the millions of people who rely on our operations, look forward to being a part of the needed solutions and innovations that will be required for our continued success. Thank you.

[The prepared statement of Mr. Huntsman follows:]

HUNTSMAN

Enriching lives through innovation

Testimony for the Record by Peter R. Huntsman
Chairman, President, and Chief Executive Officer
Huntsman Corporation

United States Senate
Committee on Energy and Natural Resources

"Full Committee Hearing to Identify Challenges to Meeting Increased Electricity Demand"
July 23, 2025, 10:00 a.m. EST
366 Dirksen Senate Office Building
Washington, D.C. 20510

Why I Am Here Today

Chairman Lee, Ranking Member Heinrich, Members of the Committee, thank you for this opportunity to appear before the Committee to testify on how policymakers at the Federal, state and local level can work together to ensure America calibrates public policy to meet increased electricity demand. It is an honor. I take very seriously our First Amendment right to engage directly with elected officials and policymakers of both parties to help educate and inform them about how Huntsman Corporation and American chemical manufacturers manage risk, make capital decisions, grow our employee base, return capital to shareholders, and safely deliver the products that make modern life possible. None of this is possible without access to cheap, abundant energy and electricity.

The primary reason I am here today is to share my observations on policy, political, business, and cultural forces that are shaping investment decisions by U.S. manufacturers, especially those that are energy intensive. I rely heavily on thousands of Huntsman associates and colleagues in the industry to help me understand the complexity of these issues. However, after four decades in the chemical industry, I do understand how energy and electricity—and other inputs—incentivize or disincentive manufacturing investment decisions in the United States.

I hope Members of the Committee come away with the following conclusions from my testimony:

1. **American manufacturing dominance, prosperity, security, innovation and power are based predominantly on our continuing access to cheap, abundant, and reliable energy, primarily in the form of hydrocarbons.**
2. **The safe and environmentally secure extraction, processing, and transportation of hydrocarbons makes modern life possible. That is not hyperbole. It is physical, immutable reality.**
3. **Given the inherent limitations of existing technology, organizing the American economy and government to *entirely eliminate* greenhouse gas emissions will create scarcity of the chemical building blocks of modern life, increase the costs of all goods and services, lower our standard of living, inhibit U.S. economic innovation and weaken America in the world.**
4. **To enable society to *reduce* greenhouse gas emissions, public policy should be calibrated to *increase* U.S. natural resource extraction, material refining capacity and chemical manufacturing more efficiently and productively here in the United States, where we have the strongest, risk-based**

environmental laws and regulation in the world. It is the chemical sector that develops the molecules that allow individuals and society collectively to lower their greenhouse gas emissions.

5. **Long term taxpayer subsidy of intermittent and unprofitable electricity production creates market distortions across the entire manufacturing value chain and supplants reliable, clean and profitable sources of energy.**
6. **If the threat of climate change is existential to humanity, the U.S. Congress should directly finance or incentivize the construction of emissions free nuclear energy facilities across the entire nation.**

The Huntsman Story

The Huntsman story is the story of American manufacturing.

Through the vision and tenacity of my father, Jon Huntsman, Sr., and supported by tens of thousands of employees over a half century, Huntsman Corporation today is a New York Stock Exchange (NYSE) traded company headquartered in The Woodlands, Texas with 2024 revenues of approximately $6 billion, 6,000 employees and operations in 25 countries. My father's life began in 1937 in a Blackfoot, Idaho home with no indoor plumbing. By the end of his life in 2018, he had built a global manufacturing company, created thousands of jobs, and donated nearly $1 billion dollars to endow the Huntsman Cancer Institute (HCI) at the University of Utah in Salt Lake City. Today, HCI is the leading cancer hospital in the Mountain West Region and has saved tens of thousands of lives through world leading cancer treatment.

After dropping out of college, I started my career in 1983 as a truck driver delivering oil across the Intermountain West. In 2000, I became President of the company and in 2017 Chairman and CEO. As our company grew from a small California packaging company into a multinational chemical company, I have witnessed boom and bust business cycles, mergers and acquisitions, multiple iterations of "peak oil," the collapse of the Soviet Union, reunification of Europe, the rise of China, the creation of the Internet and the transformational impact of hydraulic fracturing on the world, among other things. Today, I am eagerly watching how Artificial Intelligence will change the chemical industry and world. Through it all, I have observed the tax policy and regulatory environment impacting U.S. manufacturing ebb and flow across Democrat and Republican Administrations and Congresses. Our company and the chemical industry have played a role in all of it.

Raw Materials, Feedstocks, Chemical Manufacturing, and Innovation

I want to provide a basic primer on what chemical companies do because chemicals are the building blocks of all American manufacturing. In the most basic form, we take atoms and molecules, break them apart and then put them back together to make the building blocks of virtually everything you see and touch in modern life. Automobiles, passenger airplanes, solar panels, wind blades, smartphones, computers, televisions, residential and commercial buildings, pharmaceuticals, missiles, fighter planes, clothing, soap, shampoo, shoes, clean drinking water and crop fertilizer are all "modern miracles" made possible by chemical manufacturing.

The most utilized starting atoms, or "feedstocks," for chemical manufacturing are hydrocarbons derived from petroleum, natural gas, natural gas liquids and coal, otherwise known as fossil fuels. Without abundant access to fossil fuel feedstocks, nobody can manufacture chemicals. Without chemicals, virtually all U.S. manufacturing would cease.

The scientists and engineers in the American chemical sector go to work in laboratories across the country every day and work to improve existing molecules and develop new ones. When commercially viable, their laboratory innovations move to manufacturing plants and into the marketplace. While abstract to the average person, the molecular innovation we do ultimately manifests itself in our sustainable modern lives – lighter airplanes and cars, longer lasting clothes, stronger building materials, clean drinking water, new medicines and cancer

treatments, and larger crop yields. Standards of living increase and human lives are enriched and lengthened through chemical sector innovation and manufacturing.

Lack of Understanding of How Things Are Made

I lay this out in some detail as I have become increasingly concerned that many government and business leaders lack an understanding of how "things" are actually made. In the post-Cold War era of globalization, the United States underwent a low-level form of deindustrialization as the appeal of cheap labor and growth markets in Asia pushed supply chains out of North America. Two examples of this can be seen in the fate of the Pennsylvania steel industry and textiles in North Carolina in the 1990s and 2000s, and there have been countless others. Wall Street became the highest paying sector. It was then followed by Silicon Valley and the tech boom. Making things never stopped but put simply, "making things" here in the U.S. went out of vogue because it was done "out of sight and out of mind."

Looking back with the benefit of hindsight, I believe the post-Cold War manufacturing exodus led many policymakers and business leaders to simply forget how things are manufactured at the most basic molecular level or, as we say in the chemical industry, "upstream." This trend is best encapsulated by Apple's famous "Designed in California Assembled in China" label on their products. To most people, the iPhone is a supercomputer we use every few seconds connecting us to the entire world. As a chemical industry leader, I see a device consisting of minerals and elements extracted from the Earth and refined thousands of times over into chemicals, plastic, glass, and materials brought to market via one of the most sophisticated supply chains ever developed. The same is true of millions of other products we use in our daily lives.

Natural Resource Extraction is the Base of American Manufacturing & The American Way of Life

One of the biggest threats to American manufacturing power, security, and prosperity today is the growing belief, seemingly held by many, that we can choose *not* to extract our natural resources and convert them into the materials that enable our citizenry to thrive. Since the beginning of recorded history to the modern-day international system, human beings and nation states have used natural resources to survive, prosper, trade and project power. This has been an invariable part of human nature and will always be so.

In the current policy, political and business arenas, opposition to natural resource extraction manifests itself in the idea that American society – and the world – can somehow "transition" away from fossil fuels and their derivative materials, including chemicals, and somehow maintain our current standard of living and our way of life. Until the advent of new technology or a massive expansion of nuclear power, this is simply untrue and not physically possible. To believe so is both naïve and dangerous. Serious countries and people understand this reality.

Until relatively recently, the notion that we could eliminate fossil fuels while still sustaining modern society was mostly a fringe idea and dismissed by serious leaders in government and industry. Over the last two decades, as seemingly well-intentioned policy proposals developed to attempt to manage an ever-changing climate, anti-fossil fuel extraction policy has become normalized in Europe and, more recently, in parts of the United States. Many governments have organized themselves around stopping natural resource extraction in the name of reducing greenhouse gas emissions to "net zero." In the business community, many companies have made "commitments" that may (or may not) come to reality in less than three decades.

"Net Zero" & German Deindustrialization

The most notable example of the danger of "net zero" government policy is Germany. Through a series of government decisions over two decades and exacerbated by Russia's invasion of Ukraine, Germany has chosen

to embark on a once-in-a-century deindustrialization that will have enormous global impacts, including in the United States.

Just three years ago, it would have been inconceivable that the birthplace of the chemical industry and so many others could be intentionally deindustrializing. Yet here we are, waiting to see whether one of the most advanced economies and societies in modern history will be to provide cheap, reliable, and abundant heat and electricity to power its economy. I encourage all U.S. elected officials to study deeply the policy decisions Germany made as it presents a real-life example of how *not* to organize electricity, manufacturing, natural resource, energy, and industrial policy.

The Chemical Sector Enables Society to Lower Greenhouse Gas Emissions

If the goal of government and business is to reduce carbon dioxide emissions across society, U.S. government policy should be calibrated to *increase* domestic natural resource extraction and chemical manufacturing more efficiently and productively. It is the chemical sector that develops the molecules and the innovations that allow individuals and society collectively to lower their emissions. This is evident in almost every sector across the economy. In the aerospace sector, fossil fuel-derived carbon composite airplanes fly longer distances using less fuel than their aluminum predecessors. Automobiles are constructed using carbon fiber material versus steel in years past. Modern homes include insulation materials that create a building envelope, securing the valuable hot and cold air inside the home. The world population recently reached 8 billion people and, for the most part, everyone has access to food. The mass starvation that we witnessed as recently as the mid-1980's in sub-Saharan Africa is virtually obsolete. This is a new phenomenon in human history and has been made possible only by chemical fertilizer and cold chain storage. Simply stated, a vibrant chemical industry means it is within our ability to lower emissions, grow the economy, and improve lives.

American Manufacturers Welcome Strong, Effective and Risk Based Regulation

The United States has the strongest and most effective environmental laws in the world. It was not always that way and industry has made mistakes. However, when you compare the environment in the developed world today to even 1980, the progress is staggering. The water in the Potomac River, the air in Los Angeles, and our rivers and streams throughout the United States are all cleaner. This is due to the combination of strong government regulation, corporations being held legally accountable for wrongdoing and because wealthy nations have the financial resources to prioritize the environment. The more prosperous a society becomes, the better it manages the environment.

Every single day the chemical sector manufactures, handles, stores, transports and sells hazardous materials across the world. To deliver the products that make modern life possible we incur and manage the risk. We spend billions of dollars on the environmental health and safety of our employees and the communities where we operate. Safety is a deeply ingrained value and our license to operate. In my 40 years in the industry, I can state unequivocally that we have greatly improved our environmental and safety record. As in all human endeavors, mistakes and failures occur. Our safety record demonstrates we constantly strive to learn and improve as a company and industry.

Complex Industrial Systems and "Transitions"

The United States possesses the most sophisticated energy production and electricity delivery system in the world. Every day, the energy system delivers electricity to 330 million people so they can power their businesses and maintain the highest standard of living in the world. Every single American has on-demand access to refined petroleum products to fuel their automobiles. Together, the energy and automotive sectors employ millions of Americans and generate hundreds of billions of dollars in wealth for Americans.

Our energy production and electricity delivery system are the two bedrocks of American manufacturing strength. They are also two of the most amazingly complex manufacturing systems in human history. They are the envy of every other nation in the world and their processes have been refined for over 150 years through efficiency and human innovation. Yet, we take them for granted and often fail to appreciate how easily they can be irreparably harmed by bad government policy and improperly incentivized business decisions.

I encourage the Committee members to consider that, over the last decade, European and U.S. governments have collectively committed trillions of taxpayer spending to "transition" away from energy sources that have successfully powered our modern economies to energy sources that cannot do so. European and U.S. governments have subsidized a "transition" to passenger vehicles for which no mass market demand exists and the electricity generation needed to fuel them is not possible. In both cases—maybe for the first time in modern American history—we invested a huge portion of American productive capacity into duplicative and parallel energy and transportation systems that will do very little to improve lives or lift people out of poverty.

Today, government and business leaders talk about "transitions" of the U.S. energy and electricity system as a forgone conclusion that will just happen without massive financial, human and reliability costs. Complex systems that profitably mass produces materials society wants and needs are very hard to "transition" away from because they represent the essence of free market capitalism. An energy "transition" will only happen when new, undeveloped technology is scaled to meet mass market demand at a profit. No amount of government spending can supplant these systems without enormous damage to American manufacturing and American lives.

Looking Ahead

I am highly optimistic about the future. The United States, with its combination of freedom, capitalism, scientific inquiry, deep capital markets, legal protection, and entrepreneurial spirit, possesses the power to solve humanity's problems. As the geopolitical tides churn and countries reassess their priorities in a more dangerous world, regionalized supply chains will take precedence.

Government policy around natural resources, self-sufficiency and manufacturing have returned to the forefront of policymaking. Industrial policy, regulatory decisions and capital expenditures made today by government and business leaders will impact America and the world for generations to come. We don't need to look far to see the damaging impact of bad public policy around natural resources, energy, electricity, chemicals, and material innovation.

History shows that such policy decisions determine the fate of nations and societies.

I look forward to your questions.

The CHAIRMAN. Thank you, Mr. Huntsman.
Mr. Tench.

STATEMENT OF JEFF TENCH, EXECUTIVE VICE PRESIDENT, NORTH AMERICA AND ASIA PACIFIC, VANTAGE DATA CENTERS

Mr. TENCH. Chairman Lee, Ranking Member Heinrich, and members of the Committee, thank you for the opportunity to testify today. My name is Jeff Tench, and I serve as the Executive Vice President for North America and Asia Pacific at Vantage Data Centers, a Colorado-based developer, owner, and operator of hyperscale data centers for leading U.S. technology companies. I would like to briefly summarize my written remarks that have been submitted for the record.

While I do not claim to be an expert on energy policy, I have spent my career building businesses and leading teams that construct and operate the most efficient, secure, and resilient large-scale digital infrastructure in the world, and I appear before you with one message, based on what I have seen from my position: the greatest barrier we collectively face to our country's leadership on artificial intelligence today is timely access to reliable electric power. Demand for the AI and cloud infrastructure that Vantage provides is accelerating. Over the past decade, I have seen the scale and speed of hyperscale data center development grow dramatically. Five years ago, a 30-megawatt facility was considered large. Today, 100 megawatts is the starting point, with campus developments commonly reaching 500 megawatts or more. And we have multiple customers seeking one gigawatt or more for AI infrastructure, which is the equivalent of all electrical power used here in Washington, DC.

In market after market across the U.S., our development teams all report the same issue: we cannot get the amount of electricity we need in the time frame to build our data centers. Without electrical power, it is not possible to build digital infrastructure. The infrastructure that supports AI, data centers, transmission lines, and generation facilities must scale rapidly if the U.S. is to remain the global leader in AI innovation. We are asking for your leadership to drive a more modernized policy framework that reflects today's growth, aligns with investment timelines, and ensures that the power system is ready when and where it is needed. From Vantage's perspective, the challenge is clear: we cannot access power on a timeline that aligns with customer demand.

First, interconnection timelines are too long, both for new load and new generation resources. Second, we must develop new transmission for a more scalable and reliable grid. Third, permitting is fragmented and sequential, resulting in both increased costs and delays in projects that are otherwise ready to proceed.

If we do not act decisively, we risk ceding AI leadership to countries that are moving faster to modernize their energy infrastructure. The United States is at a pivotal moment. The United States is looking at an AI era that is not coming, but is here. We have the capital. We have the customers and the talent, but we will not lead if we cannot power it. By prioritizing infrastructure for high-growth sectors, strengthening federal leadership, enforcing inter-

connection reforms, and incentivizing high-impact transmission, these policies can unlock the power system needed to support America's digital future.

Vantage is prepared to invest and deliver. We bring development and operational expertise, capital, and long-term commitments to the communities where we build. Let us work together to build an energy delivery system that is ready to meet the scale and the importance of this moment. Thank you for the opportunity to share our experience. I look forward to your questions and working together on solutions that can keep the United States at the forefront of digital infrastructure, innovation, and investment.

Thank you.

[The prepared statement of Mr. Tench follows:]

Testimony of Jeff Tench

Executive Vice President, North America and Asia Pacific

Vantage Data Centers

Before the United States Senate Committee on Energy and Natural Resources

Full Committee Hearing to Identify Challenges to Meeting Increased Electricity Demand

Wednesday, July 23, 2025

Chairman Lee, Ranking Member Heinrich, and Members of the Committee:

Thank you for the opportunity to testify today. My name is Jeff Tench, and I serve as Executive Vice President for North America and Asia Pacific at Vantage Data Centers ("Vantage"), a Colorado-based global developer, owner, and operator of hyperscale data centers for leading U.S. technology companies. I have spent my career building businesses and leading teams that construct and operate the most efficient, secure, and resilient large-scale digital infrastructure in the world, and I appear before you with one message based on what I have seen from my position: the greatest challenge we collectively face to our leadership on artificial intelligence (AI) today is timely access to reliable electric power.

THE BUSINESS REALITY: DEMAND IS STRONG, BUT POWER IS NOT AVAILABLE

Demand for the AI and cloud infrastructure Vantage provides is accelerating. Over the past decade, I have seen the scale and speed of hyperscale data center development grow dramatically. Five years ago, a 30-megawatt facility was considered large. Today, 100 megawatts is the starting point, with campus developments commonly reaching 500 megawatts+—and we have multiple customers seeking one gigawatt or more for AI infrastructure, the equivalent of all electrical power used in Washington, D.C.

Vantage and our peers are ready to invest. Our customers are prepared to invest and sign long-term leases to fund needed digital infrastructure in the United States. Our goal is to move quickly and deliver world-class service, yet we routinely encounter power interconnection delays and uncertainty. In addition to land and network connectivity, data centers require timely access to reliable, stable power. In market after market across the U.S., our development teams all report the same issue: we cannot get the amount of electricity we need in the timeframe we need it to build our data centers. Moreover, the quality of that power from a deliverability perspective and price volatility perspective is an increasing risk factor. Sites with near-term grid connections are scarce, and utilities are often unable to deliver on the timelines required. Without electrical power, it is not possible to build digital infrastructure. The infrastructure that supports AI — data centers, transmission lines, generation facilities — must scale rapidly if the U.S. is to remain the global leader in AI innovation.

STRUCTURAL CHALLENGES: A SYSTEM OUT OF SYNC

Utilities are often willing to provide the electrical power we need, but they operate within planning cycles, regulatory requirements, energy markets, and business models based on decade-long horizons; moreover, many of these models and rules were developed at a time well before the Internet existed and when load growth was flat. The past has not been prologue. Now, the largest barriers to tackling the challenges we face can be traced to public policies that Congress and the Administration can improve.

Energy policy is complex. Multiple levels of government influence how and when new transmission is built and new generation is interconnected. When timelines and rules are misaligned, promising investments stall and opportunities are lost. It is on this topic that Congress can lead to find a solution that will unlock capacity and, in doing so, unleash the investment that will maintain our global leadership on AI.

Vantage and our customers are prepared to continue to invest hundreds of billions of dollars in American infrastructure. We are asking for your leadership to drive a more modernized policy framework that reflects today's growth, aligns with investment timelines, and ensures that the power system is ready when and where it is needed. If we do not act decisively, we risk ceding AI leadership to countries that are moving faster to modernize their energy infrastructure.

STRUCTURAL CHALLENGES IN POWER DELIVERY: A BUSINESS PERSPECTIVE

From Vantage's perspective the challenge is clear: we cannot access power on a timeline that aligns with customer demand. In market after market, we encounter the same three challenges:

- First, interconnection timelines are too long. This is true for both new loads—such as data centers—and new energy resources coming onto the grid. Queue studies can take several years to complete. Restudies and limited transparency add further delay. This uncertainty makes it difficult for developers to plan and for customers to commit.

- Second, transmission development lags demand. Many regions are not planning for the scale of growth driven by the digital economy. Without anticipatory planning, grid congestion worsens, and costs rise.
- Third, permitting is fragmented and sequential. Transmission and generation projects must navigate multiple federal, state, and local reviews, often with overlapping or duplicative requirements. This slows down projects that are otherwise ready to proceed.

These are not new problems, but they are now hitting at a time when urgency is growing. We believe they can be solved, but it will require clear policy direction, coordination, and accountability.

At Vantage, we prefer to source power from the grid. It should be the most efficient, reliable, scalable, and cost-effective solution for our customers. But when interconnection timelines stretch years beyond our project schedules, and the buildout of grid-connected generation capacity is not keeping pace with the demand growth rate for electricity, we have no choice but to explore alternatives. That includes deploying on-site generation to serve initial loads, co-locating near existing power plants, planning developments in phases, and coordinating with utilities and state partners to locate scarce near-term capacity. These efforts reflect creativity and adaptability. They do not represent a sustainable model for national infrastructure growth.

For example, in Virginia, we built and now operate a large electrical power generation facility using natural gas to meet urgent customer needs. We had no choice because it would have taken four to seven years, or longer, to wait for utility energization of the project, which is longer than it would have taken our teams to build and fit out the data center. We proved that we can do this off-grid generation when necessary, but it is not our preference. These types of investments divert capital away from shared infrastructure that could otherwise strengthen the grid for everyone. We may face a future scenario where large portions of load operate off-grid. That is a missed opportunity for national resilience, and it reflects a system out of sync with the scale of modern demand. When data centers are integrated into the grid with the right planning and policy framework, the load can be a source of stability. Large customers invest in shared infrastructure that improves grid resiliency and supports broader system needs without impacting rates on other customers.

No single business or technical workaround can substitute for a coordinated, modern, and responsive grid. The U.S. electrical grid has not kept pace with the demand placed on it to meet the needs of today or tomorrow. That is the bottleneck, and that is where federal leadership can make a difference. Upgrading the grid infrastructure to accommodate the needs of AI data centers and other large users is essential to support this expansion and to maintain U.S. leadership on AI and benefit the entire U.S. economy and all electric grid users with more clean, reliable, and affordable energy. By creating a policy environment that encourages investment in the grid and flexibility on solutions, we can enhance its capacity and resilience, ensuring it can meet the

evolving demands of AI technology and support the continued development of AI applications to strengthen our nation's leadership on this critical technology.

POLICY RECOMMENDATIONS TO SUPPORT LOAD GROWTH

Based on our many years' experience delivering digital infrastructure around the world, we believe the following actions will make the greatest difference and urge Congress to consider them:

1. Prioritize energy infrastructure that supports high-growth sectors:

Federal permitting, planning, and funding processes should recognize the national importance of data centers and their associated power infrastructure, particularly our national security and economic competitiveness. New dispatchable power generation and high-voltage transmission that supports data centers should be eligible for expedited treatment and coordinated interagency review. This approach streamlines the permitting process, reducing the time and resources required to get projects off the ground, thereby reducing timelines and making more power available, more quickly. Further, by implementing more timely permitting, planning, and funding processes, Congress can provide the timely certainty necessary for encouraging more investment.

2. Strengthen federal authority to improve grid readiness:

Congress should reinforce the Federal Energy Regulatory Commission (FERC)'s authority to site and approve critical electric transmission infrastructure. This includes directing FERC to establish enforceable standards for interregional transfer capacity, cost allocation, and state consultation. For example, by enabling the transfer of electricity between regions, Congress can optimize the use of available power resources and reduce the need for redundant infrastructure. This can result in lower operational costs for data centers and other large end users, as they can access more affordable and reliable power.

Regarding cost allocation, we support cost allocation policies that are based on essential principles of fairness to ensure that co-location and other innovative business models for the delivery of electricity is done in a deliberate, responsible, and collaborative manner.

Congress should also explore mechanisms to improve consultations and ensure that infrastructure development is coordinated and efficient. Consultations should identify and address regional disparities in grid capacity, ensuring that all areas have access to reliable and affordable electricity. This collaborative effort is essential for creating a resilient and interconnected grid that can adapt to changing energy demands and support the growth of reliable energy.

3. Identify and support High Demand Digital Infrastructure Zones:

The federal government should identify regions of the U.S. experiencing concentrated load growth

from digital infrastructure to be declared "High Demand Digital Infrastructure Zones." These Zones would guide proactive transmission planning, interconnection coordination, and permitting alignment across agencies. This approach would help focus public and private investment toward grid upgrades in areas of strategic national importance. For example, we have been encouraged by the Administration's efforts to identify actions and resources that support the development of dispatchable power infrastructure and AI data centers. Vantage has been an active participant in these, including by responding to the White House Office of Science and Technology Policy AI Action Plan and the U.S. Department of Energy's RFI for AI Infrastructure to identify actions and resources (i.e. powered land) that could be used to develop AI data centers and supporting power infrastructure. We suggest that a similar approach could be used here to identify and catalog locations for potential zones for such high-demand infrastructure.

4. Ensure full implementation of interconnection reforms:

Recent federal efforts by FERC to streamline interconnection are promising, but they must be enforced. Enforcing these efforts is essential for modernizing generator interconnection procedures and ensuring that the electrical grid can meet the growing demands of the digital economy. FERC Order 2023 introduced critical reforms to the interconnection queue, prioritizing viable projects and ensuring they are served first. Recent actions by FERC also modernize procedures for co-located, hybrid, and flexible resources, which are crucial for addressing the dynamic and evolving energy landscape. Data centers are increasingly adopting on-site generation and hybrid solutions to enhance their energy security and reduce their reliance on the grid. This combination of load and localized generation not only supports their operational resilience but also contributes to broader grid resiliency and reduces stress on the transmission system. By streamlining the queue process particularly around studies and clustering, enforcement of FERC's actions reduces delays and accelerates the development of essential infrastructure. Federal leadership is also needed to ensure consistent implementation across regions, with transparent progress tracking and clear agency accountability.

5. Align returns with high-impact transmission projects:

Congress should direct FERC to update its transmission return-on-equity framework to prioritize projects that deliver measurable public value. This includes high-voltage lines that improve reliability, serve rapidly growing electric loads, and expand interregional transfer capacity. Current utility business models often disincentivize proactive investment in generation and transmission, creating significant barriers for data center development. Utilities nowadays frequently require unreasonably large upfront financial assurances from data center developers, which can tie up capital and deter investment. This approach not only hampers the growth of data centers but also stifles innovation and economic development. Ensuring fair and predictable returns for these high-

impact projects based on performance and system need will help accelerate private investment in the grid.

Finally, Congress should also explore federal-level financial tools to help utilities manage risk and encourage investment in generation and transmission. Loan guarantees, credit insurance, and revolving funds are effective mechanisms that can provide the necessary financial support to utilities, reducing the burden on data center customers.

CLOSING

The United States is at a pivotal moment. The AI era is not coming, it is here. This country has the capital, the customers, and the talent. But we will not lead on AI if we cannot power it. Global demand for digital infrastructure is expanding. Investment is ready. But power availability is limiting economic growth. If we want the next wave of digital infrastructure to locate in the United States, we must ensure that developers have access to reliable, timely, and scalable grid power here. With the right policies, data centers can strengthen the grid.

By prioritizing infrastructure to support high-growth sectors, strengthening federal leadership, enforcing interconnection reforms, and incentivizing high-impact transmission, we can unlock the power system needed to support America's digital future.

Vantage is prepared to invest and deliver. We bring development and operational expertise, capital, and long-term commitments to the communities where we build. Let us work together to build an energy delivery system that is ready to meet the scale and importance of this moment.

Thank you for the opportunity to share our experience. I look forward to your questions and to working together on solutions that keep the United States at the forefront of digital infrastructure, innovation, and investment.

The CHAIRMAN. Thank you, Mr. Tench.
Mr. Gramlich.

STATEMENT OF ROB GRAMLICH,
PRESIDENT, GRID STRATEGIES LLC

Mr. GRAMLICH. Chairman Lee, Ranking Member Heinrich, members of the Committee, thank you for the opportunity to testify. My name is Rob Gramlich. I am founder and President of Grid Strategies. We are a power sector transmission and power markets consulting firm based here in the DC area. Thank you for doing this hearing. This is about one of the most important topics facing the country before one of the most—if not the most—important legislative committee. Power demand growth is sudden and significant, and it will be a challenge to meet, and affordability is equally important, as I am sure you are hearing from your constituents.

I will focus now on how we can meet demand growth affordably. Basically, we need both transmission and generation. I am going to start with transmission because that is the one that is largely in federal jurisdiction and has a federal role, while generation is largely reserved for the states under the Federal Power Act. Transmission is also the main thing we need right now. It has the highest impact. It is the great integrator of all resources. It may seem like it's a renewable energy piece of infrastructure, but that is just because over the last five years, that is all anybody was trying to connect to the grid. Right now, we are seeing a lot of other things trying to connect to the grid, including Jeff's data centers and data centers around the country, other large loads, manufacturing, and other types of generation. And whether it is nuclear, CCS, or other types of generation, guess what—it is going to face that same constrained grid. So we should really focus on the grid.

Transmission is also a great deal for consumers. The economies of scale are massive. There is a 75 percent discount if you do it at the higher voltage, like 765-kV lines, as opposed to 230, like four regions are doing. Transmission can also help in the 2020s. It's not just the 2030s or 2040s option. There are a lot of ways to expand transmission. Some lines are actually quick, and there are advanced transmission technologies and other ways to use existing corridors. Transmission supports reliability and resilience more than any other resource. The availability of transmission lines is 99.85 percent or above for all voltage classes, meaning it is much more available than any type of generation.

With severe weather events in recent years, we have seen tens of gigawatts, like up to 10 percent of a region's power, served from large-scale movements of power across the regions of the country because of interregional transmission, which is why Congress directed the North American Electric Reliability Corporation (NERC) to study interregional transmission, which it did, and it found we have a need for 35 new gigawatts of interregional transmission. The U.S. is falling far behind its competitors. China is doing 80 times what we are doing here on high-voltage transmission. So I do think transmission really should be the bipartisan and the unifying force that commands Congress's attention.

But in addition to transmission, we do certainly need to expand generation as well. There are three general types. There is, low-

cost, plentiful energy. There is the fast, flexible balancing type of generation. And then there is firm power. So I am not saying all resources provide all of these things. We do need firm power to meet peak loads. Resources provide varying levels of contributions to meeting peak loads. Nuclear has the highest contribution at 95 percent, but we're not able to get much more very soon. Gas CTs, at least according to PJM, are around 60 percent in terms of their ability to serve peak loads. Combined cycle is a little higher—in the 70s. Offshore wind is actually 69 percent. And so, none of these resources are perfect, but the point is, when you put them all together on the integrated grid, that is how you get nearly 100 percent reliability of the power system—by way of flexible loads, flexible data centers, and other loads to help alleviate the need for that capacity.

The good news is, we have two working processes in this country to get the generation we need. We have utility-owned planning—sort of regulatory planning under states, and we have some regions with markets. It's up to the state whether they want to be in a market or have planning. It turns out, both are working. Older plants are staying online longer than anybody thought, and new plants are coming in, both in the integrated resource planning context and in the market context. Look at the PJM prices that came out yesterday. Markets are screaming for generation to either stay on or be added, and that is working. The interconnection queues do need some improvement to get those there.

So in my final 20 seconds, what can Congress do here? I really would focus on transmission. I have some specific ideas in my testimony—regional planning, like FERC Order 1920-A, interregional planning, like this Committee's EPRA. By the way, congratulations on a bipartisan and decisive vote on EPRA last year. It had a lot of great ideas, and I hope that is a starting point for further bipartisan cooperation on legislation.

Thank you.

[The prepared statement of Mr. Gramlich follows:]

GridStrategies

TESTIMONY OF ROB GRAMLICH

PRESIDENT, GRID STRATEGIES LLC

US SENATE

ENERGY AND NATURAL RESOURCES COMMITTEE

Hearing: "Challenges to Meeting Electricity Demand"

JULY 23, 2025

Good morning. It is an honor to testify on one of the most important issues facing the country to the nation's most important legislative committee.

My name is Rob Gramlich and I am Founder and President of Grid Strategies, a consulting firm providing research on the transmission grid and power markets.[1] I cut my teeth working for a Republican Chairman of the Federal Energy Regulatory Commission (FERC) where my job was to seek bipartisan consensus on electric industry policies. I focus here on what have been and still should be bipartisan points of agreement, as I have as both a Republican and Democratic witness in previous Congressional hearings.

I. Electricity demand growth is sudden and significant

After 25 years of flat load, a sudden shift occurred two years ago due to electricity's ability to power so many activities including oil and gas drilling, space heating, driving, and Artificial Intelligence (AI). Grid Strategies' aggregation of utility forecasts shows the nation needs 15% more capacity or 120 GW by the end of the decade.[2] Utility forecasts may be overstated because, as with generators connecting to transmission systems, there are many more requests from potential projects to connect than actual projects that will be built. There will also likely be a continued trend towards more energy efficient algorithms,

[1] Recent clients include large and small energy developers, large and small utilities and utility associations, advocates for large and small retail consumers, state utility commissions and energy offices, large technology companies, and clean energy and environmental NGOs.

[2] Grid Strategies, https://gridstrategiesllc.com/wp-content/uploads/National-Load-Growth-Report-2024-April-Update-Presentation.pdf .

chips, and cooling systems for these large loads. On the other hand, we could also see a large rebound effect where more efficiency leads to expanded use of electricity given large appetites for computing, expansion of air conditioning, and other power uses. On balance, the real observable evidence of very large loads moving forward with construction suggests we will probably experience 2% per year or over 100 GW of growth nationally and higher in certain hot spots of load concentration.

II. Electric bills are becoming unaffordable for many Americans

Unfortunately, retail bills are starting to rise for most utility customers around the country, because:

- Old transmission and distribution assets need to be replaced.
- Generation capacity is scarce, raising prices for capacity, energy, and the power plant equipment needed to meet demand.
- Severe weather (hurricanes, wildfires, high winds, icing, flooding, and other threats) requires increased investment in stronger towers, poles, cables, and other facilities.
- Electrical equipment (transformers, towers, cables, breakers, switches) and associated materials (aluminum, steel, and copper) are scarce and expensive.
- Tariffs are raising costs for these materials and equipment.[3]
- Termination of generation tax credits raises costs of the new generation that is in most utility resource plans.
- Delayed or denied project permits restricting supply.
- Depending on the outcome of DOE orders under FPA Section 202c, forcing old power plants to run more than the economics dictate will require funding from ratepayers.

Utilities and their state and federal utility commission regulators are having to raise electricity rates to enable cost recovery for these factors.

III. Grid investment is the best way to hold down consumer bills and reliably meet load

The transmission grid is the great integrator of all resources. While it may seem like transmission expansion is needed just for renewable energy, that is just because wind, solar, and battery projects made up almost all of the requests to connect to the grid over

[3] Import penetration of large power transformers is 82%. Page 198, https://www.bis.doc.gov/index.php/documents/section-232-investigations/2790-redacted-goes-report-20210723-ab-redacted/file . The critical element is grain-oriented electrical steel (p.6).

the last five years. Today, new large loads and natural gas plants are trying to connect and they are experiencing the same slow and complicated interconnection process that results from limited capacity. Soon we may see nuclear, advanced geothermal, hydro, thermal, and other resources connect and the constraints will affect them as well. Regardless of one's preference for generation type, one should support development of a much less constrained high voltage transmission grid.

High-voltage transmission investment is a great deal for consumers because it costs ¼ as much to build high voltage (eg, 765 kV) as it does to build lower voltage (eg, 230 kV) lines. This economic phenomenon of "economies of scale" has always been and remains present in some parts of the electric industry but especially the transmission sector (in contrast to generation where bigger is not necessarily lower cost). Investment in well-planned, high-capacity transmission could save residential consumers $6.3- 10.4 billion per year across the United States after accounting for the cost of the transmission.[4] Presently across many utilities and states, we are doing transmission in the most expensive way possible—reactive, incremental and small. Shifting to proactive, multi-purpose, and large investments would achieve more and cost less.[5]

Transmission expansion can be fast and help meet loads in the 2020s. While some lines will still take over 5 years to plan, permit, and build even with permitting and regulatory reforms, many types of transmission plans can increase capacity quickly. Approximately 90% of the first tranche of MISO Long Range Transmission Plans were upgrades of capacity over existing rights of way. High-performance conductors and grid-enhancing technologies can squeeze delivery capacity out of the existing network quickly and very affordably.[6] The sooner grid planners proactively plan for future load and generation the sooner capacity can be expanded.

Transmission supports reliability and resilience more than any other option. Transmission lines typically have at least 99.85% availability across all voltage levels, far higher than any individual generation source.[7] Transmission networks are multi-directional, and once built they serve many needs that one could not have predicted ahead of time, moving power

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[4] https://gridstrategiesllc.com/wp-content/uploads/GS_Transmission-Deployment-Saves-Consumers-Money_vf.pdf

[5] See Midcontinent ISO Long Range Transmission Plans for a good model at https://www.misoenergy.org/planning/long-range-transmission-planning/ .

[6] https://ampcoalition.org/wp-content/uploads/2024/10/amp-and-watt-unlocking-the-grid-with-advanced-transmission-technologies-3834050241-e1728271773755.pdf

[7] NERC Transmission Availability Data System. https://www.nerc.com/pa/RAPA/tads/pages/default.aspx

from where it exists to where it is needed, and it does so automatically and at the speed of light. With severe weather events in recent years, sometimes 10% of a region's needs are met by large scale movements of power across major regions of the country. That is why interregional transmission is so important and was the focus of a Congressional requirement for the North American Electric Reliability Corporation (NERC) to study the need, and NERC's report found a need for 35 GW of increased interregional transmission capacity.[8]

Federal regulatory policy is needed because the current US policy and legacy industry structure we have inherited are not well-suited for large-scale long-distance transmission. The 3000 transmission-owning utilities have well-established processes for investing in their local systems. But it has been requiring policies such as bipartisan FERC Orders 2000 (in 1999), 890 (in 2007), 1000 (in 2011), and 1920 (in 2024) to enable planning for the larger regional investments that matter so much for reliability and customers' bills.

The US is falling far behind global competitors. China built 80 times more high voltage transmission than the US in the second half of the 2010s, and in the 2020s, China has completed more than 8200 miles of ultra-high voltage lines while the US has built only 375 miles. European utilities are rapidly increasing the minimum transfer capacity between countries to move power back and forth. Over 125,000 miles of high-performance conductors have been installed in India, Europe, and China but the US has installed less than 10 percent of that.

IV. In addition to transmission, expanding the three basic types of generation are needed to meet growing load

Utilities have always said that a diverse supply is needed because each resource contributes and no resource does everything. Meeting growing load will require more of each of three general generation types: (1) low-cost plentiful energy, (2) firm power, and (3) fast-ramping flexible balancing.

1. Low-cost plentiful energy. Wind and Solar energy are quickly deployable and low cost, and are helping to satisfy energy demand in much of the country. They are in advanced stages of development all around the country with signed or nearly finalized interconnection agreements, are relied upon by most utilities in the country for their supply over the next few years, and can provide the most incremental addition to electric energy this decade of any source. China had over

[8] https://www.nerc.com/pa/RAPA/Pages/ITCS.aspx

1400 GW of wind and solar at the end of 2024 while the US had around 390 GW, and China's pace of renewable development is much faster.[9]

2. Firm power (capacity). While each individual generator and class of generation is subject to forced and planned outages, nearly 100% bulk system reliability is achieved through the pooling of a diverse set of generators on the system. One can calculate each resource's contribution to serving times of need. Few if any customers want power only 95% of the time, yet 95% is the highest capacity value for any class of resource (nuclear, as compared to gas combustion turbine capacity value 60% and offshore wind at 69% in the latest PJM Effective Load Carrying Capability analysis).[10] Nuclear energy provides particularly high capacity value (contribution to system power supply at times of scarcity) but the opportunities to expand it in this decade are minimal. Natural gas is the leading source of new firm capacity and has been in recent decades. It is likely to expand but its expansion is limited by the amount of new gas turbines that can be manufactured. The capacity value of natural gas (60% for combustion turbines and 74% for combined cycle in PJM's recent analysis[11]) is significantly lower than nuclear (95%) because of common mode failures that plague gas plants such as winter freezing of wells and pipelines. Gas-electric industry coordination and firm pipeline contracts will be critical to make gas plants more firm to the power system.[5] Coal provides firm capacity (83% capacity value in PJM) but there is no realistic opportunity to expand it because of the costs and risks to investors over their 50-year lifetimes. Renewables also provide capacity value, particularly solar and storage together meeting air conditioning loads on summer afternoons. Solar is currently regularly meeting 30-40% of summer afternoon peak demand in Texas, and batteries are serving load into the evenings on a daily basis.[12] Similarly, California has been keeping the lights on

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[9] https://www.spglobal.com/commodity-insights/en/news-research/latest-news/012425-infographic-china-solar-capacity-coal-electricity-renewable-energy-hydro-wind , https://www.energy.gov/eere/wind/land-based-wind-market-report . "The 277 GW of utility-scale solar capacity installed in China in 2024 alone is more than twice as much as the 121 GW of utility-scale solar capacity installed in the United States at the end of 2024."EIA, https://www.eia.gov/todayinenergy/detail.php?id=65064 .

[10] PJM, slide 6, https://www.pjm.com/-/media/DotCom/committees-groups/committees/pc/2025/20250313-special/2026-2027-irm-fpr-elcc-and-winter-risk.pdf .

[11] PJM slide 6 https://www.pjm.com/-/media/DotCom/committees-groups/committees/pc/2025/20250313-special/2026-2027-irm-fpr-elcc-and-winter-risk.pdf .

[12] There were 9600 MW added, including 5,395 MW of solar, 3,821 MW of energy storage, and 253 MW of wind last year. ERCOT CEO Pablo Vegas said recently, "The state of the grid is strong, it is reliable—it is as reliable as it has ever been and it is as ready for the challenges of extreme weather," Vegas said. "I feel confident that we are ready for this upcoming summer season." https://insideclimatenews.org/news/28062025/texas-battery-storage-solar-reduces-summer-blackout-risk/ . See Doug Lewin posts at https://x.com/douglewinenergy?lang=en and newsletter as well as ERCOT web site for more data.

over the last five years with a massive infusion of solar meeting afternoon air conditioning load and batteries powering the system into the evening.

3. Fast -ramping flexible resources. Battery energy storage systems (BESS) are also quickly deployable and are extremely versatile shock absorbers on any part of the system (generation, transmission, distribution, and load). Demand response can provide significant flexibility to the system, if retail rates and structures support its expansion. Advances in data center and other load flexibility will enable much greater and faster growth at lower cost to those loads and minimize impacts on residential and small commercial customers.

US power demand will require more of all of these sources that can be deployed in this decade.

IV. On-site behind-the-meter generation is a last resort option but is inferior to grid power

Reliable electric power has always come from the pooling of generation plants because no single power plant or resource type is always able to operate. All plants experience forced and unforced (maintenance) outages, and some require outages for refueling. On the grid, every generator backs up every generator on utility and regional power systems. Off the grid, or "behind the meter," it is extremely expensive to build sufficient supply redundancy on a customer's site, whether that customer is small uses 1 kW like a typical home, or 1 GW like a new large data center. On-site behind the meter supply is likely to constitute only a small portion of total supply.

V. Generation supply can be managed with existing processes

Short- and medium-term supply is adequate for reliability. The bulk power system has been extremely reliable outside of a couple recent extreme weather incidents.[13] No region in the 2025-2029 NERC Long-Term Resource Adequacy Report[14] is at high risk at this point. A recent DOE study[15] provides useful information and analysis but the dramatic conclusions in the summary overstate the shortage numbers in the underlying report. Moreover, in the underlying report, retirement estimates are likely over-stated and supply additions are likely under-stated. The 104 GW of assumed retirements by 2030 in DOE's analysis is double EIA data tallying 52 GW of retirements planned by 2030. Supply growth is also likely

[13] https://docs.nrel.gov/docs/fy24osti/87297.pdf
[14] NERC LTRA updated July 15, 2025. https://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/NERC_Long%20Term%20Reliability%20Assessment_2024.pdf page 6.
[15] https://www.energy.gov/sites/default/files/2025-07/DOE%20Final%20EO%20Report%20%28FINAL%20JULY%207%29_0.pdf

much greater than DOE's study finds. DOE assumes only 56 GW (22 GW "baseload" + 34 GW battery storage) of firm generation capacity will come online by 2030 while EIA forecasts 109 GW (43.4 GW non-renewable, non-battery + 65.5 GW battery) will. The DOE did not consider generation resources presently under consideration which aims to connect to the grid in the 2027-2030 timeline (what NERC terms "tier 2" roughly); instead they only considered generation that is under construction or with signed interconnection agreements (what is termed "tier 1").

There are processes to ensure resource adequacy in the industry, operating mostly at the state level, so micro-management of specific power plants using policies such as FPA 202c at the federal level is not necessary.

For states and utilities that rely on utility ownership and state-overseen resource planning (as opposed to independent generation and markets), the ones experiencing growth have in most or all cases revisited their resource plans and adjusted demand upward and changed their retirement and addition plans accordingly.

For states and utilities that rely instead on independent generation and wholesale power markets (as opposed to utility ownership and state-overseen resource planning), current capacity prices are high which is a strong signal for existing generation to stay on-line and for new generation to be added. Stock markets are rewarding any company that can expand supply in these power markets in this decade. Supply response is happening very fast through the intended mechanisms in these power markets. States and utilities in these regions can help by placing responsibility for generation procurement with whomever is responsible for serving load.

VI. Congress can help expand the grid

A. Permitting reforms. Clearly we need to be able to build supply and delivery capacity in this country faster than we have been able to in recent years. Without infrastructure expansion to alleviate scarcity, we will have an increasing affordability problem showing up in consumers' electric bills. This Committee deserves praise for passing EPRA last year in such a bipartisan and decisive fashion. That is a great platform on which to build. EPRA clarified some issues related to allocating the costs of transmission which could helpfully foster consensus between diverse states. Greater parity between linear infrastructure including transmission and pipelines would improve national reliability and our ability to meet growing load. Unnecessary process steps such as the double NEPA required by current backstop transmission siting policy should be removed. Expansion of categorical exclusions and lead agency coordination of permitting can help.

B. Expand and support tools this committee generated. From the DOE lead agency role for transmission lines in FPA Section 216h that this committee developed and passed in EPAct 2005 to the Transmission Facilitation Program this committee developed and passed in the IIJA in 2021, this committee's policies have been helpful and should be supported and expanded.
C. Staff the permitting agencies. By and large, federal permitting agencies and career staff are trying to get infrastructure permitted while following the rules. Shortcuts only create legal vulnerabilities. The agencies need sufficient staffing to support infrastructure permitting to execute their responsibilities in legally sustainable ways. Project approvals for the wide variety of federal permits needed at the staff level should continue to be allowed rather than blocking or clogging approvals on the desks of top political appointees.
D. Keep independent agencies independent. Investment in 50+ year assets requires regulatory stability that comes with independent agencies like FERC remaining independent.
E. Congress can support the development of domestic manufacturing for electrical equipment.

Thank you for the opportunity to testify.

The CHAIRMAN. Thank you, Mr. Gramlich.

Okay, we will now begin five-minute rounds of questions, alternating between Republicans and Democrats. I will lead off, followed by Senator Heinrich and then we will alternate between Republicans and Democrats in order of seniority, subject to the early bird arrival rule.

Mr. Tench, let's start with you. In comments filed in response to the AI action plan RFI issued by the White House, Vantage noted its development of an onsite utility-scale gas power plant in Virginia to power a data center in that region. Can you explain why Vantage decided to use gas for that onsite generation?

Mr. TENCH. Well, the shortest answer is that we were left no choice. The planning cycles for our data center developments can sometimes expand multiple years. And in this particular case, we were subject to a change in the demand algorithm from the local utility. It had been planning on having allocated to us 100 megawatts, or MVA worth, of power to power our data center project there in Loudoun County, when suddenly, after we were under construction, we were told that power was no longer available and would not be available for five to seven years, at which point we had already committed hundreds of millions of dollars into the development project.

So in this particular case, we were fortunate in the fact that our property sat on top of a high-volume, high-pressure natural gas line. And we scrambled and we designed, built, and commissioned a power plant operating completely independent of the grid within 18 months, and that data center is up and running with a very important customer of ours today.

The CHAIRMAN. Great. And I assume you didn't go with others for various reasons. Nuclear would have taken too long. Why not wind and solar?

Mr. TENCH. Well, in this particular case, our option was only to be able to develop a power solution for that site that was not grid dependent at all.

The CHAIRMAN. Got you.

Mr. TENCH. And that was the choice we made, and people may refer to that as island mode, but it effectively has no connection to the public grid.

The CHAIRMAN. Right. But wind and solar wouldn't provide the——

Mr. TENCH. Not in that particular case. The parcel was only big enough to handle a turbine plant, and there would have been no way to bring in wind and solar in that particular case.

The CHAIRMAN. Got you.

Mr. Huntsman, in testimony that you provided, I believe last year to the Senate Finance Committee, you argued that affordable, abundant, reliable energy is foundational to American manufacturing dominance. America has abundant resources like coal, gas, geothermal, and in some cases hydroelectric. We also have expertise to build advanced nuclear, which I am optimistic about as far as it becoming commercially viable in the coming years, assuming we can overcome the regulatory hurdles, which we are anxiously trying to do.

Now, there have been some anti-growth forces, including environmental NGOs, that have helped capture many of our Fortune 500 companies—in some cases, big energy companies, in other cases, big tech companies—to endorse a net-zero framework. Now, I believe corporate leaders know that such goals and commitments are impossible to achieve, not to mention that they are harmful to many of the varied industries they represent. Can you elaborate on how the sustainability commitments harm energy affordability and reliability?

Mr. HUNTSMAN. Well, so many of these commitments have a longer-term objective, like we are going to be carbon free by 2050 and so forth. You would be shocked at the number of CEOs I have spoken to that have said, "I don't have to worry about that, I won't be around." I can make the commitment today, but I am not going to be around then. There is no viable path when you look at, on a global basis, when you look at just replacing hydrocarbons with renewables. Again, renewables have a very important role to play in certain areas, in certain fields. We make the raw materials to go into the wind blades and solar panels and so forth. I am not anti any of that. I want to be very clear on that. But as far as the reliable, the reason why you are building gas turbines is because you don't have the reliability. Nobody knows if a week from today wind turbines are going to be turning or not. Nobody knows exactly how much power you are going to be getting out of solar panels a week from today. They can tell you what you are going to be getting out of a gas turbine.

So I am more concerned about the today and how we get to the issues of today and how we get to the issues over the next five or ten years because that will dictate where we are in 2040 and 2050. And coming up with unrealistic goals that we just hope that eventually we will come up with some means or some mechanism just isn't plausible and isn't realistic. That's what we are seeing in Europe.

The CHAIRMAN. So they have got their place, certainly, and there are good things that can be accomplished with those, but some of those areas, including those areas that are growing fastest within our economy, things like AI data centers, you can't really rely on that because it doesn't provide baseload power. What would happen if you tried to do that, whether it's manufacturing or an AI data center that needs consistent baseload power? What would happen if you had to rely on something that is intermittent?

Mr. HUNTSMAN. Well, you are shutting down. In facilities like ours, if they go down unexpectedly, they can take as long as 30 days to restart, costing tens of millions of dollars. So unexpected shutdowns—that is why I mentioned, I think, four or five times in my oral testimony the word reliability. And that is very key here.

The CHAIRMAN. Right. And some of the emerging nuclear technologies certainly hold a lot of promise in that area, offering zero-emissions alternatives. Those are coming—not yet here in a way that is commercially deployable.

Okay, my time is expired. We will go to Senator Heinrich.

Senator HEINRICH. Mr. Tench, you may be aware the Department of the Interior recently released a memo that is going to require the Secretary to review all wind and solar projects on federal

lands. It adds just one more layer of red tape. Do you have an opinion on what the potential business impacts are of energy projects being delayed in that regulatory process—how further delays impact the business prospect?

Mr. TENCH. Our observation and our requirement is for more electrons, as you called out in your opening remarks. Vantage is relatively agnostic as to the source of those electrons. So in the case of rulemaking or regulatory action that slows down the process of approving new generation or new transmission, that would definitely be a negative for our business.

Senator HEINRICH. In the sort of five-year window, like 2025 to 2030, shouldn't we be focused on putting as many electrons, agnostic of generation source, on the grid as possible to be able to meet the kind of demand that you represent?

Mr. TENCH. Yes. Our position is that efforts to move electrons around through enhanced transmission is important. Necessary, but insufficient——

Senator HEINRICH. Sure.

Mr. TENCH [continuing]. Relative to the overall demand. We need more energy——

Senator HEINRICH. More generation and——

Mr. TENCH. More generation and we need more transmission, independent of source. That said, it does need to be a reliable, you know, grid-dispatchable source, which I believe can be accomplished with the right combination of energy source for generation and energy storage.

Senator HEINRICH. And storage.

You know, one of my concerns is, we have an existing pipeline that is the result of decisions that have been made over the course of the last decade. That pipeline is 95 percent clean energy plus storage. It's about five percent gas. You know, a year or two ago, we had a couple of nuclear plants come online, which are great. I support that, but that's kind of a one-off. You know, in the next five years, if we start building new nuclear today, whether that's SMRs or traditional light-water reactors, that is going to take longer than the five-year window. If I order a combined-cycle natural gas turbine today, it's probably going to come on the grid in 2032 or 2033, if we are lucky.

So if you don't allow the existing projects that are in the queue today that are renewables plus storage, what does that do to the price pressure on the grid? What's the impact of that?

Mr. TENCH. As it relates to price pressure, I will probably defer to Rob on that question as more of a grid expert, but in the broader context, you know, our goal is to encourage speed and change in the regulatory process to bring more electrons onto the grid. And again, you know, depending upon the site we are developing, our access to proximate energy sources varies, and we are being very pragmatic about how we approach that, making available to ourselves whatever we can in order to meet the demand.

Senator HEINRICH. Mr. Gramlich, do you want to address the price pressure issue?

Mr. GRAMLICH. Sure, I mean, basically, it's supply and demand. There is scarcity of generation, so anything that is limiting new generation from coming on, whether it's interconnection queues,

permitting holdups at Interior, or anything else, that is cutting off supply, and that is definitely raising prices and——

Senator HEINRICH. We are actually seeing prices go up as a result.

Mr. GRAMLICH. We are seeing prices go up. Wholesale power prices are going up. Those higher costs are required to be incorporated by state public utility commissions into retail bills. So retail consumers/voters are paying more.

Senator HEINRICH. Are there places where prices have actually come down in recent years that you can point to, and what was the reason why those prices came down?

Mr. GRAMLICH. Sure, well, I mean, if you just look at, say, the supply stack for someplace like Texas. Texas, just over the last couple of days, has had a majority of their peak demands—not just overnight, not just winter, but peak afternoon air conditioning-driven demand served by a majority renewables plus storage.

Senator HEINRICH. And were there rolling blackouts?

Mr. GRAMLICH. There were not. Reliability——

Senator HEINRICH. Has reliability gone up, or——

Mr. GRAMLICH. You probably heard about rolling blackouts in California like five years ago. Honestly, they got behind on resource adequacy, but what did they do? They built a lot of solar and batteries. So same dynamic there. I am sure we are seeing a majority renewable energy. Any hour now, it's going to kick in and then, you know, when the air conditioning load this afternoon is high, there is going to be solar, and then the sun will set. Air conditioning load will still be high, but the batteries will then kick in and serve through the evening. So again, they don't do everything——

Senator HEINRICH. One last question, because I am running out of time here, Mr. Gramlich. What could we do, as the Congress, to improve the interconnection queue process? Because that is preventing a lot of resources, a lot of electrons from getting on the grid in a timely way to meet the kind of demand that Mr. Tench represents.

Mr. GRAMLICH. Yes, so, FERC has been working on interconnection queues, and each RTO is kind of doing it in their own way. I think there are some great models, like the Southwest Power Pool, where it's more just a simple entry fee. You pay it, you get in, and you don't have to do a four-year-long study. Congress could encourage things like that, encourage FERC to undertake activities like that, and you have probably a couple of nominees coming before this Committee pretty soon. You could ask them about that.

Senator HEINRICH. I will.

The CHAIRMAN. We will now turn to our colleague from Mississippi, Senator Hyde-Smith.

Senator HYDE-SMITH. Thank you, Mr. Chairman. Thank you, Ranking Member. And thank you to all of our witnesses that have come to share your testimonies. It's great to have the resource that we have to you and I appreciate your willingness to do that.

My question is going to be directed to Mr. Tench. You mentioned in your testimony that Vantage prefers to connect to the grid for power, obviously, but there may be a need to deploy outside generation at the start of the project, which makes sense. And as you

point out, beyond company building schedules, adding to the grid can take a long time. It can take years, and usually taking around five years for the most traditional baseload power that you are looking at there. What short-term solutions has Vantage explored for initial builds, and do you think other companies would follow a similar pattern waiting to connect to the grid?

Mr. TENCH. In the case of Vantage, we have, coming out of the experience I described in Virginia, been far more planful in terms of the expectations of our delays as it relates to the interconnection that we applied for to receive load from the grid. And the form that it has taken, for the most part, has been in investing in a supply chain of turbines and reciprocating natural gas engines, which we increasingly plan to deploy at a mobile setting so that we can deploy them on trailers for, let's say, two years, three years, until we can get the interconnection from the grid, and that has proven to be an important part, but only one part, of our overall plan for how we make our way through the wait, if you will, as it relates to the electrons that we need.

Senator HYDE-SMITH. And you think other companies may follow a similar pattern to that?

Mr. TENCH. Well, I think that would be up to them, but certainly for us, we found it to be a way of reducing our risk and smoothing out the gaps in availability.

Senator HYDE-SMITH. And from a connectivity standpoint, what would Vantage's plan be once utilities meet electrical generation demand, once you get there?

Mr. TENCH. Well, our plan would be to connect to the grid and operate according to the regulations that exist in any of those states in terms of having a firm commitment from the utility through an electrical services agreement. And then, we would use that as our primary source of power to our data centers, coupled with emergency generation backup, which we deploy in most of our sites as well.

Senator HYDE-SMITH. Thank you, Mr. Chairman, and I will yield.

The CHAIRMAN. Senator Wyden.

Senator WYDEN. Thank you very much, Mr. Chairman. This is an important panel. And let me begin by saying I don't believe we got in this predicament by osmosis. The fact is, the Republicans have been doing favors for their big oil buddies at the consumer's expense, and that is why—a major reason why—energy bills are going through the roof. And I am just going to take a minute to look backward and then talk about where we ought to be going. We had 50 years' worth of gridlock on climate—no pricing, no regulatory reform, no nothing.

In the Senate Finance Committee, we put together an alternative, and it was based on markets. It was based on technology neutrality. Underline those words—technology neutrality. Everybody is part of the market. You get choices. And the more you reduce carbon, the bigger your tax savings. And in a couple of years, we got hundreds of billions of dollars committed—committed—to making sure that we had those renewable choices.

Now, along come the Senate Republicans, particularly in the last couple of weeks. And when the natural gas folks—these are not the environmentalists, these are the natural gas folks—basically said,

we will take electrons if they are from Mars. We have got to have electrons. We will take them from anywhere, not just because of AI, but because of growth, because of innovation. And regrettably, the Senate Republicans said, we're not for choices. We're not for options. We're not for alternatives. And of course, that doesn't let us meet the challenge of demand.

So my view is, and what I am going to keep pushing for as the senior Democrat in the Finance Committee, is working with anybody across the political spectrum to get us more choices, and particularly, as my colleague from New Mexico said, the gas industry, not the League of Conservation Voters or the Sierra Club, will tell you that the cheapest alternatives now are solar and wind, and they need them today, not tomorrow. They need them today in order to drive markets. So apropos of your good work, Mr. Gramlich, I would be interested in what your ideas are to kind of resurrect a choice-based system, rather than one that just hands out the goodies to the big oil companies. And by the way, people tell me, and you all are welcome to add this, fossil fuels cannot meet our demand today. If we are going to meet demand, we need solar and wind. We need these alternatives.

And after 50 years of gridlock on this issue, we broke up the inertia. We broke up the lack of progress. And we were making a lot of progress. And I want to see us get back to something that has as many of those choices, the technological neutrality principles that we wrote in the Finance Committee, because I think that is America's energy future. And by the way, nobody knows what the big alternatives are going to be 30 years from now. We need a science-driven kind of approach. And when we talked to Joe Manchin about putting this together, which he backed, he said we need more science, and we will get that with a technology-driven kind of system.

So tell us about what you would be working on in terms of more choices for the days ahead.

Mr. GRAMLICH. Well, Senator Wyden, thank you for your leadership on the technology-neutral tax credit. I think that is a perfect example of something that provides the support to any and all technologies that meet the performance standards that Congress can set out. And so, I thought that was a great idea. Glad to see it enacted. Sad to see the early phaseout. I think at this point it's important for Treasury to implement at least what Congress passed recently.

Senator WYDEN. So you want to make sure that there is no more stalling around because, as you know, we got a modest bit of the current system into the final bill, and now it looks like a bunch of people in the House are trying to roll that back. You tell the Administration, suck it up here and stand in there for choices and alternatives. Is that one of your messages?

Mr. GRAMLICH. Certainty is critical for investment, and uncertain IRS regulations kill certainty. You can't invest if you don't know what the rules are.

Senator WYDEN. What else would you do? More choices.

Mr. GRAMLICH. Well, I think, you know, generally, as I was saying before, the transmission grid really is in the purview of this Committee and Congress and FERC, and that is the great inte-

grator of all resources that enables choice of whatever a state may choose, and generation——

Senator WYDEN. Good. My time is up. That was the one thing that we weren't able to get in the 2022 election, and had we been able to negotiate a compromise with more choices, I would have put transmission number one as our challenge for the future. And we are going to try to get those choices back, and we are interested in working with you on transmission.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Wyden.

We will go next to Senator Cortez Masto.

Senator CORTEZ MASTO. Thank you, Mr. Chairman.

Thank you, all three of you, for being here. In many ways, Nevada has really led the way in developing new energy capacity over the last several years. And quite honestly, with the help of the tax credits in the Inflation Reduction Act, Nevada was able to attract new businesses hoping to use our natural resources, one of them being solar, geothermal, in the great state. I assume that's one of the reasons, Mr. Tench, you were there. And I am excited to hear that not only has Vantage pushed for new data centers to be sustainable by design, you are including an AI campus in Nevada, which was announced July 15th, that also seeks to use a closed-loop chiller system to minimize the need for large volumes of water, again, in the West, where there is a lot of drought.

Can you talk a little bit about why renewables are important, depending on the region where your data center is, and are you using a renewable source for this data center and the AI in Nevada?

Mr. TENCH. Yes, we are, as you know, developing a substantial AI-focused campus in TRIC, just outside of Reno, and the selection of that location was driven by a number of factors, including its proximity to the West Coast, as an alternative to California, where things can get pretty expensive and pretty hard to do. At the same time, the mix of energy sources that were available to us through Nevada Power included, as you noted, there are prior investments in solar, in particular. And for Vantage, for our customers, again, we prefer to use grid, and the combination of total cost of ownership, the ease of doing business in Nevada, and the physical location conspired to make it a great location for this deployment.

Senator CORTEZ MASTO. Thank you.

Mr. Gramlich, you have outlined some of the challenges contributing to increased electricity bills across the country. In addition to severe weather and electric equipment constraints, you listed the uncertainty surrounding the current administration's tariff policy and the Republicans' termination of the tax credits. A recent Bloomberg Government article stated that when fewer renewables meet more expensive gas and explosive demand from data centers, an upward pressure on rates is the predictable result. Some estimates suggest that electricity bills in parts of the country could jump as much as 60 percent to 350 percent over the next decade.

My question to you is, can you summarize current market considerations and why U.S. grid operators aren't in a position to turn away renewable electrons?

Mr. GRAMLICH. Yes, grid operators need all the power they can get, and as I have said, not all resources do all of the functions,

right? So we do need firm power, and by the way, the geothermal in your state is providing excellent clean firm power, and I really am hopeful about geothermal going in many more states to provide that clean firm power, but the grid operators do depend on it, and in terms of affordability, it's supply and demand. If we take any of these resources out of the mix, that just leads to higher wholesale prices, and those necessarily move down into retail customers' electric utility bills.

Senator CORTEZ MASTO. And shouldn't the states, working with the private sector, basically determine what that energy mix or that portfolio should be based on their geography, based on their opportunities there? I mean, we have geothermal. We have solar. We have wind. We have battery storage. We have natural gas. That's different than my colleague here sitting to my left, from Maine. So shouldn't it be driven by that need, based on the states where their region is, what the private sector is wanting to build there? Does that make sense?

Mr. GRAMLICH. I think that's exactly right. Well, that's the structure of the Federal Power Act that you all oversee on this Committee and its implementation at FERC. Generation is largely in the purview of states. I mean, it's kind of a states' rights issue. And so, this micromanaging of individual power plant dispatch through things like Department of Energy emergency orders, or, you know, specific targeting of projects for not getting permitting at Interior—that is really micromanaging from the federal level something that really is the states' job to address.

Senator CORTEZ MASTO. And if we are going to compete with other countries like China and others, and grow out our grid and our transmission and really invest in it, that micromanagement shouldn't occur. It really should be driven from the states, the private sector on, correct?

Mr. GRAMLICH. That's right. And I mean, the reality is, we have a very diverse electric industry structure. Your state has one structure. It's very different in Maine and other states. And so, each state uses markets or regulation or various combinations of investor-owned and other types of utilities to meet their power demand needs. And that is where the process should take place.

Senator CORTEZ MASTO. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Senator King.

Senator KING. Thank you, Mr. Chairman.

The word transmission has come up numerous times today and how important it is, and what a great important part it is of this discussion. Unfortunately, this morning, the Department of Energy terminated a loan program for a major interregional transmission system in the Midwest.

[Department of Energy press release follows:]

Department of Energy Terminates Taxpayer-Funded Financial Assistance for Grain Belt Express

The Department of Energy today announced the Loan Programs Office has terminated its conditional commitment for the Grain Belt Express Phase 1 project.

Energy.gov

July 23, 2025

2 min

WASHINGTON— The Department of Energy (DOE) today announced the Loan Programs Office (LPO) has terminated its conditional commitment for the Grain Belt Express Phase 1 project, a high-voltage direct current (HVDC) transmission line intended to connect wind and solar capacity across Kansas and Missouri. The conditional commitment, which would have provided a taxpayer-funded loan guarantee of up to $4.9 billion dollars, was issued by the Biden administration in November 2024 – one of many conditional commitments that were rushed out the door in the final days of the Biden administration.

After a thorough review of the project's financials, DOE found that the conditions necessary to issue the guarantee are unlikely to be met and it is not critical for the federal government to have a role in supporting this project. To ensure more responsible stewardship of taxpayer resources, DOE has terminated its conditional commitment.

DOE is conducting a review of every applicant and borrower – including the nearly $100 billion in closed loans and conditional commitments LPO made between Election Day 2024 to Inauguration Day 2025 – to ensure every single taxpayer dollar is being used to advance the best interest of the American people. This ongoing review positions LPO to move forward with a lower risk tolerance in lending practices and an uncompromising focus on expanding access to affordable, reliable and secure energy for the American people.

DOE remains focused on advancing projects that expand American energy dominance and deliver on President Trump's commitment to lower energy prices for the American people.

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Senator KING. So here we are talking about how important transmission is, and here's the Department of Energy, and it wasn't a grant, it was a loan guarantee program. I just think the timing is somewhat ironic.

We all know that solar and wind are intermittent. We understand that. Everybody knows that. I was in the hydro business. That's also intermittent. It doesn't always rain, as well as wind and biomass and large-scale conservation. But what's really happening is really dramatic in terms of energy storage. If you have adequate energy storage, solar and wind are baseload, because you have something to make up the difference. And I used AI in your honor, Mr. Tench, to check on where we are on batteries.

As of five minutes ago, the U.S. added a record 10.4 gigawatts of utility-scale battery storage in 2024, marking a 66 percent increase from the prior year. In 2025, the EIA anticipates a record-setting year, with another 18 gigawatts of utility-scale battery storage on the grid. Looking ahead, the EIA forecasts that U.S. utility-scale battery storage will nearly double, reaching 65 gigawatts by the end of 2026. In other words, the battery industry is no longer a fantasy or a distant dream. It's happening right now on a very substantial scale. And as you point out, Mr. Gramlich, it saved the day in Texas and in California, and it's already working—the idea of the integration of batteries with solar and wind.

Let me talk for a minute though about transportation. And Mr. Gramlich, this is what worries me. It used to be an electric bill in Maine was 25 percent transmission and distribution and 75 percent source of energy. It's now about 50/50, and transmission is getting more and more expensive. Everybody knows we have to rebuild the grid. My concern is, it's going to be done in an expensive way that's going to add dramatically to ratepayers' costs. Mr. Gramlich, you are nodding. I take it you agree. The record doesn't show nodding.

Mr. GRAMLICH. Absolutely. We are doing transmission in sometimes the most expensive way possible now and we could change that.

Senator KING. Well, one way to change it is reconductoring. Here is a conventional electric line, a high-tension conductor. Here is a carbon fiber-based conductor. This little guy will carry twice the energy as this one.

[Photograph of the two conductors follows:]

Senator KING. So if we put these on the grid, we don't need to change all the poles, the rights-of-way, all of that kind of thing, and we can get a significant amount of additional throughput in the grid at a fraction of the cost of rebuilding the whole system. The same with—you are familiar with the term GETs—the various technologies that enable the grid to be managed more efficiently in terms of temperature and load and all those kinds of things. The estimates I have seen is that reconductoring and GETs could increase throughput on the grid by something like 40 percent, at a fraction of the cost of rebuilding. My concern is that the rate-based model encourages utilities to build rather than to reconductor or use GETs.

Mr. Gramlich, talk to me about how we solve that problem. How do we provide incentives for those who will be rebuilding the grid to do so in the most cost-effective way and to minimize the effect on the ratepayers?

Mr. GRAMLICH. Yes, well, and I would note, that cable that you are holding is manufactured near Los Angeles, but unfortunately, 90 percent of that company's sales go to other countries, which are deploying advanced conductors and grid-enhancing technologies in far greater levels than we are here.

Senator KING. Is that partially because there is no incentive on our utilities to use this kind of technology?

Mr. GRAMLICH. I think that is generally right. I think a lot of utilities are actually looking at them now, but we need to get beyond pilot stage to make it more systematic.

Senator KING. And another factor we haven't talked about is demand response. That is, the ability of customers to modify their demand load in terms of what's on the grid. Is that a promising technology?

Mr. GRAMLICH. That is a very promising technology, and it's not just sort of the peak hour, but think about flexible data centers. Sometimes there is some grid contingency that might happen once every three years, and if they can just curtail just a little bit at that time, then we can integrate a lot more data centers without having to rely on the full network capacity, which takes so long to serve that data center. So that type of flexibility is critical.

Senator KING. And I should point out, I know I have run out of time, solar and wind today are (a) the cheapest and (b) the quickest to deploy. And I am worried that, as the Vice Chairman has said, there is a five- to seven-year lag in new grid-scale gas turbines. We can't give China a five- to seven-year head start in AI, and we have got to be timely as well as control costs.

So thank you all for your testimony. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Risch.

Senator RISCH. Well, thank you, Mr. Chairman, and thank you for being here today. This is a fascinating subject, really, to dig into. I have to tell you, in recent years, as I have sat in this Committee, we have had the people come in here and predict to us what was going to happen as far as demand for electricity in America because of AI and the other things that are coming on board, particularly AI. And I have to tell you, I was a doubter at the beginning, but the further we go, the more obvious it has become that

we are going to be inundated with demand for electricity here in the next recent years.

It's a problem, but the good news is that this particular problem, we know how to deal with, and that is, we know how to generate electricity. We, in Idaho, in 1951, demonstrated for the first time that nuclear energy could be used to create electricity and we have been at it ever since. Of course, we had the setback as a result of Three-Mile Island, which really put us a generation behind, but now I think the world knows there is a real renaissance going on as far as nuclear energy is concerned, not only in the United States, but also particularly in Eastern Europe, where they are trying to cut the cord with Russia.

So I guess I would like to get your thoughts on this. You know, we are going flip the switch, hopefully, in the next year or so on the first SMR, which is really going to change the delivery of electricity in the world. And this August, we are going to cut the ribbon on a microreactor that they are starting at the INL in Idaho. We are very proud of the work we do in Idaho on nuclear. We really think that we have the solution to all of this. I really think that nuclear is going to have to be—and I agree that we want to be all-of-the-above—but I think to deliver the load, I really think it's going to take nuclear to do that.

And I would like to get each of your thoughts on that. Peter, good to see you again. And your thoughts first, please.

Mr. HUNTSMAN. I believe that nuclear eventually will be able to fill that baseload, but look, I just, I will be honest with you. I am the only one that sitting here at this table that pays a power bill of over a quarter of a billion dollars a year. That's my gas and electric bill in my company. We can talk all we want about all these renewables and so forth and solar and wind. The fact of the matter is, it's failing in Europe, where it has been implemented on a widespread basis, it is failing. And the prices are going up through the roof. We can't afford it. We are shutting down facilities. We are laying off people. And we talk about these—especially in the State of Texas, we have spent hundreds of millions of dollars a year manufacturing in the State of Texas. The State of Texas's entire baseload is natural gas and nuclear and petroleum-based projects. The incremental piece that is renewable is wonderful. Again, I am not opposed to that, but without the baseload, we couldn't afford to buy electricity in Texas.

And the only way we are able to compete today is because of the hydrocarbon-based energy sources. That's just the reality of all of this. Eventually, somebody has got to pay for all this stuff.

Senator RISCH. Well, the fact that the utilities now are really kindling a lot of interest in nuclear, does that give you any solace going forward?

Mr. HUNTSMAN. Not a great deal. Personally, I am very concerned about where a lot of this stuff is going. When I see how much of this is renewable coming off—for every windmill that is built—again, this is our product—but for every windmill that is built, you have got to build a backup to it because 70 percent of the time it's not going to be turning. So you have got to have a backup that most of the time is going to be idle. So therefore, I am

paying for two systems. If I have wind, solar, and backup, I am paying for three systems.

Senator RISCH. Not a problem with nuclear.

Mr. HUNTSMAN. Not a problem with nuclear, no, but again, I think we are probably ten-plus years away from having mass-scale nuclear power.

Senator RISCH. Mr. Tench.

Mr. TENCH. You know, as I think about our fleet across the United States, we are fortunate to be operating data centers in places where part of the grid power we take down is nuclear. We are big proponents of further investment and acceleration of nuclear power, both as a complement to the entire grid, as well as some of the emerging technologies around SMR. I hope you are right about in the next couple of years us seeing the first commercially viable solution for that, but I think nuclear is absolutely a big part of the solution here.

Senator RISCH. Mr. Gramlich.

Mr. GRAMLICH. Yes, I have not seen a change in public perception about a technology ever as much as we have with nuclear, which, because so many people motivated by the climate crisis want clean power, and I think everybody who is looking at the grid also realizes, we do need firm power. So that is a clean firm source that could make a great contribution.

Senator RISCH. Well, take heart, Idaho is here to help you. We've got the SMR that we developed there and moving forward, and we are really excited about the micro that's coming. Those two things are just going to change the world, I think, as they develop them and as they prove them out in the marketplace and as they interest utilities in being able to get what will be a new wave, I think, of how they produce nuclear energy.

My time is up. Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Senator Hickenlooper, you are up next.

Senator HICKENLOOPER. Thank you, Mr. Chair.

Mr. Tench, let me start with you. I think we all agree with you that we have got to win the AI race. And it's not just our economic future, it's our national security that's at stake there. In your testimony you highlighted the importance of high-voltage transmission, noting that, and I will quote, "Enabling the transfer of electricity between regions can lower operational costs for data centers and other large users." Without action from this Administration and this Congress to accelerate high-voltage transmission development, will the U.S. stay globally competitive in the AI race?

Mr. TENCH. I don't think we can say definitively that without interregional transmission we will fail to be globally competitive. What I can say is that our ability to move electrons seamlessly across this country in between these regions will free up access to power where it's needed, and it allows us to build the data centers that contain the AI that we are all scrambling for here in terms of being able to stay competitive. So it is one part—and an important part, I think—of a change we can make in order to make better use of the grid that we have, but it is not, in and of itself, sufficient to avoid the outcome you are describing.

Senator HICKENLOOPER. Well, let me rephrase it then. Would you agree that the probability of our losing ground in the race toward AI, the probability that we are going to lose ground increases if we don't address this issue within the grid?

Mr. TENCH. Yes.

Senator HICKENLOOPER. Good. And would you believe that any bipartisan or administration-led permitting reforms aimed at supporting data centers should also include some of these ambitious reforms to building that high-voltage transmission?

Mr. TENCH. Yeah, I would agree with that, yes.

Senator HICKENLOOPER. Great.

Mr. Gramlich, studies show that high-voltage transmission improves reliability and affordability, yet in the U.S. we have only built 3,238 miles of high-voltage transmission from 2017 to 2024. Experts say we should be building 5,000 a year. So that means we should have built 35,000, and we built less than 3,500. Meanwhile, China is rapidly building a super-grid of ultra-high-voltage that allows it to support growth on a variety of facets that we will not be able to match. In 2023, Congress directed NERC to study U.S. transmission needs. The Commission found we may need 35 gigawatts of additional interregional capacity just to ensure reliability.

So Mr. Gramlich, can you explain in layman's terms the value of interregional transmission in terms of affordability and reliability?

Mr. GRAMLICH. Sure, thank you, Senator.

It is absolutely true that interregional transmission is one of the best ways to improve reliability and resilience. We sometimes see 10 percent of a region's power served by the large-scale movement of power across the country over that interregional transmission network. Unfortunately, none of us inherited a power system that is very conducive to that, with thousands of little vertical silos of utilities that don't have those horizontal connections, and our regulatory structure is only trying to catch up to that. So your work through EPRA and other efforts, other bills that you have introduced on interregional transmission, is very welcome.

Senator HICKENLOOPER. We always appreciate the preparations that our witnesses make that make us Senators look good. We appreciate that.

Senator CASSIDY. It takes a lot of preparation for you, but that's okay.

[Laughter.]

Senator HICKENLOOPER. Thank you, Senator, I appreciate that.

Also, Mr. Gramlich, I was going to put out—within all of this discussion we have been making, there is a hard truth that we need 100 gigawatts of power or more, really, by 2030, yet only four gigawatts of natural gas projects are even in the pipeline, and certainly zero for coal. So the market isn't buying what's out there being sold. What kind of state-level intervention studies and subsidies should Congress and the Trump Administration—what would we have to back, which they would be backing, to actually build that 100 gigawatts of new natural gas or coal capacity by 2030?

Mr. GRAMLICH. Yeah, it's not really feasible to do it all with gas or, you know, nuclear in this decade isn't going to happen. Nothing

against it, it's just not going to happen. Gas turbines are constrained, as Senator Heinrich mentioned. You just can't get one to get in line. So we really have to, just as a physical matter, we have to rely on many sources, all of those sources that are being developed, and that certainly includes wind, solar, and battery storage.

Senator HICKENLOOPER. Great, thank you.

So what you are saying is that we need to take those things that are in the queue and are ready to be built, even though they're not going to be sufficient to provide a baseline, that I think there is a consensus that we need to raise the baseline, or the baseload capacity. We need to build everything we can right now.

Mr. GRAMLICH. Yes.

Senator HICKENLOOPER. Great, thank you. I yield back to the Chair.

Senator CASSIDY [presiding]. Mr. Huntsman, in your testimony—now first, as context, I have seen that the GDP of Europe over the last 20 years, which was roughly equal 20 years ago to the U.S.—collective GDP—has flattened out and ours has grown. Now, there is a relationship we all know between power usage and with economic growth. You speak about the deindustrialization of Germany and how no rational executive would now invest in Germany, which is incredible. Can you expound on that? Because that would have incredible impacts upon jobs for working Germans, just like having a similarly wrongheaded policy in the U.S. would have incredibly negative implications for working Americans.

Mr. HUNTSMAN. Yeah, as somebody who has done business in Germany for 40 years, we have never had power outages in Germany. It's just not a question of availability of electrons, it is a question about the value of electrons. And in Germany, I'm paying for coal, I'm paying for solar, I'm paying for wind, I'm paying for nuclear from France, and I'm paying for imports of gas coming in from the United States. I am paying for five sources. At best, two of those sources are actually operating and supplying our facilities. But I am paying for all five of them. I mean, that literally—and you add on to that the regulatory, the carbon taxes, and the costs above that, and I am paying roughly about six times more for electricity. For exactly the same facility in your State of Louisiana, we operate a very large facility in Geismar, Louisiana, and we operate virtually the same facility——

Senator CASSIDY. So how many people did you employ at peak in Germany?

Mr. HUNTSMAN. In Europe, across Europe was about 6,500.

Senator CASSIDY. At peak?

Mr. HUNTSMAN. At peak.

Senator CASSIDY. And where are you now?

Mr. HUNTSMAN. Just over a thousand.

Senator CASSIDY. And so, the implications are that if you get your regulatory policy and if you get your electricity policy or your power policy wrong, then people disinvest, de-invest, and then you end up with working families losing their livelihood.

Mr. HUNTSMAN. Not just ours, but our customers, our suppliers, the entire supply chain.

Senator CASSIDY. I once heard you say, going to another portion of your testimony—intriguing conversation—you are suggesting

that the chemical industry may be more carbon-intensive but the downstream effect is to decrease carbon intensity. You use the example of using carbon fiber instead of steel in a plane. I can imagine how much fuel that saves in a plane. But I can imagine that the carbon-intense carbon fiber, by definition, may be a little bit more carbon-intensive to produce, or at least roughly equal. But it saves you more in life cycle.

Mr. HUNTSMAN. That's right.

Senator CASSIDY. Can you elaborate on that? Because I think there are probably other examples.

Mr. HUNTSMAN. Earlier, the Senator, I believe it was King, that had the cabling—the wraparound of that cabling, of that carbon fiber, is going to be for the most part an epoxy material that obviously insulates a lot of that transmission. That's the same materials that are going in and lightening the load, lightening the transmission, making these things stronger. The Boeing 787 gets about 35 percent better mileage than the Boeing 767, the model it replaced, and all of that is virtually no aluminum, it's mostly carbon fiber and composite materials. We have, just our company alone, about somewhere between 17 and 18 tons of liquid material—glue, essentially—that goes on each 787 or Airbus A350. That is lightening the plane. It is allowing it to fly further over the lifetime of that plane. You will be saving a hundredfold.

Senator CASSIDY. So even though, in the moment in time, in the snapshot, it may look like, oh, my gosh, emissions are increasing, or whatever is increasing at Huntsman, but if you take that product you are producing over the life cycle of its use, the global climate is better, if you are looking at it from the perspective of carbon.

Mr. HUNTSMAN. That's right. I would also tell you though that our carbon is actually coming down——

Senator CASSIDY. I accept that too.

Mr. HUNTSMAN. From our manufacturing.

We are getting the benefit of both, better and lighter usage on the customer side and also the manufacturing side.

Senator CASSIDY. Sounds good.

Well, next is going to be Senator Padilla.

Senator PADILLA. Thank you, Mr. Chairman.

Senator CASSIDY. Excuse me, hang on. I have Padilla before Cantwell. That's the list given to me.

It's up to you guys. You all work it out.

[Laughter.]

Senator PADILLA. All right, well, if you don't mind because you were here earlier.

Thank you all for your participation here today. I want to begin by talking about transmission. Obviously, the only way to meet our growing energy demand is by building out the necessary transmission infrastructure to get power from where it's generated to where it's needed. In the last Congress, I was proud to work with my colleagues on this Committee in a bipartisan manner, as we crafted the Energy Permitting Reform Act, which would have significantly advanced transmission efforts. Since last Congress, we have not only continued to see delays, but also consistent projec-

tions of load growth. And in addition to that, we have seen energy costs increase.

So Mr. Gramlich, in your testimony, you talked about the need to improve our transmission infrastructure as a means to improve energy affordability. So I would love to see you expand on that and specifically discuss how building more transmission would directly increase energy affordability.

Mr. GRAMLICH. That's right. Well, your State of California is now accessing resources in New Mexico, Wyoming, and other parts of the West, and what that does is, it's like a puzzle—putting pieces together. At different times of day, different resources are operating, right? The wind from Senator Heinrich's state or the wind from Senator Barrasso's state or others are operating at different times than the solar in Southern California, right? So you put all these resources together and you get an overall much more steady supply that holds rates down and it improves reliability. So the transmission network is critical to making that happen. Your state has been leading in getting a lot of that transmission built.

Senator PADILLA. Do I hear you suggest that multi-state coordinating of the grid will improve affordability as well as reliability and even efficiency, with some emission reductions, as a result? I hear chatter among some western states around that concept.

Mr. GRAMLICH. Yes, and that legislation in Sacramento is critical to get that regional network of an integrated grid, a seamless grid.

Senator PADILLA. As long as we get it right, I agree.

Mr. GRAMLICH. That's right.

Senator PADILLA. So, to be continued.

Let me also do a quick sidebar because I heard the Chairman in his opening remarks talk about some concerns in some quarters about solar and wind and other renewable energy and the concerns about intermittency, to which I just want to make sure we are adding storage to the conversation. If you look at California's capacity now, not just breaking records on the amount of our electricity that comes from renewable sources, but a huge reduction in the threat of blackouts, even brownouts, because of the stability brought when you add storage to the equation.

In addition to storage, another technology that I am excited about is reconductoring. So I was proud to hear a couple of you talk about the benefits of grid-enhancing technologies and high-performance or advanced conductors in meeting our load needs. Rewiring our existing transmission lines with state-of-the-art carbon fiber or aluminum alloy materials has the potential to deliver as much as twice the current of the same size conventional steel and aluminum transmission cables. And what's especially exciting, it's by utilizing existing infrastructure and existing rights-of-way.

So again, Mr. Gramlich, can you expand on how these new technologies, particularly reconductoring, can help us meet load growth in the future?

Mr. GRAMLICH. That's right. Well, we all know how scarce rights-of-way are and how hard it is to get new rights-of-way, right? So we have these rights-of-way around the country that are a tremendous asset for this country. And so, if we can squeeze more power over those rights-of-way, which might be as simple as stringing up a new cable on the existing towers, or it might be a rebuild of the

towers, but these advanced conductors and superconductors can really help to sometimes double the capacity right there. And then grid-enhancing technologies are more the operational technologies that Senator King also referenced. Those squeeze more, sometimes up to 40 percent for dynamic line ratings, for example. And these operational tools can create more headroom on the grid that allows more load to be developed reliably.

Senator PADILLA. So are you suggesting that with these upgrades, we can deliver more electricity more quickly than projects that are built from the ground up?

Mr. GRAMLICH. Yes, and we are going to need both. We are certainly going to need new rights-of-way and lines as well, but creating that headroom quickly and much more affordably seems like a no-brainer.

Senator PADILLA. So the last question I have, and I will try to make it quick, I know my time is running out here.

Obviously, I am proud to represent California. We are proud to be a policy leader on not just building capacity, but lowering our emissions footprint as a result. But California is not alone in investing and bringing online more solar, more wind. Can you name other states, maybe some not-blue states, that are similarly investing in improving their grid reliability and affordability as a result?

Mr. GRAMLICH. Well, absolutely. I mean, the whole center of the country from Texas up through North Dakota has tremendous penetrations of both solar and wind. Texas, the last couple days, has had over 80 gigawatts demand. They are nearing record demand. And a majority is being met with solar, wind, and battery storage. They are using storage, just as you suggest, and just as you do in California when the sun is setting, that is when the batteries have charged up with all the solar power and then they discharge to keep the evening lights on.

Senator PADILLA. So renewables plus storage is not a Democratic agenda or a Republican agenda. It's just common sense. Thank you very much.

Senator MURKOWSKI [presiding]. Gentlemen, thank you for being here. These kinds of hearings before this Committee, I think, are so important because they remind us that an energy policy that really covers from Maine to Alaska and Hawaii and the parts in between requires a diversity, right? I come from a state where we are proud to be producing oil. We are proud to be producing natural gas. But our reality is that most of that is—most of the oil, of course, is sent outside. Our natural gas supplies in Cook Inlet are dwindling to the point where our utilities today are discussing how they are going to keep the lights on in the South Central region, where the vast majority of Alaskans call home. And they are looking to Canada for their source of supply. That is insult to injury to this Senator, who has been working so hard to get us to a place where our energy is affordable, reliable, secure, diverse, whatever you want to call it. It is a challenge for us right now.

And one of the things that we have looked to, we have recognized that there is no one-size-fits-all that fits us. And so, I think we have—I don't know if it's fair to say that we have pioneered microgrids in Alaska, but we have darn well been leading in the country when it comes to how you take these isolated grids, be-

cause we have one grid in the state, and it's called our Railbelt grid. And it goes up about 350, 400 miles and it comes down. And it's not a grid, it's like a rope, and there is vulnerability in that rope. And so, this is something that, again, we are looking at ways that we can reduce our energy costs in the state that, unfortunately, experiences some of the highest energy costs in the entire country. And I think that is counterintuitive to so many people who think, well, wait a minute, you guys supply all of this stuff. Why are you not able to keep your own lights on?

So we are a little bit of a conundrum. At the same time, we have got great opportunities. We would love to be a leader in data servers. It's cold up there. We have got cold water. It's all the right things for you all, but if we can't power it, we can talk about these advantages until the cows come home. We don't have very many cows in Alaska. But we need to recognize that there is more that must be done in recognizing the extraordinary diversity.

Mr. Huntsman, I really appreciated your testimony. You talk about the risk of distorted markets. I absolutely agree. I think our challenge is that we don't have a distorted market, but we just need to have more on our Railbelt grid, just like we need on our microgrids. We were kind of pushed behind with this executive order that came out a couple weeks ago on wind and solar because we do have a couple projects that were going to be integrated into this broader grid that is LNG, it's hydro, it's a little bit of wind, it's a little bit of solar. Basically, we are piecing everything together as best we can, and now we see a pushback on that EO by taking away the opportunities for greater affordability and reliability.

It reminded me that we have been down this road before. It was the late 70s where the government prohibited the use of natural gas for electric generation. Think about where we would be if we still had that policy in place. And so, we are back to this place where it's kind of dangerous to pick winners and losers. Just figure out how everybody participates in, again, advancing a portfolio, an energy portfolio that makes sense across the board.

So I guess I would direct a question, well, to any of the three of you in terms of the importance of ensuring that our federal policies are not in a position where we are picking the winners and the losers. And I grant you, wind and solar have been the "mature" technologies for a long time—a long time. But we are now in a place where the Secretary of Energy and his Deputy are going to be spending a lot of their time over at DOI with a review of every individual wind and solar decision that comes before the Department. They have got a lot to do. I think that this is going to be distracting and taking away the time that they need to be working on some of the issues that all three of you have mentioned here this morning.

Any comment on that? I have run my full five minutes. So that's not very fair to you, but go ahead.

Mr. TENCH. Well, real quick. Oh, sorry, go ahead.

Mr. HUNTSMAN. I would just say, to the extent that it adds cost to consumers, I hope they take a long time in reviewing those projects because there are a lot of companies out there and a lot of consumers that just can't afford these redundant systems and

the higher cost to all of them. And I think we are losing focus here. When a Tier 4 data center comes online, they need 99.997. That means they are out of electricity—an Amazon center could be out of electricity for 27 minutes per year. They're not going to be relying on wind. They're not going to be relying on solar. That may be part of their system—a very small part of it—but for the most part it's why they are looking to buy nuclear facilities and so forth. And it's the consumers that are going to get caught up with this higher pricing and it's companies like ours that are going to get caught up with this higher pricing. So I am concerned about a lot of those.

Senator MURKOWSKI. No, I hear you. I just want to add one final point to this. I am dealing with communities, though, that if they can get 20 percent of their diesel-powered consumption offset by some incremental wind and solar, it's 20 percent that they're not spending.

Mr. HUNTSMAN. Totally right.

Senator MURKOWSKI. So we are operating in different worlds, I get that. I get your point. And I just need to make sure that you understand what it means in some of these really remote off-the-grid places.

Mr. Gramlich.

Mr. GRAMLICH. Well, I would just thank you for your leadership on the permitting issue, not just this review, which seems awfully inefficient and could take whole generation types off the table. But on the staffing, many of these permitting agencies for your state and others, have great staff, but they, you know, they need to be staffed up. They are trying to get permits issued, but they are trying to do it in a legally sustainable way. And if we lose staff at these permitting agencies, that is a real challenge for any of the infrastructure we are trying to build.

Senator MURKOWSKI. Very good.

Mr. TENCH. You made the comment a minute ago that it's not a job to pick winners and losers. You know, I agree. We are, in our business, we are simply trying to deliver for our customers the technology and the buildings and the infrastructure to drive the deployment of AI, the grid, and as we receive electrons off of it, it doesn't know what the source was. We have requirements in terms of availability. We have backup generation for those times when there is a problem with the grid. But anything we can do to encourage as many different sources of power to increase the total load that's available, along with the transmission of that load, you know, I think is a good idea.

Senator MURKOWSKI. Thank you, Mr. Chair.

The CHAIRMAN [presiding]. Thank you, Senator Murkowski.

We will now begin a second round of questions under the same terms as the original one.

Mr. Huntsman, I would like to start with you, if that is all right.

One big tech company recently released its sustainability report sometime last week, and it shows that that company's carbon emissions rose by six percent last year in 2024, primarily due to the development of data centers and electricity consumption that goes along with that and other activities. Now, despite the rhetoric from some big tech companies and others about net-zero, the reality is that their business model, particularly the business model of those

that are heavily reliant on big data centers, requires reliable power, affordable power, and oftentimes natural gas is the best option. In many cases, it is effectively the only realistic option. Can you discuss how Huntsman Corporation focuses more on innovation than sustainability as a means to achieve both economic growth and cleaner supply chains?

Mr. HUNTSMAN. Well, I think that in all of these supply chains, again, as we look at, particularly in the chemical industry, the innovation that we have is to make things lighter. If you look at just the science of something as basic as a water bottle. Think of the water bottles you pick up today. This is, unfortunately, pretty poor science right here, but most of the water bottles you pick up today, they feel like they are almost going to fall apart. That water bottle today contains about 15 percent of the material that the same application did 10 years ago. That's innovation. It's making the industry more efficient, it's lowering the cost, and it's better for the environment.

And if you apply that same technology into the lightweighting of an EV, you are going to extend the mileage, and of a plane, you are going to extend the mileage and the fuel consumption. A long-range power cable, high-voltage power cables, again, being able to lighten that, being able to increase the capacity of that, depending on the insulative materials that are built into that cable. It's all about science and it's all about innovation.

I would just note that when we talk about the battery and the materials that make all of this stuff, how much of that is actually being built and made and produced here in the United States? That's something that I think may be a topic for another day, but we import a lot of raw materials, especially on the mineral side and the copper side and all this from foreign powers and from foreign entities. And so, when we talk about the battery buildout and we talk about the long-term cable construction and so forth, a lot of this is going to require more construction and more permitting here in the United States. If we really want to domesticate and we really want to take advantage of this buildout, we ought to be building these raw materials in the U.S. as well.

The CHAIRMAN. If I am understanding you correctly, you are saying for every widget that a Huntsman chemical produces, or every widget that someone else produces using Huntsman chemical products, something like this, for example (the Chairman holds up a water bottle), I will never look at these any more without thinking "poor science." If you are able to innovate, you can produce the same number of widgets or even more widgets with fewer environmental impacts, including fewer emissions through technological innovation. Do I understand you correctly?

Mr. HUNTSMAN. I believe our industry does that as well as anybody, if not better.

The CHAIRMAN. Mr. Tench, arguably, the primary issue that your industry contends with involves the availability of reliable power. According to some reports, there are some utilities that told data center developers that additional power to fuel data centers can take up to a decade to deliver. Obviously, that could be unsatisfying in that industry, which needs to be nimble and move

quickly. What barriers exist within traditional utility business models to deploying large data centers at scale?

Mr. TENCH. You know, I am not an expert on the underlying business model for most of these utilities, but I can describe what I observe and the interactions that we have, and that is that when we begin our planning cycle, we will submit applications for engineering studies, which can take a year. They are then coupled with other developers that are looking to do similar things and, in some cases, we are all attempting to serve the same load requirement. So the utilities do have a difficult job in sifting through ten requests that may be for actually two projects that ultimately go live. Their response to that has been to require very significant financial commitments to even undertake the engineering studies. And again, those take a long time.

The need that we have is speed and certainty as it relates to that power. And in our observation over the last five years, across the country, those two factors are moving in the opposite direction.

The CHAIRMAN. So existing challenges coupled with the urgent need for permitting and regulatory reform sort of manifest to us a problem. We are kind of on the knife-edge of a problem, which, if we move in the right direction can help bring about needed reform quickly, and it can go the opposite direction quickly.

And then, finally, I want to just make a point in response to some of the comments that we have had so far that puts some of the comments in context. As the Wall Street Journal pointed out earlier this week, "the IRA," meaning the Inflation Reduction Act, "turbo-charged subsidies for wind and solar in ways that distorted energy investment because the subsidies can offset more than 50 percent of the project's cost." It's a significant amount that ends up being borne by the U.S. Government and the U.S. taxpayer. Now, the claim that these tax credits reduce electric rates is, I think, contradicted, or certainly undermined, by experience. Wind and solar credits must be backed by peaker gas plants or batteries, which cost more than three times as much as baseload power.

So the problem is not that there is anything inherently wrong with wind and solar being used to generate electricity. As I said earlier, they have their place. There are things that they can do. But baseload power is not something that they produce. And when you need baseload power, nothing else will do, and those don't provide that.

Senator Heinrich.

Senator HEINRICH. I just want to make the point that in my own experience, because the thing I find most intuitive is to look at the power in my own grid and to ask the question, does what people are representing line up with actual reality? On my grid, we are only five percent coal now, and that's because coal is really freaking expensive. We are 23 percent gas and declining, but that's very useful generation. It's hard to add to because you can't get a turbine. We are seven percent nuclear, which is great. It's firm, it's baseload—if people like those terms. I prefer capacity factors, and it has got a really good capacity factor, but it's really expensive, really expensive. And then, we are 35 percent solar, 15 percent wind, and with just 15 percent battery storage and a little bit of geothermal, we are able to balance all of that with incredible reli-

ability, and consumers will not compromise on reliability. But most importantly, they also like low cost.

And in most of the country, the average—you are paying 17 and change cents per kilowatt-hour for electricity. In my grid, we are paying about 11—10.8, to be precise. So it is bringing the price pressure down and it is providing the cheapest new sources of generation to replace the older, more expensive sources of generation.

One of the things we have to deal with here is these agencies and the role that they play in permitting new generation and transmission. So Mr. Gramlich, if our permitting agencies—for example, the Department of the Interior, which has added this new level of red tape, stall or slow-walk permits for generation projects, which we are currently seeing, and those permit projects, as a result, don't get on the grid or they get on the grid slower, what is the impact to people who pay retail electric prices?

Mr. GRAMLICH. Sure, well obviously, that will raise prices. And what's happening is, you know, love it or hate it, many utilities with their state regulators have put in place plans for the next few years of how they are going to meet load. There might be retirements. There might be load growth. They routinely go through these plans, and just the reality is, it's largely wind, solar, and storage that are in those plans——

Senator HEINRICH. About 95 percent in most cases.

Mr. GRAMLICH. Right, to meet next load. So if——

Senator HEINRICH. So if you take that 95 percent out, even some portion of it, say a third, what are you going to replace it with in year one, two, or three? Nothing.

Mr. GRAMLICH. Curtailment, per load.

Senator HEINRICH. Curtailment, exactly.

Why I said capacity factors is because I am an engineer and I don't remember a lot the terms and buzzwords that get thrown around a lot here now—firm, baseload, dispatchable. What I remember from my education is capacity factors, right? And if you look at generation today, you know, I have wind in my state that has a 40 percent capacity factor. It's not perfect, but it's pretty darn good. You know what else has a 40 percent capacity factor, Mr. Gramlich?

Mr. GRAMLICH. The gas?

Senator HEINRICH. Coal, today, in the United States of America. Everybody says it's firm and baseload and it's not. It's not, because it's expensive and it's unreliable. And when you have a coal-fired generating station go down, the whole thing goes down. It doesn't go down three percent, it doesn't go down 10 percent—you lose that generation until that thermal plant is back up and running.

So, in your testimony, you talked about the increase in demand over time. DOE also is predicting a similar amount, about two percent a year. But they are also claiming that there is somehow a hundredfold increased risk of outage, and this relates to the capacity factor issue if forecasted retirements occur between now and 2030, as predicted. What were the assumptions that went into that, that were baked into that claim?

Mr. GRAMLICH. Yeah, I think the Department of Energy, I mean, they provided useful analysis with this report, but I think they

vastly overstated the retirements of generation. And as I said earlier, we have processes, either through utility planning or markets.

Senator HEINRICH. And markets.

Mr. GRAMLICH. Right, you know, to discourage or prevent retirements, and that's happening, but also on the supply addition side. There is a lot more generation out there that could come onto the grid, and I think the Department of Energy study understated that new supply. So if you understate supply, overstate retirements, suddenly you have a reliability crisis, but it might just be manufactured by those numbers.

Senator HEINRICH. Yeah, we certainly haven't seen that in New Mexico, and we haven't seen that next door in Texas. where they have a totally separate grid from ours, but they are bringing on lots of new sources of generation, lots of new solar and batteries, in particular. You know, transmission lines are such an important piece of all this because they do help us wheel power around the country. And it's hard to build transmission. It's why we need to actually do permitting reform, which this Committee did last Congress, but hasn't done this Congress yet.

You know, I worked on one transmission line for 17 years of my life. And today, it has facilitated tens of billions of dollars of economic output. It has facilitated the largest renewable project in the continent's history, but it wasn't easy to get that done. If you create a system where the politics can change overnight, where, for example, a loan from the Loan Programs Office can be decided by politics rather than by metrics, what is the impact of that on reliability and on price pressure?

Mr. GRAMLICH. Well, I mean, so many utilities have testified before this Committee over the years about the need for stability. They are making 60-year investments—6-0—and if the policies change 180 degrees every four years, they simply can't do that. So I think your point is well taken. We need some stability, I do think. FERC is a great place for a lot of these orders, as a bipartisan, non-partisan agency. For permitting, they could do more in that regard, but we need to get that regulatory stability for investment.

Senator HEINRICH. Thank you.

The CHAIRMAN. Senator Justice.

We will go to Senator Justice, then Senator Cantwell, then Senator Hirono.

Senator JUSTICE. Thank you, Mr. Chairman.

Well, guys, you know, we have got some really smart folks up here. There is no question about that. And I am sure that you all are super-smart and I am very proud of your contributions to this great country in every way. And I really thank everybody out here in the audience and everything. I know you have family and everything, and we congratulate everybody for being here.

Let me just ask you just simply just this—or make this statement: why do we continue to make this so much harder than it is? Really and truly. I am from West Virginia. And I am a new kid on the block and I have got a lot of white hair and everything. But I was the Governor of the great State of West Virginia for eight years and everything, and we did it with logic, and reason, and businessmen or businesswomen approaches and everything, and all of a sudden, we took a state that was flat dead on its back any way

you can cut it, to prospering like you can't imagine in no time. We know in the energy sector today that a year from now or a year and a half from now, we are going to hit the wall like nobody's business. That is all there is to it. We know that.

And we absolutely know the contribution of fossil fuels, and that if we had carried on and gone down the pathway of some that would say we want rid of all of it, coal is the nastiest, terrible, most terrible word in the dictionary, and so, with all that being said, we want rid of all of it, and what would have happened? Here is exactly what would have happened, you know, and there is no point in dancing around it. We would absolutely be deciding between homes and industry or homes and jobs because we couldn't do them both. There's no way. And you know it. We all know it. All of you all know it.

So why don't get at trying to do something that is the right thing? We know what the problem is. My dad would have told me ten million times, son, you've got to first know how deep you are in the hole, but when you know the position you are in the hole, then we can try to get out of the hole. He would have also said, for God's sakes-a-livin', I don't care how hard you try, don't confuse effort with accomplishment. You know, we've got to achieve right now. That is all there is to it.

So I would ask you just this, and this is the simplest thing I can possibly ask you. We all know we have got to have reliable. We know we have to have a regulatory climate that we can function. I mean, for God's sakes, we know all the answers. Why don't we just get at fixing the problem? But my question is just simply just this—from the standpoint of can you talk about the dangers of retiring all fossil fuels, whether it be gas or coal or whatever, can you talk about where we would be in this country today if we just decided, okay, that is what we are going to try to do, because I do know this—West Virginia—83 percent of the power in West Virginia comes from coal. I do know there are states out there that don't derive a lot of power from coal. I was the guy that said embrace all, but for God's sakes-a-livin', let's quit subsidizing one and making it unfair against the others. If it's not fair, let's quit doing it.

You know, so talk to us about just what I just asked. Talk to us, please, and just go very quickly because I have only got a minute left.

Mr. HUNTSMAN. National suicide.

Senator JUSTICE. I love it. And I will tell you this, I was going to say this before we started. I love—and I don't know Peter Huntsman at all, but I love your bluntness, gosh almighty, because that's exactly what we need. We need to quit dancing around the ring around the rainbow. We need to absolutely do it.

Now, go ahead, sir.

Mr. TENCH. Look, we are at the edge right now in terms of having the power we need. We are going to be running short. We need to preserve and add resources everywhere we can.

Mr. GRAMLICH. All I will just say, I mean, your state is very different in its preferences than neighboring states and that is a good reason why states are largely in charge of generation choices and portfolios. So I don't think the Federal Government needs to be

meddling right now in specific power plans. Let's leave that to the states.

Senator JUSTICE. Would we not all say, if we were all being really smart, we have a situation that could become a national security situation, and it's right at our doorstep. Would we not all say, for God sakes-a-livin', why in the world don't we just look at what countries of the world are trying to do right today? China is building a coal-fired power plant every day, you know? And I am exaggerating to make my point, but they're not doing it just for fun. I mean, they know how absolutely important power is.

So nevertheless, I thank you for being here.

Mr. Chairman, I defer.

The CHAIRMAN. Thank you.

Senator Cantwell.

Senator CANTWELL. Thank you, Mr. Chairman.

Good to see you, gentlemen.

I like the subject of affordable electricity. It has kind of built the State of Washington over and over again. And so, we have had a pretty robust conversation now with all of my colleagues from different parts of the United States about how to get there. I haven't heard the word fusion yet. I certainly believe that while we are talking about transmission capacity and various sources of energy, the United States continuing to be a leader in breakthrough technology is also a key component, very important to the equation. Maybe if somebody wants to address that.

But I did, Mr. Huntsman, want to talk about the need for more electricity in the AI revolution, and particularly this issue you were talking about, the large amounts of composite material. I really did want to follow Senator Cassidy because it was a good lead up, being from the State of Washington and aerospace and the transformation that we want to see in aerospace with larger percentages of composite materials. But won't we be able to create some efficiencies by using AI and then making it more efficient in the development of these very lightweight materials, but also intensity in what it takes to actually produce them? Won't there be a feedback loop here that will help us?

Mr. HUNTSMAN. Absolutely, Senator. You are spot-on correct in that if you use the sciences of material scientists to lightweight anything, it's just a simple law of physics. You are going to require less energy to move that product, whether that end-item is an automobile or whether it's an airplane. And yes, AI is going to greatly facilitate the design, specifications, and the raw material usage to do these. What we also need to make sure of is that we have a permitting process in place. If AI can tell us that we can make this new product, and we have got the capability of altering our manufacturing footprint to make it tomorrow, I may have to wait three to five years for the EPA to approve a new chemistry. And that is simply not acceptable when you look at what we are doing with AI and what we are doing with material sciences. So you are spot-on.

Senator CANTWELL. Okay, so how do we accelerate that then?

Mr. HUNTSMAN. Well, it would be great if the EPA would follow the laws that all of you passed creating TSCA, which is, they have 90 days to approve a product or not. Right now, we have products that have been waiting for three to four years to get approval. I can

build a facility in China in less time than that. If you are going to be building these composite materials, you are better off going someplace other than the United States because it takes so long.

Senator CANTWELL. No, no, we don't want that. We have a world demand for 40,000 airplanes right now.

Mr. HUNTSMAN. That's right.

Senator CANTWELL. We are about to go to a major transformation where instead of building 40 planes a month, you will be able to build 100 planes a month. But wait, only if you get this next phase of composite manufacturing or thermal plastics right.

Mr. HUNTSMAN. We are ready to go.

Senator CANTWELL. And so, and we want to see that. We want to see it particularly related to AI and large-scale parts of the airplane. Obviously, you articulated very well in your earlier testimony how much the current manufacturing prowess has given us some percentage—18 to 20, maybe even higher—percentage of an airplane now with these lightweight materials, but the big move now is, you can build bigger pieces. And obviously, instead of taking hours to bake in an autoclave, you can do them in a large-scale press. And so, that's the thing in front of us.

I was thinking a little more like, I mean, yes, TSCA, but a little more about what agencies or what other people do you think we need to get involved to get people to understand that AI, you know, we went to one of our national labs and were just seeing some testing that was done that might have been done in the past by individuals—a very repetitive, formulated process, very time consuming, probably would have taken, you know, maybe years, but certainly months, but it was AI and automated and they just ran 24/7. So they are going to get that chemical analysis done in a few months instead. That's what AI is helping us to deliver.

So how can we communicate this in a broader way that we get more people understanding what the opportunity is?

Mr. HUNTSMAN. Well, I think if you make it applicable to the average person, for example, in cancer research, if you are able to apply AI, what if your cancer outcomes for cancer medications were to improve multiple fold? What if your prices of your groceries and so forth because of growing seasons and so forth and AI, what if that were to improve? I think you need to be able to—there is such a fear of AI taking my job. That needs to be supplanted with the idea that every technological advancement we have had in modern industry has benefited larger society. AI will do likewise. We need to do a better job selling that, both at a federal level and a state level, and at an industrial level.

Senator CANTWELL. We just, I know my time is up, but fusion, good idea to make sure we are keeping/making progress, right?

Mr. GRAMLICH. I would say absolutely. That's an exciting opportunity.

Senator CANTWELL. Thank you.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you.

Senator Hoeven.

Senator HOEVEN. Thanks, Mr. Chairman.

So you all need a lot of power for your AI. How are we going to get more baseload on the grid? We keep adding variable-rate

sources, and that is creating grid instability. You all want to use a lot of power off the grid. And when Chairman Lee turns his lights on and the lights don't come on, or he turns on his air conditioning on a hot day in Utah and it doesn't work because you are sucking all the power off the grid and we are having blackouts and brownouts, he is going to be really unhappy, and he has got a temper. So how are you going to get enough baseload out there to make sure that you not only can do all your great AI stuff which you have been talking about, but we keep the power on for everyone, all of our consumers that need it 24/7?

And you can go in any order you want, but I would like to get your opinions on it.

Mr. TENCH. I would be happy to start. Look, I think what we have been talking about in the hearing is about ways in which we can ensure that we can gain access to the electrons that are already on the grid through greater levels of interconnection, enhancement to the intelligence of the grid itself, so that it can be more adaptive to load changes that are occurring. And again, use better the generation and transmission infrastructure that we already have.

That said, it's not enough, and you know, our position is that we need to encourage as much new generation of whatever type as we can, including nuclear, including geothermal, et cetera.

Senator HOEVEN. Right, but if you don't balance it out, you are going to have instability, you are going to have blackouts. If you just keep adding wind power, or other variable sources, you are going to have problems. And it seems to me there are a lot of people who want to take coal off the grid and there are a lot of people that seem to have phobia about nuclear, and a lot of people don't want to allow any transmission or any of those kinds of things to be built. How are you going to break through that and get this done, because you all are bringing on a big-time demand for power at a high rate. And at some point, you know, everybody kind of wants to go on like everything is going to be just fine and they are going to have all their power and not kind of get the idea that we are going to have to do some of these things.

How are you going to crack this mindset so people kind of put their shoulder to the wheel and say, yeah, we need all these things?

Mr. TENCH. Well, hopefully, hearings like this, where we are helping to inform folks like yourselves, who are in a position to influence regulation and the other agencies that are involved in this will help. But if we can agree that the ability for the United States to be dominant in AI technology is a matter of national security, which I think it is, hopefully that will rally folks around us applying our influence, our pressure, and in our case, our capital toward incremental sources of generation and transmission.

Mr. HUNTSMAN. Simple fact——

Senator HOEVEN. Well, let me add one more thing before both of you, the others, you know, give me some thoughts, but look, nuclear is going to take some time. And we are going to have to change the way we build it to practically build it at some reasonable cost and a reasonable time frame, which, obviously, we are trying to do. Chris Wright and everybody is trying to do it. And we

are going to need to keep baseload coal around, you know, for a lot longer. So we are going to have to start putting some of these things together. How do we do that? I mean, it's not just telling our Chairman about it. I mean, somehow, we have got to get folks to really understand and buy in to this program if you guys are going to get the power that you want for AI, because a lot of folks see the potential of AI, but a lot of folks aren't all that thrilled about it.

Mr. HUNTSMAN. I am not an AI producer. I am from the chemical industry. But if I have got a trillion-dollar balance sheet, I am always going to be able to afford the power. That's not a concern to me. If he's got a billion-dollar balance sheet, he comes behind me, and if he's got a thousand-dollar balance sheet, like the average household in America, guess who is going to pay the highest price, and guess who is going to get the incremental last bit of electricity? And that is the way it's going to work. It's a pyramid.

And so, if you can afford it, and what we need to be doing is, you are absolutely right, we need to be building out the baseload power, which has got to come back to natural gas. That is going to be the cleanest. It's the fastest. It's the most economical means of having a reliable baseload across the board. And that's from our industry, because we don't have a trillion-dollar balance sheet. That's—we have been through Europe. We have been through all these continents that have tried seven different ways of making electrons and they are virtually bankrupt. It doesn't work. We know it. It's not a theory. It doesn't work.

Senator HOEVEN. That was a really well—that's exactly what I am getting at. I think folks have got to hear what you just said because that is going to be meaningful to them, you know? That was very good.

And sir, any thoughts you would have?

Mr. GRAMLICH. Well, I would just say we have heard a lot today about a balanced, diverse portfolio, and the power system is more like a basketball team. The point guard doesn't do what the center does and vice versa, and you need it all. And particularly in this moment of rapidly rising load growth, we can't be taking one of those players off the court.

Senator HOEVEN. Yeah, I mean, I just think folks need to understand what we have to do here. And I think how you all communicate that, how we all communicate it, really matters because we have got to get going.

Thanks for being here.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Senator Hoeven.

Just to wrap up, I want to push back a little on some of my colleagues claims that renewable generation paired with batteries is somehow significantly cheaper and more reliable. It's just not borne out by the data. Renewables and storage have a significant scalability issue. Backup power is required and is needed whenever you have renewables and storage operating as a significant leg of the energy stool because it happens from time to time when they don't perform adequately up to the task when demand peaks. Now, this is especially true whereas is bound to happen with some frequency demand peaks for a period of time longer than four hours.

Four hours matters because that is about the capacity of utility-scale batteries to hold power.

So you are inevitably going to have times when the wind, the sun, some combination of the two, aren't doing what they need to do when demand peaks and then, at those moments, you have got to have something to back it up. Then, additionally, if we want to cherry-pick data, let's look at some of the electric power costs in different parts of the country. Louisiana's retail cost of electricity is lower than, say, New Mexico's. And its electricity mix is 76 percent gas and three percent renewables. Utah's retail cost of electricity currently stands at around nine cents per kilowatt-hour, and statewide, the grid runs on 77 percent coal and gas-fired generation. And more specifically, my local utility also has low retail rates, about ten cents per kilowatt-hour, and runs on roughly 60 percent gas and coal.

So renewables and storage have a place. They are capable of helping do their part to make the grid more resilient and reliable, but scalability is an issue. We cannot forget the need for backup generating capacity. And if we are going to have two grids to accommodate all of that, it's going to get a lot more expensive, and that in turn drives a lot of the potential for our competitiveness, a lot of the demand for these things outside the United States, and we don't want to lose that race.

This has been a great hearing, and I want to thank each of you for being here and for your testimony. All three of you have offered phenomenal insights, and I am grateful for the participation of my colleagues as well, who made some great points.

This will wrap up today's hearing. The deadline for submitting questions for the record, any Senator who wants to do that must do so no later than 6:00 p.m. tomorrow, Thursday, the 24th of July. Senators will also have until 6:00 p.m. this coming Wednesday, July 30th, to add statements for the record to today's hearing.

Thanks again to our witnesses and to all of you who participated.

The Committee stands adjourned. Thank you.

[Whereupon, at 12:05 p.m., the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
July 23, 2025 Hearing: *To Identify Challenges to Meeting Increased Electricity Demand*
Questions for the Record Submitted to Mr. Jeff Tench

Questions from Ranking Member Martin Heinrich

Question 1: In your testimony you state that the availability of power is the leading constraint in data center buildout.

- If that's the case, shouldn't we be focused on building as much generation, including renewables, and storage as we can?

- What is limiting data centers from more extensively using medium duration energy storage as an alternative to on-site generators?

- Do you expect more storage to be deployed in the coming years?

Jeff Tench: We believe it's essential to consider all energy sources that—individually or in combination—can deliver economical, firm, reliable, and dispatchable power. Renewables paired with storage have important roles to play, but the ultimate goal is integrating technologies via the grid to meet evolving demand. No single resource will meet future needs alone. Success will depend on designing a generation mix that leverages the strengths of all available resources. Our focus is on partnering with energy providers and policymakers to ensure the grid evolves in a way that prioritizes reliability, sustainability, and cost-effectiveness through the right mix of technologies.

As data center flexibility is increasingly recognized as a way to accelerate grid connection, we expect medium-duration energy storage to become a more integral part of data center power infrastructure. However, the high upfront capital cost of battery energy storage systems compared to on-site generators remains a key barrier to broader deployment.

Questions from Senator Mazie K. Hirono

Question 1: Hawaii is still dependent on burning oil for about two-thirds of its power and it faces the highest electricity costs in the country. Hawaii is increasing its use of renewables to find both cheaper and cleaner sources of power. In March 2025, John Ketchum, the CEO of utility NextEra described renewables and batteries as being the "cheapest, fastest, and easiest way to meet surging power demand…. [i]f you take renewables and storage off the table, we're going to force electricity prices to the moon." Do you agree with that comment, and how much does the current and future availability of low-cost power factor into where your company builds data centers?

Jeff Tench: Energy costs are important for our customers and for us, which incentivizes us to work with energy providers on identifying and driving efficiency in design to deliver lower costs. Renewables paired with storage have important roles to play, but the ultimate goal is integrating technologies via the grid to meet evolving demand. No single resource will meet future needs alone. Success will depend on designing a generation mix that leverages the strengths of all available resources.

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Question 2: You described the economic and national security benefits of building new data centers. Cleaner sources of power to serve data centers also matter to the public because fossil-fueled power plants mean more air pollution and worse health outcomes in surrounding communities. Does your company evaluate the potential pollution impacts of its projects when deciding where to build new centers and does it take any steps to reduce the impacts?

Jeff Tench: Our greenhouse gas emissions profile is largely dictated by the amount of energy the data center uses, and the carbon intensity of the energy supplied to meet that demand. We partner with our customers to advance the efficiency of our data centers while also optimizing energy supply to meet our customers' requirements for speed, reliability, carbon emissions, and other factors. Many of our customers have ambitious greenhouse gas emissions reduction goals.

Additionally, all onsite generation equipment utilizes best-available emissions controls to minimize local air quality impacts and is fully permitted to meet or exceed regulatory standards.

Question 3: Your testimony stated that some of your company's customers are looking to add data centers with demand for power similar to that of Washington D.C. Some states, including Ohio, have established unique rates and requirements for data centers, recognizing that they can be much larger than a typical industrial power user. How do you think data center rates should be structured to ensure that the centers are not shifting costs to other consumers?

Jeff Tench: Affordable, reliable and dispatchable energy is integral to our business and the future growth of AI infrastructure. As such, we believe that costs should be assigned in a just and reasonable manner for all ratepayers. The parties involved should implement measures to minimize potential impacts on the market over a set period. This can be achieved through various investments, such as infrastructure upgrades, new technologies, or efficiency improvement. Vantage Data Centers is committed to paying our fair share for grid infrastructure that helps create a more reliable and resilient power grid for all customers.

Question 4: The Independent Market Monitor for the grid operator PJM stated in a June 3, 2025 report: "The basic conclusion of this analysis is that data center load growth is the primary reason for recent and expected capacity market conditions, including total forecast load growth, the tight supply and demand balance, and high prices." If data centers were to agree to briefly reduce their use of power during periods of high demand for power on the grid, how much could such flexibility by data centers reduce electricity price spikes paid by all customers in a given region? Is the company offering such flexibility in its applications to connect to the grid?

Jeff Tench: Data centers must run 24/7/365 to meet our service level agreements with our customers and to provide mission-critical services to their end users that might include hospitals, the transportation sector, and governments. At the same time, Vantage Data Centers fully supports efforts to develop a voluntary demand response program for large end users that allocates risks appropriately and incentivizes participation. We recognize demand response is an important part of a holistic effort to address both power costs and constraints, and that we have to get this right as an industry. We are excited about efforts like the Electric Power Research

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Institute's DCFlex Initiative to develop a thoughtful demand response program through collaboration between data centers, utilities, and regulators.

Questions from Senator Catherine Cortez Masto

Question 1: Your testimony described the U.S. permitting system as "fragmented and sequential." If you could change one permitting policy tomorrow to enhance domestic grid capabilities, what would it be and why?

Jeff Tench: The single largest limiting factor for data center development in the U.S. is timely access to power, so anything that the federal government can do to accelerate the availability of utility-scale power is welcome and will result in more data center development and the benefits that come with it, including powering U.S. economic competitiveness, enabling technological innovations, and safeguarding national security. We would urge Congress to continue with its efforts from last year to reform permitting under the National Environmental Policy Act.

Question 2: Your written testimony pitched the idea of "High-Demand Digital Infrastructure Zones." Can you share more about your vision for these Zones, and whether or not you believe current tax policy could keep select states or regions (like the vastness of the Western U.S.) from participating?

Jeff Tench: As I stated in my testimony, the federal government should identify regions of the U.S. experiencing concentrated load growth from digital infrastructure to be declared "High Demand Digital Infrastructure Zones." These Zones would guide proactive transmission planning, interconnection coordination, and permitting alignment across agencies. This approach would help focus public and private investment toward grid upgrades in areas of strategic national importance. This will require the convening power, coordination, and leadership of the federal government, including Congress, to identify the actions and resources necessary to support the development of the generation and transmission infrastructure required to rapidly develop AI data centers.

Regarding the impact of tax policy, more than half of the states currently offer some form of tax incentive for the data center industry. The sales and use tax exemptions for data center equipment are very similar to the sales and use tax exemptions on equipment that are often offered to manufacturers. While many states and localities offer the data center industry sales and use tax exemptions on data center equipment, the industry still pays significant state and local taxes, including sales tax on non-exempt purchases, property taxes, employment taxes, income taxes, etc., which can impact total cost of ownership and decisions about where to site the deployment of physical capital investments.

Question 3: From your perspective, are there certain Regional Transmission Organizations (RTOs) or regions of the country that you believe are taking an innovative queue management approach for interconnection – such as automation to process requests faster?

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Jeff Tench: I am bullish on the use of technologies like automation and AI to help address the challenges facing the electrical grid, and we support their careful evaluation and integration over time. Congress can help reform the interconnection process, address constraints, and encourage investments that bring about more capacity, reliability, and innovation that strengthens U.S. economic and national security. Specifically, Congress should look at how it can reinforce FERC's authority over interregional transfer capacity, prioritizing interconnection that supports digital infrastructure like data centers, identifying high-demand infrastructure zones for priority consideration, and fully implementing interconnection reforms through transparency measures backed by metrics and reportable data.

Can you explain the significance of FERC Order No. 2023, as well as ways that Congress can complement or build on these policies to further reduce interconnection study delays and meet growing demand?

Jeff Tench: Enforcing FERC Order 2023 is essential for modernizing generator interconnection procedures and ensuring that the electrical grid can meet the growing demands of the digital economy. This order introduces critical reforms to the interconnection queue, prioritizing viable projects and ensuring they are served first. FERC Order 2023 modernizes procedures for co-located, hybrid, and flexible resources, which are crucial for addressing the dynamic and evolving energy landscape. Data centers are increasingly adopting on-site generation and hybrid solutions to enhance their energy security and reduce their reliance on the grid. By streamlining the queue process, FERC Order 2023 reduces delays and accelerates the development of essential infrastructure.

Question 4: Electricity demand is increasing in my home state of Nevada, through new manufacturing facilities and datacenter operations. How should datacenters balance the need for high computation power with state laws and initiatives – such as a Renewable Portfolio Standard?

Jeff Tench: Our focus is on securing reliable and economical power to meet growing demand. When it comes to utility-supplied power or jurisdiction requirements for a particular grid mix, we rely on what the utility is able, willing, and required to provide.

Questions from Senator Ruben Gallego

Question 1: As your testimony makes clear, the need for energy for AI data centers is accelerating. This is certainly the case in my home state of Arizona, which is home to 170 data centers, the largest of which has a capacity of 180 megawatts. This is enough to power 36,000 homes on a hot day.

Your preference for connecting data centers to the grid is a sentiment I have heard echoed by many. As data centers and private companies work with utilities to be connected to the grid, it is also important to ensure that residential demand can be met.

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How do you suggest that data centers work to integrate their energy demand with other demand on the grid? Are there ways to adjust the timing of peak demand, and how do you suggest public and private entities find that balance?

Jeff Tench: The situation described is a potential use case for a demand response program. Vantage fully supports efforts to develop a voluntary demand response program for large end users that allocates risks appropriately and incentivizes participation. Data centers must run 24/7/365 to meet our service level agreements with our customers and to provide mission-critical services to their end users who might include hospitals, the transportation sector, and governments. We recognize this is an important part of a holistic effort to address power constraints, and that we have to get this right as an industry. We are excited about efforts like the Electric Power Research Institute's DCFlex Initiative to develop a thoughtful demand response program through collaboration between data centers, utilities, and regulators.

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Questions from Ranking Member Martin Heinrich

Question 1: It's common to dismiss renewables because—as the refrain goes—the "sun doesn't always shine and the wind doesn't always blow."

- Can you explain how grid operators in states like California and Texas have managed to avoid blackouts not despite renewables, but because of them?

Response:
Yes, very often Texas and California have a majority of their peak summer air conditioning demand met with a majority renewable energy and storage. Solar in particular serves the hot afternoon hours, and then batteries serve load into the evenings. As I explained in my written testimony, systems do need firm power in addition to sources like wind and solar that provide low-cost energy. Short-duration batteries provide some firm power at certain times like summer evenings after solar energy has provided power through the afternoon. Other sources often including existing gas plants provide firm capacity at other times. Firm power sources need not operate very much, and consumers can save money by using low-cost wind, solar, and battery storage most of the time. My written testimony explained the different roles that are played by resources in balanced utility portfolios.

Notably, even while meeting reliability targets, at certain times over 75% of Texas' power comes from wind and solar.[1] In 2024, ERCOT connected 3.9 GW of new storage capacity, which represented nearly 45% of its 8.7 GW cumulative capacity additions.[2] At times, renewable resources have reliably provided over 90% of generation in the Southwest Power Pool, which operates the power grid for all or part of part of 14 Plains states.[3] In 2023, power from renewable resources made up 54% of California's in-state electricity generation.[4] California has paired this significant renewable energy penetration with high energy storage deployment. Energy storage resources have helped California avoid blackouts during extreme weather events like the September 2022 heat wave, providing power during critical hours of grid stress.[5] The result is that the reliability of the California grid has been strong the last few years. South Australia reached 75% renewable energy penetration in 2023 and has not faced significant reliability challenges since 2016.[6]

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[1] Electric Reliability Council of Texas (ERCOT), *Renewable Integration Report* (Apr. 15, 2025), https://www.ercot.com/mp/data-products/data-product-details?id=NP4-760-ER.
[2] American Clean Power (ACP), *Snapshot of Clean Power in 2024*, at 14 (April 2025), https://cleanpower.org/resources/clean-power-annual-market-report-2024-snapshot/?mrcid=1745999619#unlocked
[3] Southwest Power Pool, *SPP sets regional records for renewable energy production* (Mar. 29, 2022), https://www.spp.org/news-list/spp-sets-regional-records-for-renewable-energy-production/.
[4] EIA, *U.S. States: State Profile and Energy Estimates*, https://www.eia.gov/state/?sid=CA (accessed Apr. 15, 2025).
[5] California Independent System Operator (CAISO), *Special Report on Battery Storage*, at 4 (July 2023), https://www.caiso.com/Documents/2022-Special-Report-on-Battery-Storage-Jul-7-2023.pdf.
[6] International Energy Agency (IEA), *Electricity 2024 - Analysis and forecast to 2026*, at 100 (May 2024 Revision), https://iea.blob.core.windows.net/assets/18f3ed24-4b26-4c83-a3d2-8a1be51c8cc8/Electricity2024-Analysisandforecastto2026.pdf.

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Contrary to claims made during this hearing, each renewable generation plant does not require a baseload generator to back it up. Rather, the system needs the portfolio of power sources collectively to meet load at all times. It is true that firm sources that produce power when needed for extended periods of time are needed but not on a one-to-one basis or anything close to that. A diverse portfolio with large amounts of renewable energy can be the most affordable and reliable as well as sustainable way to meet electricity demand.

- Are there areas of the country where we're seeing electricity prices decline as the share of clean energy on the grid increases?

Response: One study[7] found $750 million in savings from recent additions of battery storage in Texas. Solar and wind tend to reduce the marginal clearing price, and those wholesale price reductions flow through to reduce retail consumers' bills. Many utilities around the country assemble "integrated resource plans" (IRPs) with generation portfolios required to reliably serve load, and many of those include significant amounts of renewable energy. The addition of those resources to utility plans reduce the overall cost, otherwise they would not be included.

Question 2: A recent study published in *Nature* analyzed 2,156 blackout events across the United States from 2001 to 2020 and found that a higher share of renewable energy did not increase blackout risk. In fact, it may contribute to outages being less frequent, shorter in duration, and more limited in scale.

- Do you know what the main causes of the outages were?

Response: Almost all customer outages are caused by local issues on the distribution grid, not on the bulk power system.[8] The study to which you refer did find that a high penetration of weather-dependent renewable energy sources did not increase the risk of blackouts and might in fact lead to less frequent, shorter, smaller outages. The study also found that, where blackouts occurred, renewable resources were not the main cause.[9]

- If maintaining grid reliability is the goal, where should we prioritize our investments?

Response: I recommend focusing Congress' attention on the high voltage regional and interregional links. Those affect the most people across the widest areas, whereas more localized cases have existing mechanisms with local utilities and regulators to invest in needed infrastructure. Also, as implied by this Committee's strong vote last year in support

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[7] *https://cleanpower.org/news/new-analysis-shows-energy-storage-keeps-costs-low-and-power-reliable-in-texas/)*
[8] https://gridstrategiesllc.com/wp-content/uploads/2024/05/customer-focused-resilience-final-050118.pdf
[9] Jin Zhao & Fangxing Li, Nature Energy, *Impacts of renewable energy resources on the weather vulnerability of power systems*" (Oct. 2024), https://www.nature.com/articles/s41560-024-01652-1.

of the Energy Permitting Reform Act of 2024, interregional transmission is clearly not currently being addressed effectively by current industry or regulatory processes.

Transmission supports reliability and resilience more than any other option. Transmission lines typically have at least 99.85% availability across all voltage levels, far higher than any individual generation source. Transmission networks are multi-directional, and once built they serve many needs that one could not have predicted ahead of time, moving power from where it exists to where it is needed, and it does so automatically and at the speed of light. With severe weather events in recent years, sometimes 10% of a region's needs are met by large scale movements of power across major regions of the country. That is why interregional transmission is so important and was the focus of a Congressional requirement for the North American Electric Reliability Corporation (NERC) to study the need, and NERC's report found a need for 35 GW of increased interregional transmission capacity.

Question 3: We often hear that natural gas and coal are "dispatchable" or "baseload," yet they sometimes do not perform when needed.

- Are those meaningful concepts for system operators? If not, which ones are more useful?

Response: I think the term "firm" most accurately describes the attribute of being available at all times. The term "dispatchable" conflates the fast-ramping attribute with the as-available attribute. Those are different attributes that provide different services. Sometimes power systems need more of one, or more of the other in their system, so it is not useful to lump them together into a general category. The term "baseload" is a description of the load (not generation) that is always present so that is not a useful descriptor of generators. I do believe it is important to have firm resources in addition to fast-ramping and high-volume low-cost energy. It is more important from an environmental standpoint to make sure the high-volume energy comes from low- or zero-carbon resources like renewables, because they will run a lot and produce the most energy. It is not very harmful environmentally to have fossil resources provide firm capacity because they operate when needed but don't necessarily operate (burn fuel) very often.

The current focus on "dispatchable" resources ignores the fact that those resources are: (1) not always reliably available, since they may malfunction or not have fuel available during the extreme weather events when they are most needed; and (2) are not as dispatchable or flexible as batteries. "Firm capacity" is a more meaningful term as it suggests availability at all times.

- Why might it be inefficient to run a power system using only nuclear or coal, even though they may have high-capacity values?

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Response: The operating cost of these resources can be very high and much higher than renewable sources. Resources like nuclear and coal have high capacity values (highly likely to contribute to meeting peak loads), but are inflexible so it would be inefficient—if not impossible—to reliably operate a power system with generation from only those resources. Too much of any one resource only makes the system vulnerable to the same threats. This leaves the system susceptible to correlated outages that can pose significant reliability risks.

All generation types are vulnerable to forced and planned outages. During extreme events, especially when it is very hot or cold, conventional generation can go offline or have their output fall due to mechanical failure and fuel supply issues. For example, disruptions to natural gas supply and delivery during periods of extreme cold are common.[10] Similarly, coal piles at coal-fired power plants can become unavailable due to flooding or freezing, as was seen during Hurricane Harvey in Texas and Louisiana in 2017 and during the February 2021 cold snap in Texas and the South Central United States (i.e., Winter Storm Uri).[11,12] In addition, thermal generators, such as natural gas, coal, and nuclear generators, are frequently de-rated, or forced to operate below full capacity, and lose efficiency during heat waves, which can pose significant reliability risks.[13]

In addition, all generator types, including conventional generators such as coal, nuclear, and natural gas, are subject to planned outages for maintenance. In the past these planned outages could be performed in the spring and fall when there was excess capacity, but recently there have been shortages in these seasons.

While capacity accreditations for individual renewable generators are often lower than those of individual thermal generators, a portfolio that relies on a diverse set of resources, including renewables, is the most affordable way to achieve grid reliability.

Questions from Senator Mazie K. Hirono

Question 1: The Trump Administration and Congressional Republicans are removing tax incentives for solar and wind, the cheapest sources of new power by many estimates, as well as rescinding federal funds for transmission projects and adding barriers to solar and wind projects on federal land. What do the reductions in federal support for renewable

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[10] EIA, *Winter storms have disrupted U.S. natural gas production* (Mar. 13, 2024), https://www.eia.gov/todayinenergy/detail.php?id=61563.
[11] *NERC*, *Hurricane Harvey Event Analysis Report*, at 17 (Mar. 2018), https://www.nerc.com/pa/rrm/ea/Documents/NERC_Hurricane_Harvey_EAR_20180309.pdf.
[12] FERC, NERC, and Regional Entity Staff, *The February 2021 Cold Weather Outages in Texas and the South Central United States*, at 81 (Nov. 2021), https://www.nerc.com/pa/rrm/ea/Documents/February_2021_Cold_Weather_Report.pdf.
[13] NERC 2024 Reliability Assessment at 16 and 132-133.

power and transmission mean for the costs that households and small businesses will pay in the face of a rising demand for power?

Response: There would be a hole in many utility portfolios if wind and solar energy were removed by permitting, premature tax credit expiration or uncertainty, or other barriers. Reducing supply at a time of scarcity would increase costs significantly. Utilities need balanced portfolios with firm power, fast-ramping flexibility services, and low-cost energy, and no single resource provides all of these. Utilities need a diverse portfolio of supply sources that collectively deliver these services. Renewables provide low-cost energy, some flexibility, and some firm capacity on which utilities depend.

Question 2: The Trump Administration has tried to cast wind and solar power as unreliable. Can a grid with a high share of renewables be reliable and cost-effective with energy storage and a robust power grid?

Response: Yes, power systems can be reliable with something like 80% of the energy coming from wind, solar, and short-duration batteries, depending on the system and the resources available. Firm power is also needed for the times those resources are not available. Transmission is a key element because across wide areas "the wind is always blowing somewhere" as the saying goes.[14] That opportunity of integrating resources across large areas is of course not available to island systems like Hawaii, but Hawaii does have excellent solar and battery opportunities, and the alternatives to renewables are much more expensive than in most other states.[15]

Question 3: In 2021, Hawaii became one of the first states to use performance-based rates, in which utilities earn their revenues by meeting certain reliability and cost targets. Depending on design, such performance-based rates can serve to spur utilities to expand the capacity of existing transmission lines, make it easier for homes and businesses to connect solar power and storage systems, and incentivize energy efficiency. Are there additional steps beyond what you covered in your testimony that you would recommend state and federal regulators take toward grid upgrades and other investments to accommodate increased demand for electricity while keeping electricity affordable and reliable? Please feel free to include the titles of particular papers or studies you would recommend to the committee on the topic.

Response: Hawaii, Texas, and Alaska have relatively unique regulatory structures where full jurisdiction is at the state level, and for certain policies like performance-based regulation (PBR), that makes the job easier. For other states PBR is more complicated. There are opportunities for targeted PBR at the federal level for FERC. One such option is

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[14] See pg 16, https://gridstrategiesllc.com/wp-content/uploads/GridStrategies_RAValueInterregionalTx_250601.pdf
[15] https://www.nrel.gov/grid/hawaii-integration-studies; https://www.esig.energy/resources/hawaii-solar-integration-study/

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for a "shared savings" incentive that FERC could employ under its authority in FPA Section 219(b)(3). A shared savings model would allow utilities that deploy GETs to retain a portion of the cost savings (e.g., avoided transmission upgrades, reduced congestion costs, or faster interconnection timelines), while passing the rest along to customers. This creates a direct financial incentive for utilities to pursue low cost, high impact grid upgrades like GETs. This proposal is detailed in the WATT Coalition's FAQ on Shared Savings Incentives: https://watt-transmission.org/resources-2/shared-savings-faq/ . A similar approach could be adopted for High Performance Conductors.

Question 4: Some states, including Ohio, have established unique rates and requirements for data centers, recognizing that they are much larger than a typical industrial power user. How do you think data center rates should be structured to ensure that the centers are not shifting the costs to other consumers?

Response: State regulatory policies are addressing this question in most or all of the states where significant data center load growth is projected. I do not believe "data centers" should be treated as a less valuable service than other large loads, partly because almost every American is using those data centers on our phones almost every hour of every day. However, large loads generally do impact the system differently than small loads like homes and small businesses. Most states experiencing large load interconnections are requiring firm financial commitments in order to 1) prevent cost-shifting to other customers, and 2) prioritize loads that are most likely to be built, thereby increasing the accuracy of load forecasts that are used to form the basis for investment plans.[16] *Each state balances the various interests and equities in somewhat different ways. This is a state policy as opposed to a federal regulatory policy because these are retail (end-use) customers.*

Question 5: The Independent Market Monitor for the grid operator PJM stated in a June 3, 2025 report: "The basic conclusion of this analysis is that data center load growth is the primary reason for recent and expected capacity market conditions, including total forecast load growth, the tight supply and demand balance, and high prices." If data centers were to agree to briefly reduce their use of power during periods of high demand for power on the grid, how much could such flexibility by data centers reduce electricity price spikes in a given region?

Response: Flexibility by data centers would help increase the pace of data center growth and reduce costs that might be shifted to other customers. It is easier said than done though. I have yet to see many non-cryptocurrency data center customers actually curtailing consumption in response to wholesale prices, mainly because the value of chips and computing is so much higher than the value paid to curtail consumption. But achieving even a little flexibility from all demand sources would significantly improve the efficiency of

[16] See slides 17-20, https://gridstrategiesllc.com/wp-content/uploads/National-Load-Growth-Report-2024.pdf

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the grid, avoid excessive expensive investments, enable more economic development, and reduce the risk of cost-shifting to other resources. Significant attention from utilities, data center owners and developers, DOE, and national labs could help expand this opportunity. Sometimes the reason for expensive and time-consuming network upgrades is the very low probability of a certain "contingency" happening, meaning a forced outage of a transmission line or generator somewhere on the network. If data centers and other customers can reduce consumption in the event of this contingency, then physically they should be able to be connected quickly and for less cost.[17] *What the data center industry values more than anything is the speed of connection. I expect we will see some creative temporary configurations before full network transmission service is available.*

Questions from Senator Catherine Cortez Masto

Question 1: When considering tariffs, do you believe the U.S. is adequately investing in workforce programs and supply chains to support our rapidly growing power demand needs, both today and into the future?

Response: No, I believe the US can do more to develop domestic supply chains and manufacturing. This requires targeted incentives to these facilities but also a stable "demand pull" in the market for technologies of tomorrow. There is a small and limited role for tariffs, but they tend not to work by themselves without predictable supply incentives and demand. Tariffs may raise costs significantly for electricity consumers since significant supplies of aluminum and steel are needed.

There are also increasing constraints in ensuring adequate workforce to support transmission development, with transmission developers managing uncertainty in development timelines—especially around permitting—that make it difficult to secure labor for the moment construction can finally begin. Developers are also sharing the same workers across transmission projects, having to compete not only for supply and demand for the project and for supply chain queue positions but also for the labor required to actually construct the project. The Transmission Siting and Economic Development grants program established in the Inflation Reduction Act included grants to bolster workforce. For example, in the initial round of awards,[18] *the U.S. Department of Energy's Grid Deployment Office awarded funds to Oregon to launch a Lineman College and Training Hub; to Oklahoma to build a workforce development center; to Michigan to invest in workforce development initiatives to support transmission construction; to New Jersey to provide pre-apprenticeship and apprenticeship training for electrical careers in partnership with an IBEW local union; to Colorado for workforce training; and to Virginia for the Hampton Roads Energy Workforce Development Initiative.*

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[17] https://nicholasinstitute.duke.edu/sites/default/files/publications/rethinking-load-growth.pdf
[18] https://www.energy.gov/gdo/TSED

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Question 2: Your written testimony highlighted the importance of sufficient staffing at federal agencies to support infrastructure permitting. How detrimental is the Interior Department's recent memo, specifying that the Secretary of the Interior has to personally approve wind and solar projects?

Response: It could be very detrimental to the energy development on which utilities are relying. The uncertainty alone can scare investors away.

How do you see it impacting the rapid deployment of new electrons to the grid?

Response: Much more clarity and speed will be needed to avoid a significant loss of some of the energy needed to meet growing demand over the next few years.

How are these hurdles compounded by ongoing employee terminations across federal agencies? Does this uncertainty put the U.S. at a competitive disadvantage for AI leadership?

Response: Yes, limited grid capacity already harms the US' position relative to other countries for AI-driven data centers, and slowing generation development of any type worsens the nation's competitive position.

Question 3: A recent report from Americans for a Clean Energy Grid determined that while new sources of generation are coming online, the U.S. is not building transmission projects to deliver that power fast enough and adhere to surging power demand. Can you highlight some of the existing federal tools that can be utilized or expanded to get new transmission lines built?

Response: There are several federal tools that can help advance needed large-scale transmission development, some of which are less certain today than they were a few months ago. First is the U.S. Department of Energy's Coordinated Interagency Transmission Authorizations and Permits, or CITAP, Program, established via rule in May of last year pursuant to Federal Power Act Section 216(h) and provisions of EPAct 2005. Under that program, DOE acts as the lead agency to coordinate all federal reviews and authorizations required for qualifying transmission projects. The effort to stand up the program followed from a memorandum of understanding among nine federal agencies, which coincided with Congress making changes to NEPA in the Fiscal Responsibility Act of 2023. There are currently at least two projects proceeding through the new process, which is designed to cut the average federal permitting timeline in half. But the staff implementing the program is significantly less than it was when DOE stood up the program, which calls into question how effective it will be, at least in the near term.

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Another existing federal tool, also first established in the Energy Policy Act of 2005, are National Interest Electric Transmission Corridors, or NIETCs, as set out in Section 216(a) of the Federal Power Act. DOE attempted to use this authority once in the past, unsuccessfully, but revamped the program in 2023 and was in the process of designating NIETCs as of the change in Administration. The impact of NIETC designation includes not only triggering FERC's limited federal backstop siting authority under Federal Power Act Section 216(b) but also unlocking federal financial tools that Congress established in the Infrastructure Investment and Jobs Act in 2021 and the Inflation Reduction Act in 2022 (though their status changed as of Congress's passing of the OBBBA earlier this year).

Other federal tools to advance transmission development at DOE include several financial tools: third-party financing with Power Marketing Administrations (established in Section 1222 of the Energy Policy Act of 2005), Grid Resilience Innovation and Partnership grants (established in the Infrastructure Investment and Jobs Act of 2021), the Transmission Facilitation Program (established in the Infrastructure Investment and Jobs Act of 2021), , and direct loans from DOE's Loan Programs Office.

Federal tools at FERC to catalyze transmission development include FERC's transmission planning rules (Order Nos. 890 (2007), 1000 (2011), and 1920 (2024)), transmission incentives rule (Order No. 679), generator interconnection rules (Order Nos. 2003 and 2023), and backstop siting rule (Order No. 1977). FERC's authority over transmission planning and cost allocation, transmission incentives, and generator interconnection is critical, and some of these areas are ripe for further reform. For example, a strong "shared savings" incentive for advanced transmission technologies could be valuable for advancing smart, cost-effective grid expansion (under Federal Power Act Section 219(b)(3)). FERC's authority over permitting transmission lines is very limited; Congress should consider bolstering this authority through permitting reform legislation.

Adoption of DOE's Categorical Exclusion for reconductoring and rebuilding transmission lines by all federal agencies would be helpful.

Question 4: Are there ways that the U.S. can better incorporate inter-regional planning and power transfer capabilities in order to adhere to energy demand needs and prevent against threats to the grid?

Response: Yes, FERC could require best-practice transmission planning methods for interregional transmission as it did for intra-regional transmission in Order 1920. Congress could direct FERC to issue a rule doing that, as was proposed in the Energy Permitting Reform Act of 2024.[19] Another option is a minimum transfer requirement, as they have in Europe,[20] and that could be based on the recent NERC Interregional Transmission

[19] https://gridstrategiesllc.com/wp-content/uploads/EPRA-Transmission-Explainer-Grid-Strategies.pdf
[20] https://energy.ec.europa.eu/topics/infrastructure/electricity-interconnection-targets_en

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Capability Study, which Congress required NERC to prepare in the Fiscal Responsibility Act of 2023.[21]

How critical is interregional planning for energy demand management and maximizing power load efficiency?

Response: Interregional transmission is one of the most important ways to maximize efficiency of the power system because it enables power flow between areas that have peak loads and generation supply output occurring at different times.

In many cases there is more generation and load diversity between regions than within regions, meaning there is more likely to be excess energy available to flow in times of need. Interregional transmission also provides substantial resilience value by bridging weather-related differences between regions. Demand does not peak in every region across the country at the same time. A grid that is "bigger than the weather"—be it a polar vortex or cloud cover—enables power to be shared from a region that is not peaking into a region that is, lowering consumers' costs in both regions. Interregional transmission can provide greater diversity in both load and generation across greater distances as well.[22]

Reports on the value of interregional transmission:

- *Resource Adequacy Value of Interregional Transmission*[23]
- *NERC's Recommended Grid Expansion Would Save Consumers Billions*[24]
- Quantifying a Minimum Interregional Transfer Capability Requirement[25]
- The Value of Transmission During Winter Storm Elliot[26]
- Transmission Makes the Power System Resilient to Extreme Weather[27]

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[21] https://gridstrategiesllc.com/wp-content/uploads/2023/05/GS_Interregional-Transfer-Requirement-Analysis-final54.pdf

[22] https://gridstrategiesllc.com/wp-content/uploads/GridStrategies_RAValueInterregionalTx_250601.pdf

[23] https://gridstrategiesllc.com/wp-content/uploads/GridStrategies_RAValueInterregionalTx_250601.pdf
[24] https://gridstrategiesllc.com/wp-content/uploads/GS_NRDC_NERCs-Recommended-Grid-Expansion-Report54.pdf
[25] https://gridstrategiesllc.com/wp-content/uploads/2023/05/GS_Interregional-Transfer-Requirement-Analysis-final54.pdf
[26] https://acore.org/wp-content/uploads/2023/02/The-Value-of-Transmission-During-Winter-Storm-Elliott-ACORE.pdf
[27] https://gridstrategiesllc.com/wp-content/uploads/2024/05/transmission-makes-the-power-system-resilient-to-extreme-weather.pdf

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Question 5: As wildfires grow more frequent and destructive, how do you see this risk impacting the ability of electric companies to finance, build, and harden the infrastructure needed to meet rising electricity demand?

Response: Wildfire risk, particularly for utilities in the Western US, can harm utilities' ability to invest in new transmission that expands capacity. Significant capital will likely be needed to harden systems, install low-sag carbon and composite core High Performance Conductors and other types of technologies that reduce wildfire vulnerabilities, and quickly recover from any line outages that may result from wildfires.

Note that HPCs, which operate at lower temperatures and sag less than traditional wires, reduce wildfire ignition risk while doubling line capacity without requiring new corridors. Therefore, HPCs offer a dual benefit in supporting system hardening and capacity expansion with a single investment.

Question 7: From your perspective, are there certain Regional Transmission Organizations (RTOs) or regions of the country that you believe are taking an innovative queue management approach for interconnection – such as automation to process requests faster?

Response: The California Independent System Operator (CAISO), Southwest Power Pool (SPP), and Midcontinent Independent System Operator (MISO) have instituted reforms to speed up interconnection queue processing, beyond those required by FERC. Their efforts to simplify the process by shifting the complicated network planning needs over to the transmission planning process leaves less complicated processing for the interconnection process itself. SPP is developing an "entry fee" approach to provide much more clarity and certainty to interconnecting generators. CAISO is planning certain transmission zones to make interconnection available to the amount of demand expected there. Most of the RTOs are implementing automation and AI tools. It is not clear yet that these tools produce results that can be replicated by the interconnecting generators in a way that provides clarity and consensus on the upgrades needed.

Can you explain the significance of FERC Order No. 2023, as well as ways that Congress can complement or build on these policies to further reduce interconnection study delays and meet growing demand?

Response: Encouragement from Congress and specifically from committees that oversee agencies like FERC to address important policy priorities is generally welcome from my perspective. Interconnection is one of those recent important policy areas where FERC heard a message that it was important to fix some problems. By and large I believe important reforms are well underway at FERC and transmission providers on interconnection even if they have been slower than they should have been. The basic thrust

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of FERC Order No. 2023 is moving transmission providers towards studying interconnecting generators in groups, called clusters, rather than on an individual generator-by-generator basis, as well as reforms to increase accountability and deadlines for both generation and transmission owners. While the reforms are still being implemented, early indicators suggest the changes are helping improve the interconnection process in many regions. Further reforms are needed beyond those FERC mandated through Order No. 2023. It will be important for FERC to continue spreading best practices. These reforms are necessarily mainly at the regional level, meaning what is needed depends on the region, because each system is different. FERC can encourage some general themes such as simpler processes including entry fee type approaches, as described here: https://gridstrategiesllc.com/wp-content/uploads/Exec-Sum-and-Report-Unlocking-Americas-Energy-How-to-Efficiently-Connect-New-Generation-to-the-Grid.pdf. To the extent Congress legislates, it will be important to make sure that agencies retain the flexibility to evolve rapidly based on successes and failures, in a way that is faster than legislation can address.

Question 8: Wildfire liability—particularly in the West—is starting to affect credit ratings, utility financing, and ultimately the cost and timing of those projects. What is your perspective on how those financial dynamics are influencing transmission investment?

Response: Utility credit ratings is a significant issue for many utilities and states across the country, and particularly in the West. Liabilities can affect utilities' ability to attract investments needed for reliability and affordability. State regulators and legislators across the West are actively evaluating options to address these liabilities, and Congress should consider the issue as well.

Questions from Senator Alex Padilla

Question 1: China is outpacing the United States in the deployment of high-voltage transmission lines and renewable generation. How has the current federal regulatory structure hindered the deployment of transmission and left us behind other countries like China? How can reforms in transmission permitting set us up to meet the moment?

Response: Lack of clear federal regulator requirements in the US compared to China and the EU hinder our ability to build the interregional capacity that global competitors are employing. We have essentially no interregional transmission policy presently. We have uncertain implementation of FERC Order 1920 for regional transmission. We do not have a clear federal regulator for transmission like we do for natural gas pipelines (FERC). We have an opportunity to put in place stronger regional and federal systems for regional and interregional transmission.

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There are lot of challenges to building linear infrastructure like transmission lines. These include the big three: planning, paying, and permitting.

Drilling down on permitting, it regularly takes over a decade to develop a large-scale transmission project, and for some, more like 15 years or more. Much of that time is spent in the permitting process. For most large-scale transmission, federal, state, and local permits are required. Sometimes county-by-county permits are even required, which can be incredibly time-consuming for transmission developers. For some permits, there is no required timeline for the authority to use the permit, and where there is a timeline, there are frequent delays. The average time for a federal agency to complete a NEPA environmental impact statement for a transmission project is four years, though it is usually longer for large-scale transmission and completing the EIS does not mean the project has yet secured authorization to begin construction—that sometimes takes several years longer.

To give you a couple examples, as I mentioned, in 2024, we saw over 800 miles of new high-voltage transmission built, which was a pretty significant increase from 2023, and even more from 2022. But to put it into perspective, 125 of those miles was from the Ten West Link project that CAISO first approved for inclusion in its transmission planning process in 2013—so over a decade before it went into service. Another 102 miles of the 2024 total came from the Cardinal-Hickory Creek project, which MISO included as part of its Multi-Value Projects portfolio in 2011—so over a decade ago. This project faced protracted litigation and permitting battles. And a third project that came online in 2024 is the Energy Gateway South line, originally announced by the developer in 2007, partially completed in 2015, and the last segment finally completed 17 years after its development was first announced. This is similar to the SunZia project, which is currently under construction after 17 years of development, as well as the Boardman to Hemingway project, which has been in permitting for going on two decades.

Questions from Senator Ruben Gallego

Question 1: Extreme heat is becoming more frequent and lasting longer across the United States. At the same time, on July 9th, Arizona's two largest electric utilities broke energy demand records. As you mentioned regarding air conditioning in your testimony, when temperatures rise, people reach for the thermostat—leading to surges in electricity demand.

Especially in rapidly growing states like Arizona, we have seen rising utility bills and lagging capacity growth to keep up with electricity demand. People across the country should not have to worry about astronomical bills, utility shutoffs, or the possibility of blackouts during times of high demand.

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Outside of rising costs, what additional electricity demand challenges are caused or worsened by extreme heat? What steps should be taken to ensure the nation's electric grid can keep up with rising demand during extreme heat, without passing the cost burden onto households or risking reliability?

Response: State regulators and utilities should be planning to ensure sufficient capacity is available to protect people from extreme heat. Heat related deaths are rising: https://www.epa.gov/climate-indicators/climate-change-indicators-heat-related-deaths . Air conditioning is a public health necessity at certain temperatures and heat index levels. Certain end-uses of electricity are less critical than others on extreme heat days. States should be evaluating ways to compensate users from reducing consumption at times of excessive heat.

- *Energy storage resources have helped California avoid blackouts during extreme weather events like the September 2022 heat wave, providing power during critical hours of grid stress.[28] The result is that the reliability of the California grid has been strong the last few years.*
- *In addition, thermal generators, such as natural gas, coal, and nuclear generators, are frequently de-rated, or forced to operate below full capacity, and lose efficiency during heat waves, which can pose significant reliability risks.[29]*
- *In 2022, CAISO even put together a short documentary to show how their grid operators are using batteries to support grid reliability, especially during extreme heat.[30]*
- *During an August 2024 heat wave, ERCOT leveraged complementary resources to keep the state's air conditioning on while keeping prices reasonable. Low-cost solar generated significant power during peak hours. Batteries, charged on cheap, excess wind and solar generation during off-peak hours, met the demand during peak hours after the sun had set. The renewable generation kept strain off of natural gas plants and avoided the need to run more expensive units.[31]*
- *Between August 31 and September 9, 2022, when a prolonged heat event hit California, solar generation met much of the daytime load while energy storage*

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[28] California Independent System Operator (CAISO), *Special Report on Battery Storage*, at 4 (July 2023), https://www.caiso.com/Documents/2022-Special-Report-on-Battery-Storage-Jul-7-2023.pdf.
[29] NERC 2024 Reliability Assessment at 16 and 132-133.
[30] CAISO, *From Idea to Reality - Battery Storage Comes of Age on the California Grid* (Mar. 2022), https://www.youtube.com/watch?v=waY4yQkTeHA.
[31] Paul Denholm, et al., National Renewable Energy Laboratory, *How the U.S. Power Grid Kept the Lights on in Summer 2024* (Nov. 2024), https://www.nrel.gov/docs/fy25osti/91517.pdf.

resources met soaring demand into the evening. CAISO indicated that these contributions were crucial in avoiding blackouts.[32]

- *In Texas in June 2023, a record-breaking heat wave led to peak electricity demand exceeding 75 GW. While many fossil fuel generators faced operational issues, including mechanical failures and fuel supply constraints, renewable and energy storage resources overperformed, keeping the grid reliable and minimizing price spikes associated with high demand.*[33]
- *During the heat waves that hit the Western U.S. in July 2024, CAISO relied on its diverse portfolio of renewable and energy storage resources, along with demand response programs, even as demand soared in response to sustained record temperatures. California's grid performed so well that it was able to export power during key hours to neighboring systems, which had fewer renewable and energy storage resources on which to rely while facing similar extreme temperatures.*[34]

Question 2: In your description of firm power generation, you mention that nuclear energy has the highest capacity value for any type of resource at 95%. This means that nuclear energy is very good at providing power supply at times of scarcity. However, you also say that opportunities to expand nuclear within the next decade will be minimal, in contrast to fast-deploying wind and solar or fast-ramping battery storage.

How do you propose balancing near-term demand with the need for longer-term reliability and efficiency? How do we ensure that a range of renewable energy sources work well together?

Response: A balanced portfolio of wind, solar, short-duration batteries, along with firm sources can provide an affordable, reliability, and more sustainable supply to meet growing demand in the near term. I expect many older units will remain on line longer than previously expected in response to the signals from markets and utility planning processes that their capacity is needed over the next few years. Keeping such units on line and available to provide firm capacity does not necessarily reduce state, consumer, and utility environmental goals because being available to provide capacity does not necessarily mean the plants run very often. In the next decade, "clean firm" sources such as advanced geothermal, large and small nuclear fission plants, nuclear fusion, and other sources may become economic. The government has an important role to play in developing and commercializing these technologies.

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[32] CAISO, *2023 Special Report on Battery Storage* (July 2024), https://www.caiso.com/documents/2023-special-report-on-battery-storage-jul-16-2024.pdf.
[33] Arpan Varghese & Scott Disavino, Reuters, *Wind, solar help Texas meet record power demand during heat wave* (June 2023), https://www.reuters.com/business/environment/wind-solar-help-texas-meet-record-power-demand-during-heat-wave-2023-06-30/.
[34] CAISO, *Managing the July 2024 heat wave with our partners in California and the West* (July 2024), https://www.caiso.com/about/news/energy-matters-blog/managing-the-july-2024-heat-wave-with-our-partners-in-california-and-the-west.

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Business of Energy

Turning old into new: Meeting Immediate Data Center Demands by Converting Gas Peaker Plants to CCGT

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July 30, 2025

1. Introduction

The rapid expansion of data centers (i.e., specialized facilities housing racks of CPUs and GPUs) is placing new and often unpredictable demands on the U.S. power grid.[2] This strain has been intensified by the surge in high-density, around-the-clock compute demand driven by the training and deploying frontier large language models (LLMs), which has grown at a rate of 1.2 times annually since 2010 (Emberson 2024). While LLMs existed prior to 2022, they were primarily confined to research and developer environments. A major inflection point came with the launch of ChatGPT in late 2022, introducing LLMs to general public in a highly accessible form. Despite modest internal expectations, the model reached one million users in five days (Milmo 2023), revealed unprecedented demand for interactive, public-facing generative AI based on LLMs. The surge in usage overwhelmed OpenAI's infrastructure. Reports noted that OpenAI's compute costs reached millions of dollars per week, and service disruptions becoming common (Roose 2023).

This moment catalyzed an industry-wide AI arms race. While OpenAI's GPT has 57% adoption rate, other industry players such as Meta and Google accelerated the development and release of their own frontier models, aiming to compete not only on model performance, but also on scalability and integration across both consumer and enterprise platforms (Gupta 2024).[3] This race to develop and deploy advanced models has triggered infrastructure race to build data centers required to support them. In 2025 alone, Google and Amazon plans to spend $185 billion in total on AI and cloud infrastructure (Bhuiyan and Kerr 2025). Meta pledged "hundreds of billions" in investment of new U.S. data centers (Singh and Soni 2025). These massive capital investments are driving the rapid expansion of physical infrastructure and the exponential growth in energy demand.

As a result, access to both compute and reliable energy sources has become a critical bottleneck to scaling generative AI (Sevilla et al. 2024). By 2028, data centers are predicted to consume up to

[1] The findings and conclusions presented in this research are those of the authors and do not represent the official views or policies of the University of Southern California. All errors are the authors.
[2] We therefore limit the types of data center operators to two types: hyperscalers (e.g., Amazon, Google, Microsoft, Meta), which own and operate their data center facilities and develop proprietary AI models, and colocation providers (e.g., Equinix, QTS), which lease computational capacity to other wholesale and retail clients. We exclude facilities that do not require 24/7 uptime (e.g., cryptocurrency and powered shells).
[3] At the same time, 15% of the enterprises are actively developing their own proprietary LLMs to achieve greater customization and control, seeking models better tailored to their goals (Gupta 2024).

580TWh or 12% of total U.S. electricity, up from 4% (176 TWh) in 2023 (Shehabi et al. 2024).[4] At the same time, policy and stakeholder pressure to decarbonize the grid system by phasing out fossil-based generation is increasing, presenting challenges for both dispatchable and baseload solutions.

As data centers drive rapid load growth, a key question is what sources can reliably supply power in the near term. One option frequently mentioned is commercial solar and wind, which plays an essential role in enhancing diversified and overall resilient system. However, these are variable energy resources by design, where their output depends on weather conditions and time of day. With continuous power needed for ultra-reliable loads, such as Tier IV data centers requiring 99.995% uptime (i.e., no more than 26 minutes of downtime annually) (Davis 2023), renewables require pairing with long-duration energy storage or fast-ramping backup generation to ensure reliability across all hours (NERC 2025). However, while 4-hour battery storage is scaling rapidly, deployment of multi-hour to multi-day storage at grid scale remains constrained by technology maturity and high costs (IEA 2024).

As a result, the effect load-carrying capability (ELCC) of solar and wind during peak demand periods is typically estimated at below 30% of nameplate capacity (NERC 2025). While significant progress is being made in in both the supply forecasting and demand-side load shifting, the near-term power requirements of data centers, which require near-continuous uptime, impose reliability standards that are difficult to meet with variable resources alone.[5] As a result, data center operators and policymakers across the aisle are actively evaluating alternative firm power solutions capable of providing high-reliability, dispatchable capacity on a near-term timeline.

Data center leaders and policymakers across the aisle are considering alternative solutions.[6] One possibility is advanced nuclear power, specifically small modular nuclear reactors (SMRs). Boasting lower costs and safety risks with capacities under 300MW, SMRs are an attractive option that can be sited anywhere, including co-located with the data centers. Nevertheless, the regulatory approval process is likely to delay their commercialization until the early 2030s (Shenk 2025).

The other possibility is building new combined-cycle natural gas plants (CCGT), which leverage abundant, low-cost natural gas and achieve a power output efficiency of 55%. However, two significant challenges hinder this option's viability in the short term. Supply chain constraints on high voltage transformers and gas turbine parts have extended product delivery wait times of 2 years for transformers and between 2.5 and 3 years for new gas turbines (Jacobs et al. 2024; Cobb 2025). Furthermore, interconnection queue times (i.e., the time a new generation facility must wait to connect to the grid) range from 38 to 71 months, posing an additional obstacle (Wilson and Lenoir 2024).

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[4] Projected estimates vary with the Electric Power Research Institute estimating 9% of total electricity by 2030 (Aljbour et al. 2024). For a comparison of various historical estimates of data center energy use from both academic and industry sources, see Figure 1.2 (p. 13) in the report by Lawrence Berkeley National Laboratory (LBNL) (Shehabi et al. 2024).

[5] On the supply side, better weather forecasting, expanded geographic distribution of wind and solar assets, and enhanced grid flexibility are helping mitigate variability. On the demand side, including large energy users, strategies such as load shifting, demand response, and intelligent energy management systems are increasingly being adopted. However, while the recent work (Norris et al. 2025) highlighted that some AI training workloads may offer temporal flexibility, the authors also note “data center have historically exhibited low participation rates” (p.9) . Our analysis focuses on near-term siting and load growth, where speed and reliability often take priority over latent flexibility.

[6] Accelerating Deployment of Advanced Nuclear for Clean Energy (ADVANCE) Act was signed into law in 2024 with broad bipartisan support. The law streamlines licensing for advanced reactors and SMRs (U.S. Department of Energy Office of Nuclear Energy 2024).

Amidst the challenges to meet the immediate power needs of planned data centers between 2025 and 2030, we assess the conversion of underutilized gas peaker plants to full-time combined-cycle gas turbines (CCGTs). This presents a potential near-term solution to add reliable, dispatchable capacity using existing assets. These conversions enhance efficiency, extend capacity factor, and support baseload operation, while leveraging existing interconnections points, zoning, and infrastructure, which can reduce permitting hurdles compared to new builds. While material increases in output typically trigger formal interconnection studies (FERC Order No. 845), such projects may still proceed faster than new plants, particularly when prioritized for reliability, as seen in PJM's fast-tracking of CCGT repowers under its Reliability Resource Initiative (PJM Inside Lines 2025b). Additionally, peaker-to-CCGT conversions reuse existing gas turbines, avoiding lengthy wait times associated with entirely new turbine sets.

This report presents a nation-wide assessment of peaker-to-CCGT conversion potential. The analysis begins with a practical working definition for peaker plants, followed by a geographic distribution of peakers across the United States. Projected capacity and energy output increases are then modeled across multiple conversion scenarios for all qualifying plants. A four-criteria screening framework is applied to identify high- and moderate-potential candidates for conversion, incorporating policy environment, site feasibility, economic margins, and gas turbine suitability.

Based on our analysis, we identify approximately 30% (185 plants) of U.S. peaker plants as high potential for conversion and 11% (70 plants) as moderate potential for conversion. High and moderate potential peaker conversion adds nameplate capacity of 134 GW or 1170 TWh to the grid, while just high potential peaker conversion adds 98 GW capacity or 858 TWh to the grid. The conversion of high and moderate potential peakers can provide more than enough energy to satisfy the energy demand of planned data centers through 2030.

Finally, the analysis examines how this conversion potential overlaps with the regional distribution of planned data center development and evaluates key constraints (such as interconnection delays and supply chain bottlenecks) that could affect the pace and scale of implementation. The results point to a significant but time-sensitive opportunity.

2. Definition of Peaker Plants

The U.S. Energy Information Administration broadly describes a "peak-load plant" as "a plant usually housing old, low-efficiency steam units, gas turbines, diesels, or pumped-storage hydroelectric equipment normally used during peak-load periods".[7] The "peaking-load" category from EIA (2024) captures units with average capacity factors up to about 36%, with the upper bound driven by the oldest combined-cycle units (started operating in 1980–1998), without prescribing numeric standards. Other organizations apply various numerical thresholds: the U.S. Government Accountability Office (2024) defines peakers as fossil-fueled plants with capacity factors below 15% and at least 10 MW of nameplate capacity, while the Clean Energy Group (2022) applies a 20% cutoff with the same 10MW minimum.[8]

[7] https://www.eia.gov/tools/glossary/index.php?id=P#peak_load_plant

[8] U.S. Government Accountability Office (2024) reports that, of 999 peaker plant (including natural gas, coal, and oil with ≤15% capacity factor and ≥10MW nameplate capacity), 70% are fueled by natural gas, accounting for 83% of total net generation in 2021 (over 106 million MWh) and representing 80% of the sector's nameplate capacity (approximately 190,000 MW). See the same report for several alternative peaker definitions, such as capacity factors below 10% and no minimum nameplate capacity.

For this report, we limit our analysis to gas-fired plants because peaker-to-CCGT conversion involves adding a boiler, steam turbine, and water cooling infrastructure to existing gas turbines.[9] We adopt a more inclusive cutoff to account for diverse operating profiles: peaker plants are gas-fired plants with one or more simple-cycle gas turbines, a four-year average capacity factor below 35%, and a nameplate capacity of at least 10 MW, based on SNL Energy (S&P Global).[10] Given the forward-looking nature of the peaker-to-CCGT analysis, this report focuses on the currently operating gas-turbine units that are not scheduled to retire by the end of 2025. Plants lacking coordinate data, nameplate capacity, or capacity factor are excluded from the analysis.

3. Peaker Plants Overview

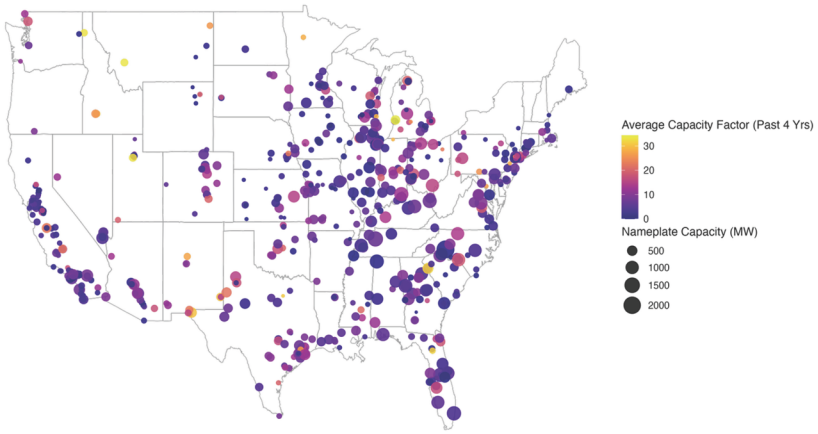
After filtering out plants with missing location, nameplate, or performance data, we identify 612 qualifying peaker plants across the U.S. ***Figure 1*** illustrates their regional distribution of peaker plants, with color representing the plant-level average capacity factor over the past four years and marker size proportional to nameplate capacity.[11] On average, peaker plants had 244 MW of nameplate capacity and a four-year average capacity factor of 6.7%.

[9] Our analyses focus on gas-fired power plants that include at least one simple-cycle gas turbine unit (filtered by generation type "Gas Turbine") and excludes plants composed solely of other technologies (e.g., combined-cycle, steam turbine, internal combustion). For plants with multiple turbine units, we applied this filter at the unit level and then aggregated all metrics back to the plant level.

[10] The "peaking-load" category from EIA (2024) captures units with average capacity factors up to about 36%, with the upper bound driven by the oldest combined-cycle units (started operating in 1980–1998) and lower bound driven by the single-cycle gas turbine (13%). Setting our cutoff at 35% allows us to capture the full range of simple-cycle turbines, including those with capacity factors approaching the 36% threshold. When fewer than four years of capacity-factor data exist, we average over the records available within that four-year window.

[11] Approximately 1% of peaker plants are located outside the contiguous United States (the U.S. mainland). These plants were included in all quantitative analyses but excluded from map visualizations.

Figure 1. *Peaker Plants by Nameplate Capacity and Capacity Fact*



4. Conversion Scenarios: Capacity and Energy Potential from Peaker-to-CCGT Conversion

Before introducing the peaker-to-CCGT conversion likelihood model, we first quantify the system-wide capacity potential under three distinct conversion scenarios: (1) a ***no-conversion baseline***, which reflects each plant's historical and projected generation profile based on four-year average capacity factors; (2) a ***2x1-only scenario***, in which all eligible turbine units located in the peaker plants are grouped into pairs of combustion turbines and a single steam turbine while unpaired turbines are modeled as simple cycle and left unconverted; and (3) a ***mixed 2x1 and 3x1 scenario***, assigning 3x1 blocks when five or more CTs are available to take advantage of efficiency gains and economies of scale.[12]

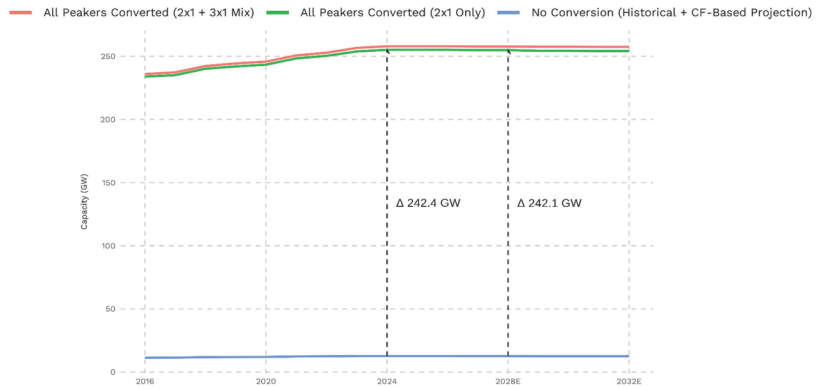
In the 2x1 configuration, the addition of a steam turbine increases capacity by approximately 50%, resulting in a combined-cycle block that delivers around 1.5 times the original combustion turbine nameplate capacity (Dubin 2019).[13] The mixed scenario, which applies a combination of 2x1 and 3x1 configurations, the 3x1 blocks are assumed to increase the capacity by 57%.

Figure 2 shows that, under the full conversion scenario, peakers could add up to 242 GW of new nameplate capacity to the U.S. grid by 2028. Assuming a typical combined-cycle utilization rate of 55%, this would yield around 133 GW of effective dispatchable capacity.

[12] For example, a five-unit site forms one 3x1 and one 2x1 block, while a four-unit site forms two 2x1 blocks.

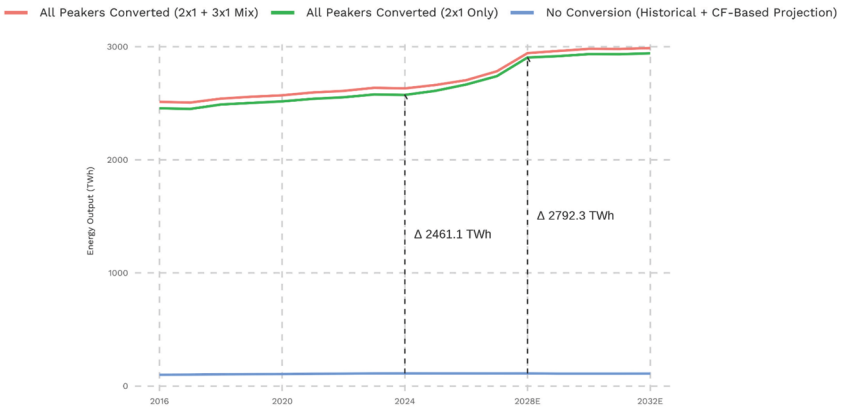
[13] In a 2x1 combined-cycle configuration, two combustion turbines (CTs) are paired with one steam turbine (ST) that generates additional power using waste heat from the CT exhaust. The steam turbine typically contributes additional output equivalent to approximately 50% of the total capacity of the two CTs combined. For example, if each CT has a nameplate capacity of 100 MW, the two CTs provide 200 MW, and the steam turbine would add roughly 100 MW, bringing the total output of the combined-cycle block to 300 MW. This results in a total capacity that is 1.5 times the original CT-only nameplate. Therefore, a 2x1 configuration increases the effective capacity of the plant by 50%, and the total combined-cycle block delivers 150% of the CT nameplate capacity.

Figure 2. *Projected Capacity Increases from Peaker Conversion Scenarios (GW)*



In terms of energy output, converting all eligible peakers to combined-cycle configurations could deliver up to 2,800 TWh of annual generation by 2028 (**Figure 3**). Applying the same 55% utilization rate, this translates to approximately 1,540 TWh of effective energy output: roughly 35% of current U.S. electricity consumption, and equivalent to the combined annual electricity use of California, Texas, Florida, and New York. Yet, as noted below, not all peakers will convert.

Figure 3. *Projected Energy Output Increases from Peaker Conversion Scenarios (TWh)*



5. Criteria of Peaker – CCTG Conversion Likelihood Model

Table 1 summarizes the four criteria used in the conversion framework along with their associated weights and data sources: policy and regulatory context, land availability, peaker vs. combined-cycle margin spread, and combustion turbine (CT) suitability. Each criterion is described in detail

in the sections that follow, including a discussion of the data sources noted in **Table 1** (see Appendix **Table A1** for specific weights and cutoffs).

Table 1. *Overview of Peaker - CCTG Conversion Criteria*

Criteria	Description	Go/No-go criteria	Weight	Data Source
Policy & Regulatory Context	State policy environment, attainment area, proximity to class I area	➤ Conversion feasible under current regulatory conditions	High	EPA, NPS/FWS/USFS, BEI
Land Availability	Unencumbered space for STG, HRSG, cooling, etc.	➤ Must be sufficient	Moderate	OSM
Peaker vs. CC Margin Spread	Economic case for conversion	➤ Wider = Stronger case	Moderate	SNL
CT Suitability	Class and number of CTs to enable efficient conversion	➤ F-Class+ and 3+ CTs preferred	Low	SNL

a. Policy & Regulatory Context:

This factor carries the highest weight in the screening process, reflecting the critical importance of external conditions in allowing conversion projects. We calculate the overall policy and regulatory context as a weighted combination of three factors: state-level policy support, proximity to Class I areas, and overlap with EPA nonattainment zones.

First, plants located in states with regulatory conditions supportive for peaker-to-CCGT conversion, including states that do not explicitly prohibit gas-fired generation upgrades (e.g., remain open to fossil-based capacity for reliability or efficiency improvements) are rated more highly. State-level permitting feasibility scores for conversion are based on from qualitative assessments developed by the USC Business of Energy Initiative (BEI). See **Table 2** for selected examples and Appendix **Table A3** for the complete list of states with their corresponding scores.

Table 2. *Selected States by Regulatory and Permitting Feasibility for Conversion*

State	Feasibility Tier Score	Comments
OH	Tier 5 (Supported with Coordination)	Supports gas, flexible regulation. Market structure favors efficiency.
TX	Tier 5 (Supported with Coordination)	Market-based economics drive asset optimization. No decarb pressure.
KY	Tier 5 (Supported with Coordination)	Despite lack of green policy, would support CCTG as an "efficiency improvement." Not opposed to more gas.
IN	Tier 4 (Mixed Regulatory Landscape)	Pro-gas, utility-friendly PSC (Public Service Commissions). Strong support for generation upgrades.

PA	Tier 4 (Mixed Regulatory Landscape)	One of the largest natural gas reserves (Marcellus Shale), policy-neutral but market makes it viable.
VA	Tier 3 (Conditional Pathway)	VCEA (Virginia Clean Economy Act) sets decarbonization targets by 2045, but Dominion may support CCTG for reliability.[14] State Corporate Commission (SCC) less predictable.[15]
MA/NJ/OR/WA	Tier 2 (Constrained by Policy Context)	Climate mandates discourage any new or upgraded fossil generation, even efficient. For example, Massachusetts targets net-zero emissions by 2050.
IL	Tier 1 (Limited Permitting Pathway)	CEJA (Climate and Equitable Jobs Act) restricts new fossil generation unless zero or near-zero emissions.
NY	Tier 1 (Limited Permitting Pathway)	CLCPA (Climate Leadership and Community Protection Act) targets phasing out fossil.
CA	Tier 0 (Prohibited or Unviable)	Actively closing gas plants. CCTG investment face major pushback.

Additional environmental constraints are considered through penalties based on air quality attainment status and proximity to federally protected Class I areas, which are subject to visibility protections under the Clean Air Act and often trigger stricter permitting requirements. Air quality nonattainment designations for pollutants such as ozone, $PM_{2.5}$, and SO_2 were collected from the U.S. Environmental Protection Agency's Green Book.[16] Class I area boundaries were compiled from geospatial shapefiles published by the National Park Service (NPS), U.S. Fish and Wildlife Service (FWS), and U.S. Forest Service (USFS).[17]

For each plant, we calculated the distance to the nearest Class I area and applied highest penalties for plants located within 100kms, with by lower penalties applied to those within 300km.[18] Similarly, we applied penalties for plants overlapping with any of the EPA nonattainment zones. These constraints serve as a "go/no-go" filter to deprioritize sites that are likely to face environmental opposition or permitting delays.

b. Land Availability

Land availability evaluates the physical feasibility of hosting the additional equipment required for CCGT conversion, such as steam turbines (STGs), heat recovery steam generators (HRSGs), and cooling infrastructure. For fast and large-scale screening, we implement buffer-based geospatial analysis using OpenStreetMap (OSM), subtracting

[14] https://virginiabusiness.com/dominion-files-for-scc-approval-of-chesterfield-gas-fired-plant
[15] https://www.newsfromthestates.com/article/scc-swallows-dominions-irp-and-serves-stakeholders-nothingburger
[16] https://www.epa.gov/green-book/green-book-gis-download
[17] https://www.nps.gov/subjects/air/class1.htm
[18] 100km and 300km buffers follow established air dispersion modeling practice. For example, the South Carolina Department of Environmental Services defines these buffered areas as Class I "impact areas" in model. Their air dispersion modeling is available at https://des.sc.gov/programs/bureau-air-quality/air-dispersion-modeling-overview.

encumbered features within a defined radius around each plant-level coordinate, weighted by siting requirements.[19] While there is no universal standard for buffer distances, we applied a conservative approach and assigned each plant with buffer radius based on the number of simple-cycle gas turbines present, reflecting the spatial requirements for steam cycle integration: 750 m for 1 turbine, 1000 m for 2, 1250 m for 3, 1500 m for 4, and 1750 m for 5 or more.

Within this area, we identify and exclude encumbered land, including buildings, power lines, water bodies, national parks, and public roads.[20] The remaining unencumbered land surrounding the plant-level coordinate is converted into acres and used to assign a land availability score.[21] We prioritize sites with at least 9 acres of unencumbered land, reflecting typical size of combined-cycle (CC) facility (around 10 acres).[22] Larger or more recent configurations may require significantly more space. For example, Florida's West County Energy Center, one of the largest natural gas plants in the U.S., occupies 220 acres for three CC units, according to Pennsylvania Independent Oil & Gas Association (PIOGA).[23]

c. Peaker vs. Combined Cycle Margin Spread

This dimension evaluates the economic value of converting to combined cycle by comparing current peaker spark spreads to those of a hypothetical CC configuration. Wider spreads indicate a stronger investment case. The analysis uses hub-level natural gas and power price (both historical records and projections), sourced from SNL Energy (S&P Global), along with plant-specific heat rates for the existing simple-cycle configuration.[24] Combined cycle margins are estimated using a fixed heat rate of 6,800 Btu/kWh, a conservative assumption relative to industry standards.[25]

Where hub-level power price projections are unavailable, spreads are imputed first from historical hub prices, and then from broader ISO-level averages if no historical hub prices were available. For the non-ISO regions (i.e., West and Southeast), we use the region-level

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[19] See **Table A2** for the comparison of land availability assessment methods. This report relies on geospatial analysis, with the highest data availability and the lowest complexity. While it has lower spatial precision than CAD or satellite-based methods, it allows scalable, nationwide screening using publicly available data source.

[20] Private roads directly adjacent to the plant-level coordinates are not treated as encumbrances and are assumed to be available for potential conversion.

[21] Approximately 6.5% of peaker plants lacked sufficient OpenStreetMap geospatial data to calculate a land availability score. For these cases, we imputed values using the average score of nearby peaker plants, with matches prioritized in the following order: same ZIP code and turbine count; same ZIP code with similar turbine count; same county and turbine count; and finally, same county with similar turbine count.

[22] https://www.energy.gov/sites/prod/files/2019/09/f66/Life%20Cycle%20Analysis%20of%20Natural%20Gas%20Extraction%20and%20Power%20Generation%2005_29_14%20NETL.pdf

[23] https://pioga.org/wp-content/uploads/2023/06/Just-the-Facts-Electric-Efficiency-Reliability.pdf

[24] For plant-specific heat rates, we used the most recent available data from 2016 to 2024, with most values drawn from 2023 or 2024. For about 3% of peaker plants lacking historical heat rate data, we imputed values using the average across all peaker units.

[25] This value is lower than commonly cited benchmarks from the U.S. EIA, including the national fleet average of 7,146 Btu/kWh (Chen and Morey 2022) and the 7,000 Btu/kWh standard often used in spark spread modeling (Kwon 2017), yet remains above the 5,300–6,400 Btu/kWh range achieved by advanced turbines such as the Siemens SGT6-9000HL and GE 7HA. This balance avoids overstating margin projections while capturing efficiency gains from modern CCGT technology. See https://www.gevernova.com/gas-power/products/gas-turbines/7ha for 7HA gas turbine from GE Vernova.

averages.[26] In cases where off-peak prices are not provided, they are estimated using a 0.7 ratio to on-peak prices based on historical norms.

Plants are matched to the nearest pricing hubs using plant-level coordinates. For plants located near a pricing hub without future price projections, we impute them by using projections from nearby hubs with similar historical pricing.

Annual 24/7 spark spreads are calculated using weighted averages of on- and off-peak spreads based on 80 peak hours and 88 off-peak hours per week. The difference between the hypothetical CCGT margin and the existing peaker margin (i.e., full conversion margin) reflects the economic potential of improved heat rate and increased capacity factor.

Plants with higher 24/7 CCGT margins are assigned a higher score, while those with lower or margins receive a lower score or are deprioritized. This factor carries a moderate weight in the final composite score, reflecting financially viability of conversion opportunities.

d. CT Suitability

The technical suitability of gas combustion turbines (CTs) is evaluated based on both technology class and unit count downloaded from SNL Energy (S&P Global).[27] F-Class and newer turbines are favored due to their thermal performance and compatibility with CC operation, while aero-derivatives are generally less suitable (see Appendix **Table A4** for example of turbine model and manufacturers). Plants with three or more CTs are also scored higher, as they allow for efficient pairing with one or two steam turbines. Though this factor is weighted lower overall, it remains essential in determining feasibility and conversion potential.

6. Peaker Plants by Conversion Tier and Planned Data Centers

Based on our screening framework, we classify 30% of U.S. peaker plants (185 plants) as having high potential for combined-cycle conversion, approximately 11% (70 plants) as moderate potential, and the remaining 58% (357 plants) as low potential **(Figure 3)**.

If all high- and moderate-potential sites were converted by 2028, they could collectively add over 134 GW of new nameplate capacity. Assuming a typical combined-cycle utilization rate of 55%, this would yield approximately 74 GW of effective dispatchable capacity.[28] High-potential sites alone account for more than 98 GW of capacity, which would translate to about 54 GW of dispatchable capacity under the same utilization assumptions.

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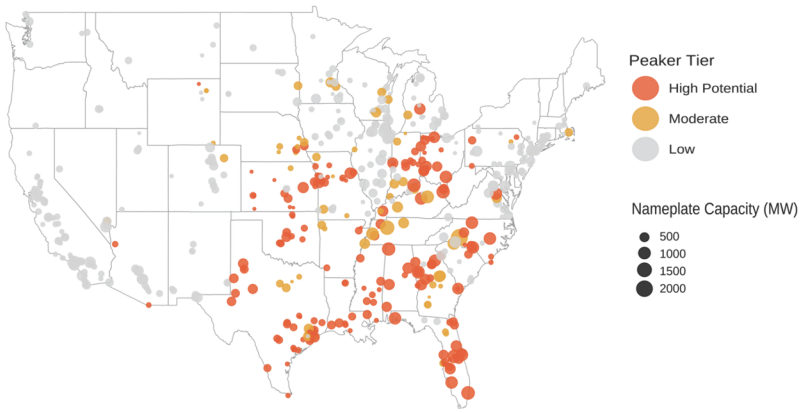
[26] SNL Energy reports power prices and projections for two non-RTO regions (i.e., the West and the Southeast) which include several power hubs. For example, power hubs in the Southeast region include Entergy, Florida Reliability Coordinating Council, Florida-Georgia Border, and Into Southern.

[27] Among peaker plants, about 33% lack information on gas turbine type. We note that older and smaller turbine units were more likely to have no information. For example, units without turbine information went into service in 1987 on average (versus 2003 for those with turbine data) and have a unit-level nameplate capacity of 58 MW (compared to 87 MW). To retain these observations in our screening model, we imputed any missing turbine-class scores using the median turbine score of units in the same vintage-and-capacity cohort.

[28] 55% capacity factor aligns with average CCGT capacity factors in EIA historical data, available at https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_a.

Table 3. *Peaker Plants by Conversion Tier*

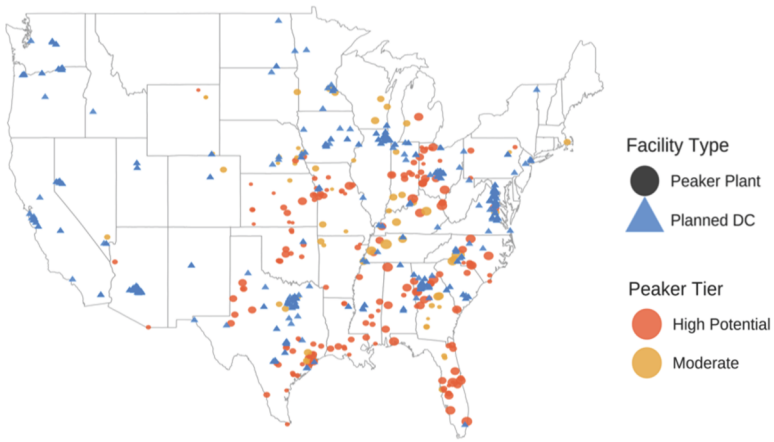


Planned data centers (i.e., pre-operational facilities) with expected build years through Q4 2030 are projected to require over 55 GW of confirmed capacity disclosed to date (equivalent to 480 TWh of nameplate energy demand).[29] These estimates are based on facility-level data compiled by 451 Research (S&P Global, as of Q4 2024). Of over 970 total planned data centers, around 750 report a disclosed build year of 2025–2030 and disclose a non-zero utility load. While projects lacking load data or build year are excluded from capacity estimates, their locations are still included in geographic analysis in the **Figure 4**.

High-potential peaker plants for combined-cycle conversion are geographically concentrated in states that also overlap with significant share (26%) of planned data center counts, such as Texas, Georgia, and Ohio. Virginia, while accounting for over a quarter of planned data centers, has most of its peaker plants categorized as low potential, similar to with Arizona, Illinois, and California.[30] On the other hand, Florida and Kansas are among the few states with a substantial number of high potential peaker plants but have relatively less data center development planned. Although their locations do not overlap perfectly, the aggregate conversion potential of high and moderate-tier peaker plants appear to provide more than enough energy to satisfy the energy demand of planned data centers through 2030.

[29] We define planned data centers as pre-operational facilities at various stages of development, including those with secured land, formally announced, and those currently under construction (as of Q4 2024), based on facility-level data from 451 Research (S&P Global).
[30] Three states together account for around 20% of planned development.

Figure 4. *Conversion-feasible Peaker Plants and Planned Data Centers*



7. Key Challenges for New CCGT Builds and Implication for CCGT Conversion

Interconnection Queue

One of the most significant challenges facing new CCGT projects is the growing backlog in regional interconnection queues. As of 2024, the average wait time from queue entry to proposed online date ranges from approximately 38 months in PJM to over 70 months in regions like SPP, posing a major hurdle for timely project deployment (Wilson and Lenoir 2024).

To address urgent capacity needs for data centers and other critical loads, many RTOs/ISOs are experimenting with fast-track process, efforts that can benefit any shovel-ready resource, including conversion projects. PJM's Reliability Resource Initiative (RRI) is the most prominent example: a "one-time opportunity for shovel-ready resources that have short lead times to construction and operation and can most effectively contribute to reliability" (PJM Inside Lines 2025b). PJM has announced to fast track 51 projects (9,300 MW) in total, which consist of 39 uprates and 12 new constructions. Among the new builds, combined-cycle gas projects account for about 66 percent of the capacity, and the majority of the twelve selected projects. This highlights the importance of efficiency-driven CCGT capacity in meeting near-term load growth and grid reliability.

While some grid operators have begun implementing fast-tracking mechanisms (PJM Inside Lines 2025a) and piloting AI-based tools (Porat 2025) to accelerate queue processing, most others still rely heavily on third-party consultants, many of whom face staffing shortages and high demand (Gramlich et al. 2021). These delays are pronounced in areas with strong conversion potential, further limiting the short-term feasibility of peaker conversions. Addressing this gap requires reconsidering the extension of similar fast-track processes and streamlined restudy procedures to peaker conversions.

Supply Chain Bottleneck

Critical equipment for new CCGTs such as high-voltage transformers carries lead times of about two years (longer for 230 kV+ units), while new gas turbines average 3 to 3.5 years (Jacobs et al. 2024; Cobb 2025). Steam turbines for CCGT configurations have shorter waits, but overall procurement timelines remain a major barrier to rapid capacity addition. In contrast, peaker-to-CCGT conversions can bypass these bottlenecks by reusing existing gas turbines and interconnection infrastructure. While transformer supply chain constraints remain relevant, conversions can proceed significantly faster than new builds.

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Appendix

Table A1. *Summary of Scoring Framework for Peaker-to-CCGT Conversion Potential*

Criteria	Scoring / Cutoff	Weight
Policy & Regulatory Context	**RegScore (-6 to 3) =** (State Feasibility) + (Class I Penalty) + (Attainment Zone Status) • ***State Permitting Feasibility:*** Scored from -2 to 3, where -2 indicates the most supportive regulatory environment for conversion and 3 the least (see Table A3 for full list). • ***Class I area penalty:*** *-2* if located within 100 km of a Class I protected area; -1 if within 300 km; 0 otherwise. • ***Attainment zone penalty:*** -2 if the plant overlaps with *any* EPA-designated nonattainment area; 0 otherwise.	2.5 (High)
Land Availability	**AreaScore (1–3):** When the unencumbered area is less than 9 acres = 0; over 9 and below 100 acres =1; over 100 acres = 2	2 (Moderate)
Peaker vs. CC Margin Spread	**SpreadScore (1–3):** Plant's 24/7 load-spread metric binned into tertiles	1.8 (Moderate)
CT (Combustion Turbine) Suitability	**TurbineScore (1–3)** = (Mean Turbine Class Score) × 0.7 + (Number of CTs Category) × 0.3 • ***Mean Turbine Class Score:*** Scored from 1 to 3, based on the plant-level average of turbine class ratings: 1 if <5; 2 if 5–<10; 3 if ≥10. Individual turbines are scored as 2 (aeroderivative/legacy), 5 (E-Class/Frame), or 10 (F-Class and newer). See Table A4 for examples. • ***Number of CTs Category:*** *Reflects the number of simple cycle gas turbines at the plant.* 1 if 1 CT, 2 if 2 CTs, 3 if 3 or more CTs.	1.6 (Low)
Composite Score		
2.5 × RegScore + 2 × AreaScore + 1.8 × SpreadScore + 1.6 × TurbineScore		
Conversion Tier		
High Potential: Composite Score 13.3 or higher ***Moderate Potential***: Composite Score between 11.5 and 13.3 ***Low Potential***: Composite Score < 11.5		

Table A2. *Comparison of Land Availability Assessment Methods*

Method	Data Availability	Accuracy	Complexity	Notes
Computer-Aided Design (CAD)-Based Analysis	Low	High	High	Most accurate; used in engineering-grade site assessments; however, CAD files for power plants are often not readily accessible
Satellite Imagery	Medium	Medium	Medium	Good for visual obstruction mapping; automation may require machine learning
Geospatial Analysis	**High**	**Medium**	**Low**	**Scalable method that leverages public geospatial and satellite-informed data; suitable for large-scale screening**

Table A3. *Peaker Conversion Feasibility Tiers by State*

States in bold indicate 10 or more planned data centers (with expected build years through Q4 2030; as of Q4 2024).

Category (Conversion Feasibility Tier Score)	**State Abbreviations**	**Comment**
Streamlined Pathway (Tier 6)	AL, LA, **MS**, OK, WV	Offer robust incentives, minimal regulatory barriers, and active utility partnerships, making conversion highly feasible.
Supported with Coordination (Tier 5)	AR, PR, FL, **GA**, KY, **OH**, **TX**, WY	Supportive markets with cooperative regulators; conversion viable with stakeholder outreach and alignment with local energy goals.
Mixed Regulatory Landscape (Tier 4)	AK, **AZ**, **IN**, KS, MO, MT, NE, **NC**, ND, NM, **PA**, **SC**, TN, UT	Mixed policy signals require targeted engagement, detailed analysis, and early stakeholder consultation for conversion feasibility.
Constrained by Policy Context (Tier 2-3)	CO, DE, ID, IA, MI, **MN**, **NV**, SD, **VA**, WI, CT, MA, MD, ME, NH, NJ, **OR**, RI	Limited support due to high permitting costs, small market size, or competing clean energy mandates; conversions may face significant hurdles.
Limited Permitting Pathway (Tier 0-1)	**CA**, DC, HI, **IL**, NY, VT, **WA**	Prohibited or strongly discouraged by stringent clean energy laws (e.g., CLCPA, CEJA, state renewables mandates) and active plant closures.

Table A4. *Gas Turbine Class and Examples*

Turbine Class Score	Class Description	Example Turbine Types and Manufacturers
10	F-Class and Newer (H-Class)	7F (GE), 7H (GE), 301G (Westinghouse Electric Company), 501F (Siemens), SGT6-4000F/5000F/9000HL (Siemens), Other F-class turbines (Siemens)
5	E-Class / Frame Turbines	7E (GE), 6B (GE)
2	Aeroderivative / Legacy / Small-scale	LM6000 (GE), LMS100 (GE), FT 8 (Pratt & Witney), Trent 60 (Rolls-Royce), Taurus 70 and 60/Mercury 50 (Solar Turbines Inc)

From: Black Flare <comms@blkfla.re>
Sent: Monday, August 4, 2025 2:42 PM
To: fortherecord (Energy) <fortherecord_@energy.senate.gov>
Subject: FOR THE RECORD – July 23 2025 Hearing: "Identifying Challenges to Meeting Increased Electricity Demand"

Senator Lee, Ranking Member Heinrich, and Members of the Committee:

BlackFlare converts stranded flare gas into on-site power for NVIDIA-class AI-compute pods, destroying **> 98% of methane** at the source. Each 1 MW pod eliminates roughly **19 000 t** CO_2-equivalent per year—equivalent to removing **4 100** gasoline cars—while creating six skilled jobs in energy communities.

To maximize grid reliability while curbing super-pollutant methane, we respectfully urge the Committee to:

1. Ensure DOE's forthcoming Methane Mitigation FOA explicitly covers flare-to-power projects that also supply high-density compute.
2. Coordinate with PHMSA so operators can connect modular flare-capture units without right-of-way delays.
3. Clarify that verified methane destruction under such projects qualifies for IRA §48C advanced-energy investment credits.

Flare-to-compute solutions simultaneously quell a potent greenhouse gas and build U.S. sovereign AI infrastructure—exactly the kind of dual-benefit investment that meets rising electricity demand while strengthening energy security.

Thank you for including these comments in the official record of the **July 23 2025** full-committee hearing, "Identifying Challenges to Meeting Increased Electricity Demand."

Respectfully,

Thomas McLaughlin
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Boyertown, PA 19512
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