Niskanen Center

Testimony of

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for the United States Senate Energy and Natural Resources Committee Hearing:

“State of the Bulk Power System”

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Chair Lee, Ranking Member Heinrich, and distinguished members of the Committee, thank you for inviting me to testify on the critical issue of the state of the bulk power system. My name is Liza Reed, and I am the Director for Climate and Energy Policy at the Niskanen Center, a non-partisan think tank founded in 2015. The Niskanen Center has, for 10 years, operated on a central philosophy that market-based policy tools are essential to ensuring a reliable and affordable domestic energy supply.

The topic of today's hearing is one I have worked on for the last decade, starting with my dissertation research at Carnegie Mellon University, where I evaluated technical, economic, and regulatory barriers to adopting more high-voltage direct current transmission technology into our system. As Director of Climate and Energy Policy, I lead a team that researches and educates on the policies needed to build a dominant energy system. Such a system will need to integrate a diverse set of generation resources with a strong transmission backbone to move power across the country, keeping prices low for consumers and enabling growth across industries.

Where does transmission fit into our energy system?

My testimony today will focus on the role of electricity transmission, the wires of the bulk power system. The high-voltage lines of the bulk power system serve two primary roles: one is to move power from where it is generated to the cities and counties where it is consumed. It is the distribution system that then brings it all the way down to the house or retail level. The second role that transmission serves is to move power between regions to ensure reliability, strengthen our resilience to changing weather patterns, and ensure affordable energy is available across the country.

Expanding our bulk power system with more high-capacity interregional transmission is an essential part of any solution for growth, affordability, and American competitiveness. Energy consumption is strongly correlated with GDP growth, and increased access to electricity improves everything from productivity to health outcomes. The electricity grid is a strategic asset. The National Academies identified it as the greatest engineering achievement of the 20th century.[1] We cannot squander that in the 21st century by pitting it against other power solutions when, in fact, transmission supports all forms of generation, and all power solutions are necessary for the next stage of growth.

We need more energy and transmission to move that energy.

An important reason to upgrade transmission is its nexus with interconnection. Planning reforms, automation, and islanding certain types of loads can all help, but the quality of the grid infrastructure determines what we can ask of the system. Recognizing this relationship, FERC just approved a merger of the interconnection and transmission planning processes in the Southwest Power Pool, which Commissioner David Rosner called "one of the most innovative, common-sense proposals presented to [FERC] since the inception of open access transmission service."[2]

Interconnecting generation depends on a transmission system that can move the power around the region. PJM approved a process in 2025 to ensure dispatchable projects had their interconnection agreements in hand quickly, allowing them to move ahead of other projects that were in the queue. But the projects that came out of PJM's expedited process still needed billions of dollars of grid upgrades, with one upgrade projected to take up to 7 years to complete.[3]

The same concerns apply to load. A shortage of grid capacity is the primary barrier to the cost-effective and swift deployment of AI in this country. The data center infrastructure can go anywhere it can get power–it does not have to be here in the U.S. In fact, it won't be if we cannot update our regulatory systems to build the bulk power lines we need for a dominant grid.

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[1] W.A. Wulf, *The Bridge,* National Academy of Engineering, https://www.nae.edu/File.aspx?id=7327&v=e3a8f2e0, at 6

[2] D. Rosner, *Commissioner Rosner's Concurrence in Southwest Power Pool, Inc.*, Federal Energy Regulatory Commission, https://www.ferc.gov/news-events/news/commissioner-rosners-concurrence-southwest-power-pool-inc

[3] *Comment and Motion to Intervene of Josh Shapiro, Governor of the Commonwealth of Pennsylvania to FERC*, ER26-1556-000, 20260320-5293, (March 20, 2026). https://elibrary.ferc.gov/eLibrary/filedownload?fileid=197E92AD-F253-CDB1-9132-9D0CB1000000. At footnote 15.

This committee heard sobering stats from Rob Gramlich of Grid Strategies last year: "In the 2020s, China has completed more than 8,200 miles of ultra-high voltage lines while the U.S. has built only 375 miles. European utilities are rapidly increasing the transfer capacity between countries to move power back and forth."[4] Competitors are preparing for the future, and we will get left behind if we do not do the same.

To meet the projected load growth, Niskanen estimates that by 2030, the total capacity of peak-capable energy sources in development will reach about 118 gigawatts (GW).[5] This includes approximately 37 GW from gas and nuclear, 26 GW from wind and solar during peak times, and 55 GW from storage and hybrid resources. Because each of these resources has different availability patterns, fuel constraints, and failure modes, scaling any single source alone would leave the system exposed to correlated outages or performance shortfalls during extreme conditions.

Grid planners evaluate these risks using real-world stress events. Winter Storm Fern offers a concrete example of that complementarity. During the storm, all major resource types experienced some level of stress or underperformance in at least one region.[6] At the same time, each resource made important contributions to keeping the system operating: gas, coal, nuclear, renewables, and storage all supplied significant power when it was most needed. In most areas, wind exceeded expectations, helping reduce peak demand for other resources, while in others, thermal generation provided steady output. Not one resource is sufficient on its own. Reliability depends on how these resources work together. Transmission enables the system to draw on complementary strengths across regions.

Relying too heavily on any single fuel source creates both reliability and economic risks, since each fuel source faces its own weather-related operational concerns and supply problems. As shown in **Figure 1,** data from the U.S. Energy Information Administration reveal that 22 of the 48 contiguous states rely on a single energy source for 50 percent or more of their electricity mix in 2025, often leading to mismatches between energy supply and demand.[7] High-capacity,

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[4] R. Gramlich, *Challenges to Meeting Electricity Demand*, testimony before the Senate Committee on Energy and Natural Resources, July 23, 2025, https://www.energy.senate.gov/services/files/AF68ACFA-8FD9-4611-A936-76F4418E0C7C, at 4.

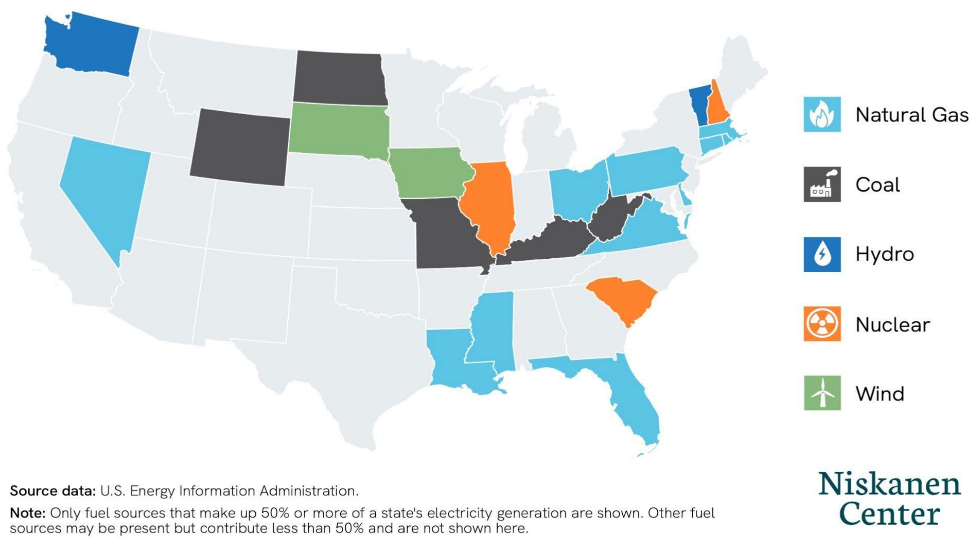
[5] K. Sercy and L. Reed, *The arithmetic of availability: Prospects for American grid dominance in 2030*, https://www.niskanencenter.org/the-arithmetic-of-availability-prospects-for-american-grid-dominance-in-2030/

[6] R. Levine and M. Goggin, *Winter Storm Fern's impact on the price of power, and what to do about it*, https://www.niskanencenter.org/winter-storm-ferns-impact-on-the-price-of-power-and-what-to-do-about-it/.

[7] Adapted from R. Allen and R. Levine, *Unlocking HVDC: How Congress Can Enable a More Resilient Grid*, https://www.niskanencenter.org/how-congress-can-enable-a-more-resilient-grid/, Niskanen Center, 2025, at 4. Data from U.S. Energy Information Administration (EIA), Electric Power Operational Data, https://www.eia.gov/opendata/browser/electricity/electric-power-operational-data?frequency=annual&data=generation;&start=2025&end=2025&sortColumn=period;&sortDirection=desc;.

interregional transmission would allow these states to diversify their portfolios. Transmission is one of the best tools we have for managing that risk by connecting regions with different generation mixes and weather patterns, drawing from a broader, more diverse supply base.

Figure 1: For 22 states, over 50% of power generated is from a single fuel source



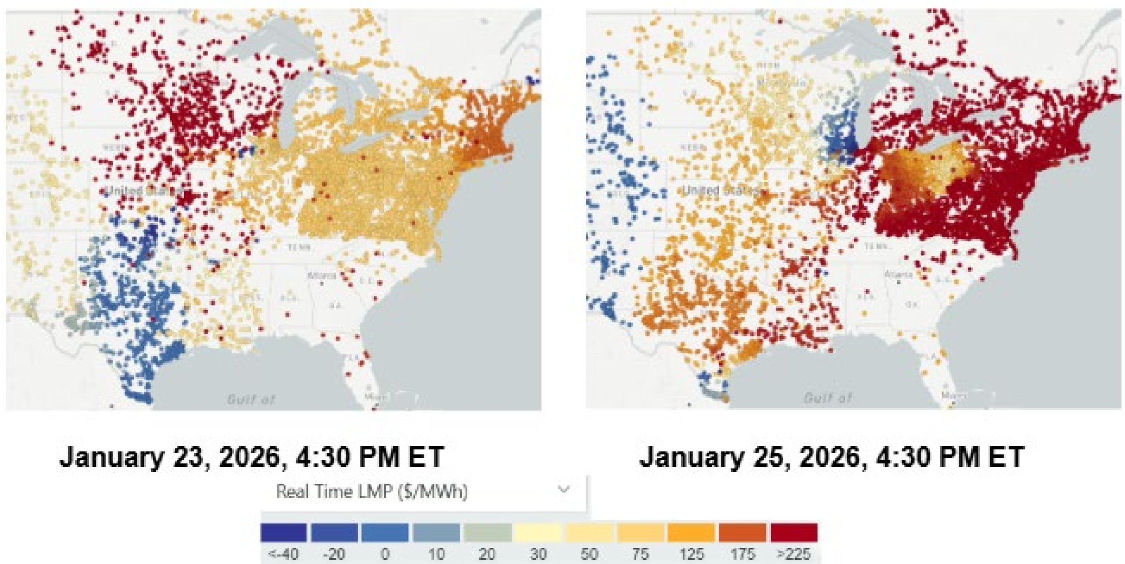
We need to connect electric regions.

At the highest level, we have three distinct grids, between which there is very little power transfer. These are the Eastern Interconnection, the Western Interconnection, and the Electric Reliability Council of Texas (ERCOT). Within the eastern and western interconnection, there is further distinction into planning regions and then individual utility footprints. These planning regions are important because they are the areas where groups of utilities have come together and agreed to co-plan their transmission systems and coordinate their operations. These were established to support reliability, but have also helped improve energy affordability by sharing power within the region. The Midcontinent Independent System Operator (MISO) and the Southwest Power Pool (SPP) have each undertaken regionwide transmission planning that provided double or more the benefits to consumers in reduced costs compared to the cost of the projects.

Recent weather events illustrate that there's still a lot of money left on the table, particularly between regions, and that cost is borne directly by consumers who have to pay more for energy. During winter storm Fern, locational marginal pricing (LMP) for power changed significantly by day and region as the storm moved across the country, as shown in **Figure 2.** Transmission connecting these regions would have reduced these differences, saving consumers money.

Severe weather tends to be geographically concentrated and shift over time. If one region is facing a power shortage and, therefore, higher prices, interregional transmission would allow the system to draw from a neighboring region experiencing a surplus. In addition to lower pricing, this also limits the need for every region to overbuild local generation capacity for outlier events.

Figure 2: Power prices during Winter Storm Fern changed significantly by region and day



It is essential to identify and remove the barriers that create these power price divisions and enable the energy arbitrage that captures that value and delivers it back to consumers' pocketbooks. The regulatory processes in place favor incumbent utilities and local solutions over interregional projects and a broader universe of developers.

Interregional transmission is essential to electricity affordability.

Due to lack of interregional transmission, energy is left on the table. During Winter Storm Fern, the solar and wind generation curtailed in SPP could have saved MISO consumers nearly $37 million if there were enough transmission to deliver it.[8]

[8] M. Goggin, *Winter Storm Fern Lessons: Supplying Reliable Power to Meet Peak Demand*, testimony before the House Committee on Energy and Commerce, March 17, 2026, Grid Strategies, https://d1dth6e84htgma.cloudfront.net/03_17_2026_ENG_Testimony_Goggin_9c06568654.pdf, at 8.

Figure 3: Expanding transmission ties by 1 GW between neighboring grid operators could have captured up to $183 Million in value[9]

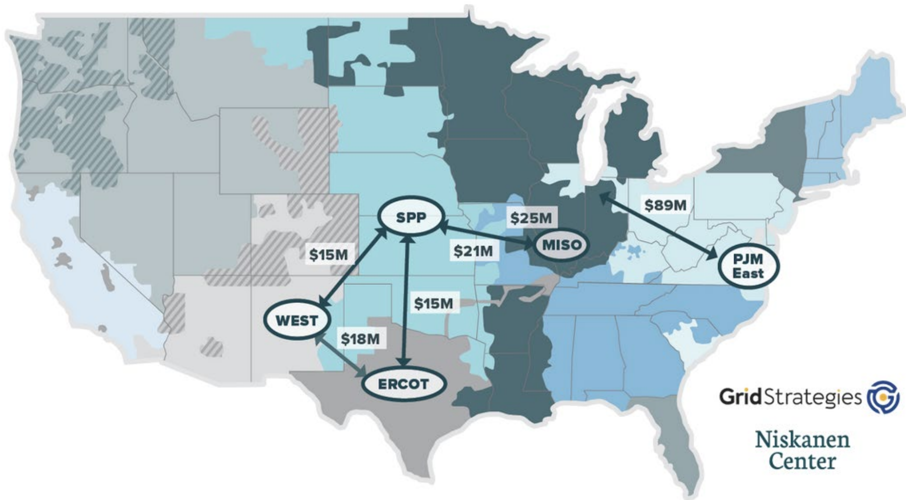


Figure 3 shows the value that expanded interregional transmission could have brought across grid regions. If transmission ties had been expanded by 1 GW between regions, comparable to one new transmission line, ratepayers would have seen up to $183 million in value between January 23 and February 3, 2026.[10]

The lessons aren't singular to Winter Storm Fern. Analysis by Grid Strategies after Winter Storm Elliott found that a single 1 GW transmission line between ERCOT and TVA would have provided nearly $95 million in value during that five-day event.[11] After Winter Storm Uri, Grid Strategies' analysis found that a 1 GW transmission line between ERCOT and the Southeast could have saved Texas consumers nearly $1 billion.[12] A nation-wide historical analysis by Lawrence Berkley National Lab (LBNL) assessed the price differences from 2012 to 2022 and

[9] Id.

[10] R. Levine and M. Goggin, *Winter Storm Fern's impact on the price of power, and what to do about it,* Niskanen Center, https://www.niskanencenter.org/winter-storm-ferns-impact-on-the-price-of-power-and-what-to-do-about-it/

[11] ACORE, *The Value of Transmission During Winter Storm Elliot,* https://acore.org/wp-content/uploads/2023/02/ACORE-The-Value-of-Transmission-During-Winter-Storm-Elliott.pdf, at 2.

[12] M. Goggin and J. Schneider, *The One-Year Anniversary of Winter Storm Uri*, GridStrategies, https://gridstrategiesllc.com/wp-content/uploads/the-one-year-anniversary-of-winter-storm-uri-lessons-learned-and-the-continued-need-for-large-scale-transmission.pdf, at 8

found that “additional transfer capacity between regions would have been especially valuable, with a median value of $116 million per GW per year.”[13]

These statistics are not outliers; they are trends, and we are not on track to fix this problem.

Interregional transmission improves reliability.

In the Fiscal Responsibility Act of 2023, Congress directed the North American Electricity Reliability Corporation (NERC) to assess the current interregional transfer capability and recommend “prudent additions …that would demonstrably strengthen reliability.”[14] NERC’s report, published in 2025, defined a prudent addition as one that meets three criteria: strengthens reliability, serves load under extreme conditions, and does not create unintended reliability concerns.[15]

The report found that U.S. interregional transfer capability is about 84 GW. This capability is not only limited but highly uneven across pairs of regions and even seasonally. According to NERC’s assessment, the U.S. grid needs 35 GW of additional transfer capability for reliability, which is roughly a 40 percent increase over the 84 GW baseline. NERC notes that some of this need may be met by projects already in planning, permitting, or construction, but the gap remains large enough to warrant deliberate policy attention. As noted in Niskanen’s comments to FERC,

> [U]nlike in the past decade, the U.S. is no longer experiencing steady load growth. In 2023, the Lawrence Berkeley National Lab (LBNL)…projected that [data center] load would triple to 12% [of nationwide consumption] by 2028–surpassing the Department of Defense, currently the largest electricity consumer in the U.S.[16, 17] As a result, the transfer capacity values calculated in the [NERC Interegional Transfer Capability Study (ITCS)] are already outdated and will become increasingly obsolete as data center demand surges toward 2030.

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[13] J. Mulvaney Kemp *et al.*, *Electric transmission value and its drivers in United States power markets*, Lawrence Berkeley National Laboratory, https://www.nature.com/articles/s41467-025-63143-5, at 1

[14] Fiscal Responsibility Act of 2023, Pub. L. No. 118-5, § 322, 137 Stat. 10 (2023), https://www.congress.gov/bill/118th-congress/house-bill/3746/text.

[15] NERC, *Interregional Transfer Capability Study (ITCS) Final Report*, https://www.nerc.com/globalassets/initiatives/itcs/itcs_final_report.pdf, at xiv

[16] *Id.*, at 52

[17] U.S. Department of Defense, *Annual Energy Performance, Resilience, and Readiness Report, FY2023*. https://www.acq.osd.mil/eie/ero/ier/docs/aeprr/FY23-AEPRR-Report.pdf, at 1; U.S. Department of Energy, *Total Site-Delivered Energy Use in All End-Use Sectors by Federal Agency (FY2023)*, https://ctsedwweb.ee.doe.gov/Annual/Report/TotalSiteDeliveredEnergyUseInAllEndUseSectorsByFederalAgencyBillionBtu.aspx

Winter storms are further instructive of why interregional transmission supports reliability. Winter Storm Uri (2021) primarily affected Texas and the central United States, including the ERCOT, SPP, and MISO regions. During the event, ERCOT experienced outages across all major fuel types, averaging approximately 34,000 MW over two consecutive days, nearly half of its winter peak load.[18] The storm and associated power outages contributed to 246 deaths in Texas alone.[19] Meanwhile, ERCOT was only able to import approximately 800 MW from SPP during the week of the cold snap. By contrast, MISO, which maintained stronger interregional connections, was able to import roughly 13,000 MW at peak, approximately 15 times as much as ERCOT.[20] The contrast between these regions shows that when outages occur across multiple resource types simultaneously, the ability to rely on neighboring regions can be the difference between keeping the lights on and widespread blackouts.

Winter Storm Elliott (2022) illustrates how transmission constraints can prevent the system from responding even when resources are available elsewhere. The storm affected a broad portion of the Eastern Interconnection, including PJM, MISO, SPP, and the Southeast. During the event, widespread outages of thermal generation, particularly gas plants affected by fuel supply disruptions, coincided with strong renewable output in parts of the Midwest. On Christmas Eve morning, wind plants in western MISO appear to have been forced to curtail their output while neighboring TVA was experiencing rolling blackouts, with power prices slightly negative in western MISO and exceeding $8,000/MWh in TVA territory at the same time.[21]

Winter Storm Fern (2026) reinforces this pattern under more recent system conditions. The significant regional price differences indicate that transfer limitations again constrained the system's ability to move surplus power to where it was needed. As with Uri and Elliott, Fern demonstrates that as the load grows and system conditions evolve, the ability to share resources across regions becomes increasingly important for maintaining reliability.[22]

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[18] M. Goggins and J. Schneider, *The One-Year Anniversary of Winter Storm Uri*, GridStrategies, https://gridstrategiesllc.com/wp-content/uploads/the-one-year-anniversary-of-winter-storm-uri-lessons-learned-and-the-continued-need-for-large-scale-transmission.pdf, at 3

[19] P. Svitek, *Texas puts final estimate of winter storm death toll at 246*, Texas Tribune, https://www.texastribune.org/2022/01/02/texas-winter-storm-final-death-toll-246/

[20] M. Goggins and J. Schneider, *The One-Year Anniversary of Winter Storm Uri*, GridStrategies, https://gridstrategiesllc.com/wp-content/uploads/the-one-year-anniversary-of-winter-storm-uri-lessons-learned-and-the-continued-need-for-large-scale-transmission.pdf, at 4

[21] ACORE, *The Value of Transmission During Winter Storm Elliot*, https://acore.org/wp-content/uploads/2023/02/ACORE-The-Value-of-Transmission-During-Winter-Storm-Elliott.pdf, at 2

[22] R. Levine and M. Goggin, *Winter Storm Fern's impact on the price of power, and what to do about it*, Niskanen Center, https://www.niskanencenter.org/winter-storm-ferns-impact-on-the-price-of-power-and-what-to-do-about-it/

What are the barriers to the transmission we need?

Interregional transmission lines are in the national public interest, yet they face much higher, often insurmountable, siting and permitting barriers than other energy infrastructure.[23] While transmission lines offer clear regional and national economic and reliability benefits, the authority to approve them rests largely with individual states or, in some cases, individual counties. A regional or interregional transmission line crossing multiple states must satisfy each state's siting process. As a practical matter, this means the slowest state determines when construction can begin. Of the five transmission projects in process at the time of a 2016 Lawrence Berkeley National Lab review, scheduled for completion by 2020, only one had been completed as of 2021, and that was a single-state project.[24] The significant interregional benefits that transmission could yield are unlikely to be realized under a system designed around local decision-making.

Existing market structures also create unnecessary barriers to new transmission technologies, particularly high-voltage direct current technology. High Voltage Direct Current (HVDC) lines are a transmission solution that can provide both ancillary support, which helps maintain grid balance, and capacity services, which ensure sufficient supply to meet future demand.[25] However, current RTO and ISO regulations do not allow HVDC operators to be compensated for these services, even though grid operators have markets in place to pay generators and other participants for the same functions. Allowing HVDC to compete on its merits to qualify for these payments would improve system reliability and strengthen the economic case for developers to build.

Regulatory structures have also been used to shield incumbent utilities from transmission competition. Over a decade ago, FERC removed the federal "right of first refusal" (ROFR) for regionally-planned, cost-allocated transmission projects in an effort to expand competition. Since then, roughly a dozen states have enacted their own laws,[26] granting incumbent utilities priority rights to build new transmission within their service territories, even when competitive

[23] L. Reed, *Transmission stalled: siting challenges for interregional transmission*, Niskanen Center, https://www.niskanencenter.org/transmission-stalled-siting-challenges-for-interregional-transmission/

[24] J. Eto, *Building Electric Transmission Lines: A Review of Recent Transmission Projects*, Lawrence Berkeley National Laboratory, https://emp.lbl.gov/publications/building-electric-transmission-lines

[25] R. Allen and R. Levine, *Unlocking HVDC: How Congress Can Enable a More Resilient Grid*, Niskanen Center, https://www.niskanencenter.org/wp-content/uploads/2025/07/Unlocking-HVDC-How-Congress-can-enable-a-more-resilient-grid-FINAL.pdf, at 7

[26] R. Levine, Z. Norris, and G. Olsen, *ROFR laws fragment America's transmission grid*, Niskanen Center, https://www.niskanencenter.org/rofr-laws-fragment-americas-transmission-grid/

bidding could reduce project costs by 20 to 30 percent.[27] These laws suppress competition in wholesale electricity markets because fewer transmission lines mean less ability to move power across regions, thereby concentrating market power among local generators.

What can Congress do?

The lesson from winter storms is clear: no type of generation is immune to severe weather. The geographic footprint of risk shifts from event to event, and the resources most affected change with each storm. Under these conditions, reliability depends not on any single fuel or technology, but on access to resources outside the most affected areas. Interregional transmission provides access by allowing system operators to draw on a broader and more diverse pool of supply, reducing the impact of localized disruptions and improving overall system resilience.

Some grid operators have undertaken regional buildouts that provided affordability and reliability benefits to consumers, but there is a dearth of interregional transmission. NERC's recent report highlights the gap and recommends a significant increase in interregional transmission as a prudent approach to strengthening reliability. The issue is that we lack mechanisms to spur that development, and, in fact, we have specific regulations that deter it.

Congress can change this with legislation that lets markets work. A clear, narrow Federal siting authority for high-capacity interstate transmission lines would cut through state-by-state red tape and incumbent biases, opening the energy markets to more competition. Further, Congress can explicitly support interregional transmission development through planning or capacity requirements. NERC's analysis indicated a significant need for reliability, and many studies have demonstrated the economic value. Planning or capacity requirements are far from risking an overbuild in transmission: analyses by industry and non-industry groups agree that there is plenty of room for growth. Congress can direct FERC to address technology biases that prevent high-voltage direct current lines from receiving compensation for the reliability benefits they can provide, and similarly support grid flexibility solutions that recognize the value data centers bring to the economy and the grid.

These policies will deliver a grid that grows the economy, that provides affordable energy, and that demonstrates America's competitive edge. The next industry can be built anywhere there are electrons; let's make sure it's right here in the U.S.

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[27] J.P. Pfeifenberger *et al.*, *Cost Savings Offered by Competition in Electric Transmission*, The Brattle Group, https://www.brattle.com/wp-content/uploads/2021/05/16726_cost_savings_offered_by_competition_in_electric_transmission.pdf, at 1