

# Expanding transmission infrastructure to achieve low-cost, reliable, and abundant energy



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Cover: HVDC towers in New Jersey.  
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March 2026

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### Acknowledgments

The authors would like to thank the Fletcher Foundation for supporting this project. They also thank Kate Burnett for her assistance with data analysis.

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## I. Introduction

Electricity demand is surging in the United States—driven primarily by growth from data centers and electrification—but the US power grid is struggling to keep pace. After years of relatively flat demand, the rapid addition of new power generation and demand sources are testing the limits of an aging power grid. Outdated infrastructure and bottlenecks in the transmission system are preventing new generators from connecting to the grid to meet these needs, raising costs and decreasing grid reliability. Conversely, developing transmission infrastructure would enable generators of every type to connect to the grid, encourage competition, increase the capacity of the grid to transmit power, and, in many cases, lower costs.

The slow pace of transmission capacity expansion is threatening the grid's ability to meet rapidly growing power demand. It takes an average of six and a half years to secure a permit for a new transmission line before construction can begin, with some transmission projects waiting more than ten years for permits.<sup>1</sup> This pace is insufficient to meet the needs of a modern and growing power system.

The United States has a major opportunity to harness the economic, environmental, and reliability benefits provided by low-cost energy resources by upgrading, expanding, and reshaping the transmission grid. Without additional infrastructure, the country risks hamstringing its capability to meet surging energy demand, rapidly deploy cheap power, maintain resilience during extreme weather events, and capture the eco-

nommic benefits of transmission projects in the forms of jobs, infrastructure, and energy savings.

Expanding and upgrading the transmission system is essential to ultimately lowering the cost of electricity. This effort will require large investments in the near term but, in many cases, transmission costs can be offset by the savings enabled by cheap power, improved grid operations, reduced curtailment, and fewer outages.

Transmission infrastructure's tremendous value to the electricity grid and to consumers should motivate stakeholders to identify opportunities to lower costs and expand benefits while minimizing the extent to which necessary grid upgrades burden consumers. In this report, the authors examine these issues: the need for transmission system upgrades and expansion; the barriers to building and upgrading transmission grid infrastructure to deliver electricity; the cost impacts of these barriers; the levers that can lower the cost of the transmission buildout and the price of electricity; and a survey of existing government policies, regulations, and proposed changes.<sup>2</sup> Toward that end, the authors make recommendations to improve system planning, streamline permitting, adopt expedited development processes, upgrade technology, increase energy efficiency, adopt pricing strategies, deploy innovative financing mechanisms, and address supply chain constraints.

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1. Blake Deely, "U.S. Permitting Delays Hold Back Economy, Cost Jobs," American Clean Power, April 2024, [https://cleanpower.org/wp-content/uploads/gateway/2024/04/ACP-Pass-Permitting-Reform\\_Fact-Sheet.pdf](https://cleanpower.org/wp-content/uploads/gateway/2024/04/ACP-Pass-Permitting-Reform_Fact-Sheet.pdf). A Department of Energy study of more than thirty US transmission projects that started development after 2005 found that average time to receive all needed permits was around ten years, noting that many wait fifteen years or longer. Ryan Wiser, et al., "Transmission Impact Assessment: Power Sector Infrastructure Deployment to Reduce Costs, Improve Reliability, and Lower Pollution," US Department of Energy, October 2024, [https://www.energy.gov/sites/default/files/2024-10/DOE\\_OP\\_2024\\_Report-Transmission\\_Impact\\_Assessment.pdf](https://www.energy.gov/sites/default/files/2024-10/DOE_OP_2024_Report-Transmission_Impact_Assessment.pdf).
  2. "Unleashing American Energy: Executive Order 14154," Executive Office of the President, January 20, 2025, <https://www.federalregister.gov/documents/2025/01/29/2025-01956/unleashing-american-energy>.

## II. The need for transmission expansion and upgrades

The US transmission system faces several critical issues that affect reliability and long-term affordability: the rising demand for electricity, the need to bring new generators online, an aging grid, and growing power curtailment.

Projections show that demand for electricity will continue to increase in the near term. Electric vehicles, data centers for artificial intelligence (AI), and possibly cryptocurrency are primary drivers of this expected growth.<sup>3</sup> Power demand from data centers is projected to double or triple by 2028.<sup>4</sup> Moreover, many transportation, industrial, commercial, and residential processes that were powered by the combustion of fossil fuels are being electrified. A recent Grid Strategies study estimated that US electricity usage will increase by 32 percent by 2030, and new power sources are needed to meet this demand.<sup>5</sup>

Renewable generators have dominated as new entrants to the power grid because they are often more cost competitive than fossil fuel generators.<sup>6</sup> In 2024, more than 90 percent of the new capacity added in the United States comprised solar, battery storage, wind, geothermal, hydrogen, and nuclear projects.<sup>7</sup> In February 2025, the US Energy Information Administration (EIA) estimated that 93 percent of capacity additions will

be renewable, a number that might decrease slightly due to recent Donald Trump administration policy interventions including the One Big Beautiful Bill Act (OBBB), ending tax credits, and executive orders halting fully permitted wind projects that are often close to being completed.<sup>8</sup> Although these interventions rolled back tax credits for renewable energy technologies, these technologies' cost competitiveness and reliability will continue to drive development of these energy sources, which will need to interconnect to the grid.<sup>9</sup>

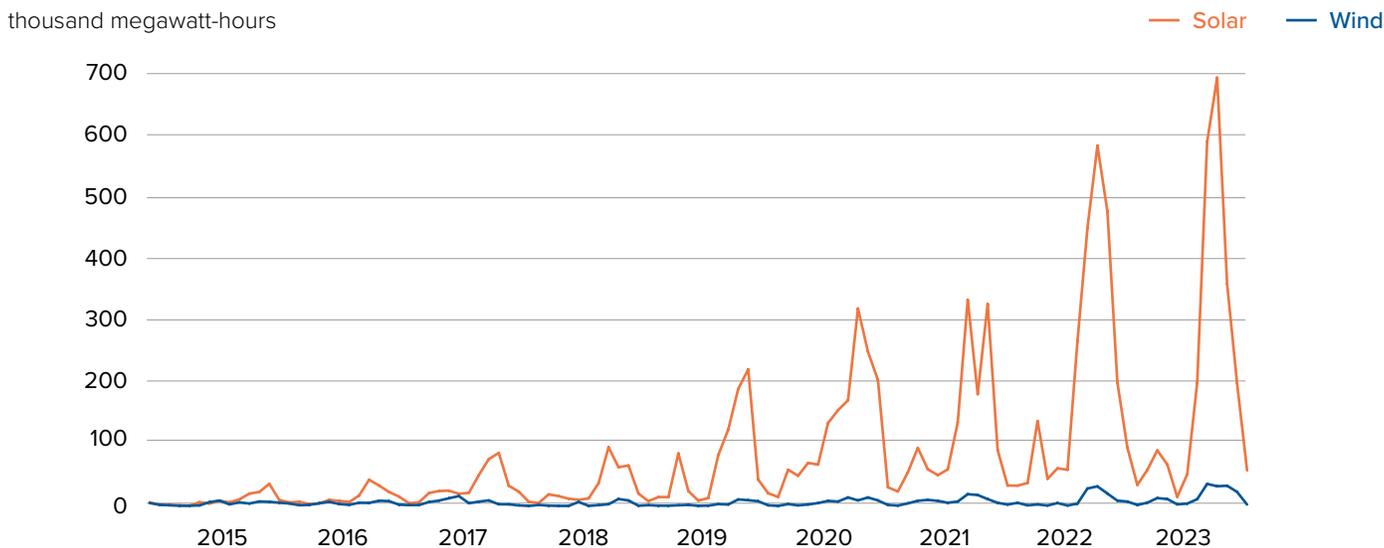
The existing grid, however, was largely built in the 1950s to 1970s, when generators were large, centralized, high-capacity fossil fuel power plants that required fewer transmission lines to deliver to the end user. Today, the most affordable forms of generation are decentralized, distant from demand centers, and intermittent, requiring many more transmission lines to connect supply to end users. Despite a short-term buildout of gas generators to meet baseload demand, a large number of fossil fuel-based power plants—eventually the vast majority—will retire or significantly reduce their operations because of cost, and more clean energy generators will be needed to meet rising demand.<sup>10</sup>

3. Alex Knapp and Alan Ohnsman, "Current Climate: Crypto and AI Have Emerged As Major Energy Hogs," *Forbes*, February 5, 2024, <https://www.forbes.com/sites/alanohnsman/2024/02/05/current-climate-crypto-and-ai-have-emerged-as-major-energy-hogs/>.
4. "Berkeley Lab Report Evaluates Increase in Electricity Demand from Data Centers," Berkeley Lab, January 15, 2025, <https://newscenter.lbl.gov/2025/01/15/berkeley-lab-report-evaluates-increase-in-electricity-demand-from-data-centers/>.
5. John D. Wilson, Sophie Meyer, Zach Zimmerman, and Rob Gramlich, "Power Demand Forecasts Revised Up for Third Year Running, Led by Data Centers," Grid Strategies, November 2025, <https://gridstrategiesllc.com/wp-content/uploads/Grid-Strategies-National-Load-Growth-Report-2025.pdf>.
6. This issue brief is the second in a series of publications by the Atlantic Council on the cost of clean energy in the United States. The first issue brief analyzed the comparative cost of generating electricity from different energy sources. It concluded that the levelized cost of electricity is fairly robust as a tool for estimating generation costs but is not sufficient for assessing overall competitiveness because it fails to capture the whole system cost of electricity. See: Ken Berlin and Frank Willey, "Transitioning to the Clean Energy Grid: A Deep Dive into the Levelized Cost of Electricity," Atlantic Council, August 2023, <https://www.atlanticcouncil.org/wp-content/uploads/2023/08/Transitioning-to-the-Clean-Energy-Grid-A-Deep-Dive-into-the-Levelized-Cost-of-Electricity.pdf>; Benjamin Storrow, "Wind and Solar Energy are Cheaper Than Electricity from Fossil-Fuel Plants," *Scientific American*, June 17, 2025, <https://www.scientificamerican.com/article/wind-and-solar-energy-are-cheaper-than-electricity-from-fossil-fuel-plants/>; "91% of New Renewable Projects Now Cheaper Than Fossil Fuels Alternatives," International Renewable Energy Agency, July 22, 2025, <https://www.irena.org/News/pressreleases/2025/Jul/91-Percent-of-New-Renewable-Projects-Now-Cheaper-Than-Fossil-Fuels-Alternatives>.
7. Michelle Lewis, "Renewables Provided 90% of New US Capacity in 2024—FERC," *Electrek*, February 7, 2025, <https://electrek.co/2025/02/07/renewables-90-percent-new-us-capacity-2024-ferc/>.
8. "Solar, Battery Storage to Lead New U.S. Generating Capacity Additions in 2025," US Energy Information Administration, February 24, 2025, <https://www.eia.gov/todayinenergy/detail.php?id=64586>; "Fact Sheet: President Donald J. Trump Ends Market Distorting Subsidies for Unreliable, Foreign-Controlled Energy Sources," White House, July 7, 2025, <https://www.whitehouse.gov/fact-sheets/2025/07/fact-sheet-president-donald-j-trump-ends-market-distorting-subsidies-for-unreliable-foreign-controlled-energy-sources/>.
9. Alexa St. John and Isabella O'Malley, "\$14 Billion in Clean Energy Projects Have Been Canceled in the US This Year, Analysis Says," *Associated Press*, May 29, 2025, <https://apnews.com/article/climate-clean-energy-investments-trump-solar-wind-349e80c0d9c2cc768e63de9d48813d31>.
10. Suparna Ray, "Retirements of U.S. Electric Generating Capacity to Slow in 2024," US Energy Information Administration, February 20, 2024, <https://www.eia.gov/todayinenergy/detail.php?id=61425>.

To accommodate demand growth, bring new energy technologies online, and maintain a secure, affordable, and reliable electricity system, the transmission system must be interconnected, expanded, and modernized with data-driven technologies. In the long run, interconnecting grids can lower electricity bills and reduce greenhouse gas emissions because they enable electricity to travel farther and deliver cheaper, cleaner power to more locations. Creating a larger network of solar or wind installations also helps address the intermittent nature of renewables by increasing the number of generators supplying power to the network and thus the likelihood electricity will be available at any given time. This, in turn, reduces the need for building local, higher-cost thermal generators. Data-driven technologies can also help grid operators balance supply and demand and optimize the energy system’s performance. When power flow exceeds the capacity of a transmission wire, for example, the system operator must dispatch higher-cost generators and deliver power via a different path, reconfigure the network—or, in extreme cases, initiate preventive outages to maintain system reliability. The cost of transmission congestion, which is ultimately borne by electricity consumers, amounted to \$20.8 billion in 2022, according to Grid Strategies.<sup>11</sup> Increasing grid capacity would lower this cost.

A larger grid can also reduce electricity curtailment, which is when a grid operator limits power production to maintain balance between energy supply and demand or in response to transmission constraints. It occurs when generators produce more electricity than the grid demands or is capable of transmitting. Curtailment due to oversupply of electricity or congestion on the grid forces generators to “ground” their power, in effect stopping the supply of generated electricity to end users. In California, for example, wind and solar curtailments have been rising substantially because generators produce more electricity than the grid demands at certain times and additional infrastructure is not being built at a fast enough rate to store or use that power. Wind and solar curtailment has risen under system operators in several regional markets, including the California Independent System Operator (CAISO), Electric Reliability Council of Texas (ERCOT), Midcontinent Independent System Operator (MISO), New York Independent System Operator (NYISO), and Southwest Power Pool (SPP).<sup>12</sup> Curtailment can be reduced by expanding and connecting grids, which reduces intermittency by expanding the mix and area from which renewable generation can be drawn and creates a larger pool of diversified generation resources.

**Figure 1: Monthly wind and solar curtailments, California Independent System Operator (January 2015–July 2023)**



Source: California Independent System Operator<sup>13</sup>

11. Richard Doying, Michael Goggin, and Abby Sherman, “Transmission Congestion Costs Rise Again in U.S. RTOs,” Grid Strategies, July 2023, [https://gridstrategiesllc.com/wp-content/uploads/2023/07/GS\\_Transmission-Congestion-Costs-in-the-U.S.-RTOs1.pdf](https://gridstrategiesllc.com/wp-content/uploads/2023/07/GS_Transmission-Congestion-Costs-in-the-U.S.-RTOs1.pdf).  
 12. “Production and curtailments data,” California Independent System Operator, last accessed February 17, 2026, <https://www.caiso.com/library/production-curtailments-data>.  
 13. Lori Aniti and Susanna Smith, “Solar and Wind Power Curtailments are Rising in California,” US Energy Information Administration, October 30, 2023, <https://www.eia.gov/todayinenergy/detail.php?id=60822>.

Despite the clear need for US transmission expansion, the growth in transmission capacity has slowed over the past several years, delaying new capacity additions to the grid. From 2010 to 2014, an average of 1,700 miles of new high-voltage transmission lines were built per year. From 2015 to 2019, the average dropped to 925 miles per year, and from 2020 to 2023, the average was only 350 miles per year.<sup>14</sup>

This slowdown in transmission project development raises the final cost of electricity significantly because cheap renewables cannot interconnect to the grid, which forces utilities to turn to more expensive options to meet demand. Proposed projects that would add approximately 2,290 gigawatts (GW) of new generation capacity are waiting in long interconnection queues. If approved and built, these projects—more than 90 percent of which are renewable—would almost double the capacity of the current power grid.<sup>15</sup> The majority of capacity is not expected to clear the queue: 19 percent of proposed projects (14 percent of capacity) that entered the queue between 2000 and 2019 reached operational status by the end of

2024. In 2024, 50 GW of solar was installed on the US grid, a small fraction of the total capacity in queue.<sup>16</sup>

Interconnection wait times and costs are growing. The time required to secure a connection has increased by 70 percent since 2014 due to a higher volume of applicants, burdensome application and review processes, and a lack of transmission capacity.<sup>17</sup> The cost of interconnection has more than doubled over the same period, driven primarily by the need to upgrade the transmission system.<sup>18</sup> The growing timeline and cost of interconnection is inhibiting the cost-effective deployment of new sources of electricity generation. A survey conducted by LevelTen Energy revealed that almost 90 percent of renewable developers identified interconnection timelines and costs as the largest barrier to installing new projects.<sup>19</sup> Alleviating transmission constraints with upgraded technology and additional infrastructure can mitigate congestion and interconnection delays, which would lower costs.

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14. “Americans for a Clean Energy Grid and Grid Strategies Release New Report on Declining Large-Scale Transmission Construction in the U.S.,” Americans for a Clean Energy Grid, July 30, 2024, <https://cleanenergygrid.org/fewer-new-miles-2024/>.
  15. Joseph Rand, et al., “Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection,” Lawrence Berkeley National Laboratory, April 2024, <https://emp.lbl.gov/queues>.
  16. Zoë Gaston and Sylvia Leyva Martinez, “Solar Surge: The US Solar Industry Shatters Records in 2024,” Wood Mackenzie, March 11, 2025, <https://www.woodmac.com/news/opinion/solar-surge-the-us-solar-industry-shatters-records-in-2024/>.
  17. Will Gorman, et al., “Grid Connection Barriers to Renewable Energy Deployment in the United States,” *Joule* 9, 2 (2025), <https://www.sciencedirect.com/science/article/pii/S2542435124005038>.
  18. Joachim Seel, et al., “Generator Interconnection Costs to the Transmission System,” Lawrence Berkeley National Laboratory, June 2023, [https://live-lbl-eta-publications.pantheonsite.io/sites/default/files/berkeley\\_lab\\_interconnection\\_cost\\_webinar.pdf](https://live-lbl-eta-publications.pantheonsite.io/sites/default/files/berkeley_lab_interconnection_cost_webinar.pdf).
  19. Rob Collier, “Standing in Line: How Congested Interconnection Queues are Slowing Renewable Build-Out,” LevelTen Energy, November 2, 2021, <https://www.leveltenenergy.com/post/interconnection-slowdown>.

### III. Challenges facing the transmission buildout

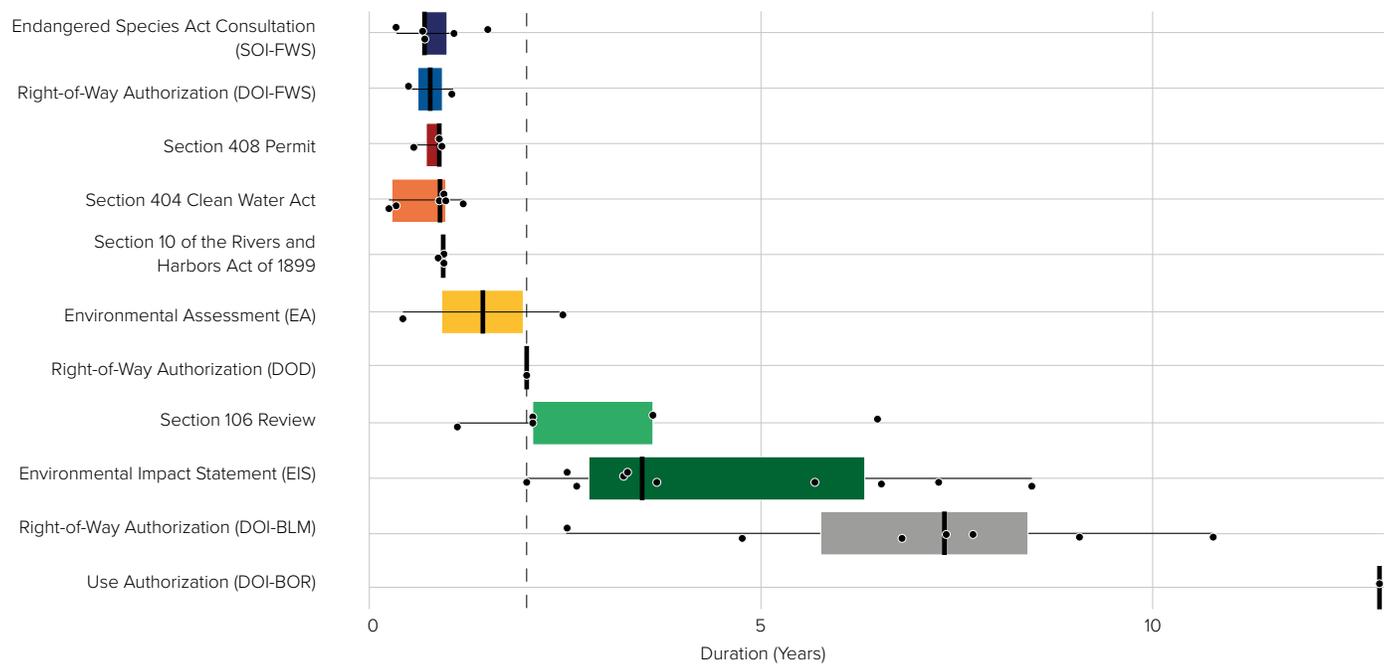
As the United States looks to expand and upgrade the transmission system, it will need to address permitting, cost, planning, and supply chain challenges, which will contribute to already long timelines for transmission buildout. One of the biggest impediments facing transmission development is the difficulty setting permitting and planning procedures that reduce the time and cost it takes to build or upgrade wires. Ineffective, utility-by-utility planning processes and antiquated cost allocation rules can make the delivery of cheaply generated renewables more expensive than delivering fossil fuel-based energy. Such cost increases for ratepayers present another challenge for policymakers and regulators trying to persuade constituents that paying higher rates in the short term to invest in transmission upgrades will pay dividends over the long term. A third barrier to transmission buildout is related to the

materials required to build and modernize infrastructure. The United States imports grid materials from across the globe, making transmission upgrades, expansion, and their associated costs vulnerable to supply bottlenecks.

#### Delayed permitting for transmission infrastructure and community opposition

Lengthy and redundant permitting procedures are a major barrier to the rapid deployment of transmission infrastructure. On average, securing permits for a new transmission line and building it takes six and a half years, with some projects taking ten years or more to complete.<sup>20</sup> The chart below shows average permit review times for certain large, complex transmission projects.

**Figure 2: Permit processing duration by permit type**



Source: Federal Permitting Dashboard. This graph is based on a limited dataset of 47 permits across 11 transmission projects listed on the Federal Permitting Dashboard. Projects span FAST-41 Covered and Transparency projects, Department of Transportation (DOT) projects subject to the FAST Act, and other projects tracked on the Dashboard for federal permitting oversight.<sup>21</sup>

Timelines are hampered by an inefficient process involving several authorities with differing requirements. Whenever a

regulated utility wants to build an interstate transmission line, it must file a request with the Federal Energy Regulatory Com-

20. Deely, “U.S. Permitting Delays Hold Back Economy, Cost Jobs”; A Department of Energy study of more than thirty US transmission projects that started development after 2005 found that average time to receive all needed permits was around ten years, noting that many wait fifteen years or longer. Wisner, et al., “Transmission Impact Assessment.”

21. “Permitting Dashboard,” Permitting Council, last visited February 12, 2026, <https://www.permits.performance.gov/>.

mission (FERC) and seek approval from the Department of Energy (DOE), Bureau of Land Management, and other federal and state agencies. The permitting process can be arduous due to varying requirements for state and federal permits as well as challenges with securing rights of way and community support. Litigation initiated by local communities, local ordinances, and state laws often block or restrict the development of transmission infrastructure, which prevents new, cheaper generators from coming online.<sup>22</sup> This often stems from insufficient engagement with local communities, which the Salata Institute argues is initiated too late into project development.<sup>23</sup> Along with the aforementioned, the many federal and state entities with which developers must interact include the Environmental Protection Agency, Bureau of Indian Affairs, US Forest Service, US Fish and Wildlife Service, Department of Defense, and state land and natural resource agencies, environmental agencies, public utility commissions, transportation agencies, and public lands agencies, among many others.

Delays in the permitting process for transmission projects have a direct impact on costs. A study comparing initial project cost estimates with final observed costs found overages ranged from 18 percent in the central United States to 70 percent in New England, the latter primarily due to delays and design challenges of three projects.<sup>24</sup> Though some of the cost escalation is attributable to inflation and necessary adjustments to project plans, additional costs associated with the permitting and siting process are significant.<sup>25</sup> Extending timelines for transmission projects affects the financial health of the projects when companies need to pay high legal fees to resolve permitting challenges, while firms are also exposed to interest payments and the costs of materials escalating. Regulatory hurdles can be difficult to clear and can be compounded by additional lawsuits from other parties. There are downstream

impacts as well. Generators that would otherwise connect to the grid via the line are unable to do so, slowing the pace of the energy transition. The permitting process can be improved through the many measures described in section V, including legislative measures that set deadlines on decision-making and fast track processes for specific types of projects.

## Rebuilding the grid for the modern era

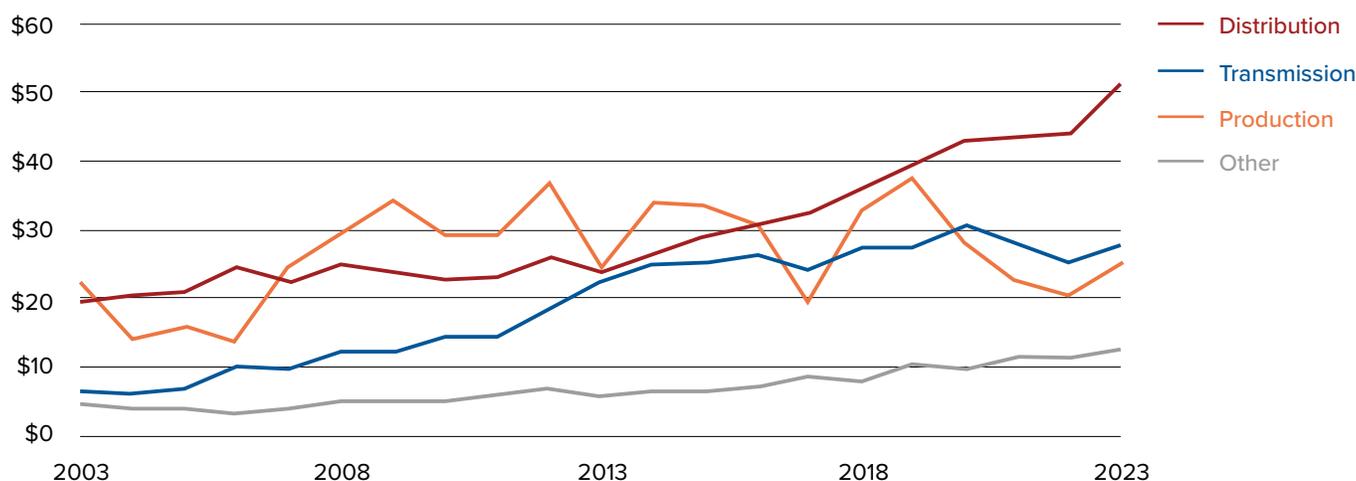
The cost of delivering electricity through the transmission and distribution network is relatively small, but it is already a growing percentage of US customers' utility expenses. Further cost increases to cover additional transmission upgrades and expansion will make consumer buy-in difficult.

A key escalator of transmission costs is the need to maintain and upgrade aging infrastructure, which is approximately forty years old on average.<sup>26</sup> The costs of maintaining and improving grid resilience in the face of damage from fires, storms, and freezes are also on the rise.<sup>27</sup> Utility capital expenditures for transmission and distribution infrastructure are escalating quickly, with transmission spending almost tripling between 2003 and 2023 and distribution spending growing by 160 percent over the same period to replace, upgrade, or expand parts of the grid.<sup>28</sup> S&P Global observes that utility spending on power delivery was 65 percent higher on average in 2020 than in 2010.<sup>29</sup> This translates to higher bills for customers. From 2013 through 2023, transmission and distribution costs rose from 4 percent to 8 percent as a share of total utility operating expenses, while the cost of generation declined from 50 percent to 41 percent. Finding ways to minimize cost increases as the grid modernizes to meet changing needs is critical.

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22. Matthew Eisenson, et al., "Opposition to Renewable Energy Facilities in the United States: June 2025 Edition," Sabin Center for Climate Change Law, June 2025, [https://scholarship.law.columbia.edu/sabin\\_climate\\_change/251](https://scholarship.law.columbia.edu/sabin_climate_change/251); Stephen Ansolabehere, et al., "Crossed Wires: A Salata Institute-Roosevelt Project Study of the Development of Long-Distance Transmission Lines in the United States," Salata Institute for Climate and Sustainability at Harvard University, June 2024, <https://salatainstitute.harvard.edu/wp-content/uploads/2024/06/Crossed-Wires.pdf>.
  23. Ibid.
  24. Johannes P. Pfeifenberger et. al., "Cost Savings Offered by Competition in Electric Transmission," Brattle Group, April 2019, [https://www.brattle.com/wp-content/uploads/2021/05/16726\\_cost\\_savings\\_offered\\_by\\_competition\\_in\\_electric\\_transmission.pdf](https://www.brattle.com/wp-content/uploads/2021/05/16726_cost_savings_offered_by_competition_in_electric_transmission.pdf).
  25. Ibid.
  26. Christine Oumansour, et al., "Modernizing Aging Transmission," *Fortnightly Magazine*, April 2020, <https://www.fortnightly.com/fortnightly/2020/04/modernizing-aging-transmission>; "DOE Launches New Initiative from President Biden's Bipartisan Infrastructure Law to Modernize National Grid," US Department of Energy, January 12, 2022, <https://downloads.regulations.gov/EPA-HQ-OPPT-2022-0593-0108/content.pdf>.
  27. "Tackling High Costs and Long Delays for Clean Energy Interconnection," US Department of Energy, May 11, 2023, <https://www.energy.gov/eere/i2x/articles/tackling-high-costs-and-long-delays-clean-energy-interconnection>.
  28. Lori Aniti, "Grid Infrastructure Investments Drive Increase in Utility Spending over Last Two Decades," US Energy Information Administration, November 18, 2024, <https://www.eia.gov/todayinenergy/detail.php?id=63724>.
  29. Jared Anderson, "US Power Transmission, Distribution Costs Seen Outpacing Electricity Production Costs," S&P Global, November 24, 2021, <https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/112421-us-power-transmission-distribution-costs-seen-outpacing-electricity-production-costs>.

**Figure 3: Annual US capital additions by sector (2003–2023)**

in billions (USD 2023)

Source: US Energy Information Administration and Federal Energy Regulatory Commission<sup>30</sup>

Rising transmission costs, however, can be offset in other areas, such as by low generation costs. After adjusting for inflation, major US utilities spent 2.6 cents per kilowatt hour (kWh) on electricity delivery operations in 2010, using 2020 dollars, and 4.3 cents/kWh on delivery operations in 2020, while utility spending on power production operations decreased from 6.8 cents/kWh in 2010 to 4.6 cents/kWh in 2020.<sup>31</sup> Transmission spending increased by 1.7 cents per unit while power production costs fell 2.2 cents, so between these two expense categories, there was a net decrease in cost of 0.5 cents per kWh over the 2010–2020 period. Moreover, a recent study of sixteen US grid operators’ transmission plans found that for every dollar spent on large-scale, high-voltage transmission, consumers receive \$3.80 to \$4.70 in benefits.<sup>32</sup> Transmission infrastructure improves grid flexibility, reliability, and access to cheaper power, all of which contribute to lowering consumer bills.

The future costs of expanding transmission infrastructure in the United States will depend in large part on how the energy mix evolves—specifically the amount of distributed energy built

and the land and technologies available. A Princeton study defined and modeled five scenarios for decarbonizing the United States by 2050, with cost estimates for transmission needs ranging from \$950 billion to \$3.6 trillion by 2050 depending on the extent of electrification and constraints on renewables, land, or other energy supply. The reference case—no new policies or action to address climate change or greenhouse gas emissions, highly constrained renewables, and low fossil fuel prices—was estimated at \$950 billion, although this does not account for the cost of damages caused by climate change.<sup>33</sup> For a completely renewable system (not including nuclear energy), the cost estimate is \$3.6 trillion, which would break down to \$144 billion per year over twenty-five years—approximately twice the total spending on all electricity infrastructure in 2019—versus \$38 billion per year in the reference case.<sup>34</sup> In a high electrification scenario with no constraints on electricity supply sources, the study estimates that total capital investment in transmission upgrades must reach \$2.2 trillion by 2050 to triple the capacity of the transmission network. In this scenario, if policy prohibits siting new generators on prime far-

30. Aniti, “Grid Infrastructure Investments Drive Increase in Utility Spending over Last Two Decades.”

31. Jeff St. John and Maria Virginia Olano, “Chart: US Utilities Are Spending Less on Making Electricity and More on Getting It to Customers,” Canary Media, January 7, 2022, <https://www.canarymedia.com/articles/utilities/chart-us-utilities-are-spending-less-on-making-electricity-and-more-on-getting-it-to-customers>.

32. Zach Zimmerman, et al., “Large-Scale Transmission Deployment Saves Consumers Money,” Grid Strategies, June 2025, [https://cleanenergygrid.org/wp-content/uploads/2025/06/GS\\_Transmission-Deployment-Saves-Consumers-Money\\_vf.pdf](https://cleanenergygrid.org/wp-content/uploads/2025/06/GS_Transmission-Deployment-Saves-Consumers-Money_vf.pdf).

33. This estimate does not include incentives from the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, as the study was published before these acts were signed into law.

34. Erik Larson, et al., “Net-Zero America: Potential Pathways, Infrastructure, and Impacts,” Princeton University, October 29, 2021, <https://netzeroamerica.princeton.edu/the-report>.

mland or on relatively intact landscapes, costs would increase to \$2.5 trillion total by 2050.

The vast range of cost and cost savings estimates for the transmission system is representative of both the uncertainties and opportunities inherent in the electricity grid. The National Renewable Energy Laboratory estimates that making similar investments to bolster the transmission network could result in US electric system cost savings between \$270 billion and \$490 billion through 2050.<sup>35</sup> Uncertainties include future energy demand, issues arising from insufficient planning and coordination, and regulatory challenges. However, opportunities to mitigate uncertainty abound in the form of better grid management, new cheap power, enhanced grid reliability, and advanced transmission technologies such as advanced conductors, power flow controllers, and dynamic line rating.

## A fragmented approach to grid planning

Historically, utilities in the United States plan their electricity grid in isolation from other regional and national utilities. Planning in isolation can lead to redundancies in the system and overbuilding, which raises consumer bills but is historically how utilities have managed their systems.<sup>36</sup> The lack of coordinated planning among utilities and between regions precludes cost sharing for large infrastructure projects that have joint economic and reliability benefits to the system.<sup>37</sup> Existing inter-regional planning mostly focuses on incremental upgrades to existing infrastructure rather than greenfield projects, such as the planning conducted by MISO and the Pennsylvania-New Jersey-Maryland Interconnection (PJM).<sup>38</sup> Legacy methodologies for planning focus exclusively on reliability 90 percent of the time with no cost-benefit consideration.<sup>39</sup> This leads to fragmented, ad hoc solutions to grid problems—solutions that might have benefitted from economies of scale to prevent duplicative or unneeded measures. As planning methods have

become increasingly innovative, incorporating regional or inter-regional planning can facilitate the buildout of infrastructure at the scale required and reduce redundancies across the entire grid.

## Cost allocation, pricing, and financing

**Cost allocation and recovery.** The questions of who bears the cost for transmission system upgrades, known as cost allocation, can be contentious and can even lead to a project's demise. These decisions are becoming more complex as rising energy demand from data centers requires significant grid capacity upgrades. In some cases, these costs may be passed on to non-data-center customers, with the additional risk that utilities and, in turn, their customers, will bear the cost of stranded assets should demand fail to materialize as anticipated.<sup>40</sup> Compounding this issue, utilities are often not incentivized to invest in advanced transmission technologies that could otherwise provide savings.<sup>41</sup> There are changes being made at multiple levels, from individual utilities to FERC.

Closely related to allocation is cost recovery, the way in which utilities recover costs of new infrastructure through rates, which is becoming especially controversial with the addition of new data centers and other large load customers. Seventy percent of the places where the price of electricity has risen were located near significant data center activity, and costs grew by as much as 267 percent in some regions. ICF predicts that average electricity rates will increase between 15 percent and 40 percent by 2030, and that some rates could double by 2050, representing a significant burden on Americans' wallets.

**Pricing.** New large loads are creating pricing challenges that necessitate changes to rate design. Customers with large or uninterruptible power requirements can increase peak demand, which can lead to higher prices and higher system costs to ensure enough generation capacity is available at all

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35. Emily Mercer, "National Transmission Analysis Maps Next Chapter of US Grid Evolution: Release of National Transmission Planning Study Shifts Energy Transition Into High Gear," National Renewable Energy Laboratory, October 3, 2024, <https://www.nrel.gov/news/features/2024/national-transmission-planning-study.html>.
  36. J. Michael Hagerty, Peter Heller, and Evan Bennett, "Modernizing Southeast Grid Investments: How Enhanced Regional Transmission Planning Supports a Growing Economy," Brattle Group, April 2, 2025, [https://carolinasceba.com/wp-content/uploads/2025/04/SERTP-Report-Summary\\_FINAL.pdf](https://carolinasceba.com/wp-content/uploads/2025/04/SERTP-Report-Summary_FINAL.pdf).
  37. Johannes Pfeifenberger, "Proactive Transmission Planning for a Clean Energy Transition," Brattle Group, March 28, 2024, <https://www.brattle.com/wp-content/uploads/2024/03/Proactive-Transmission-Planning-for-a-Clean-Energy-Transition.pdf>.
  38. "MISO Transmission Expansion Plan (MTEP)," Midcontinent Independent System Operator, 2025, <https://www.misoenergy.org/planning/transmission-planning/mtep/>. PJM Interconnection, L.L.C., "Order Nos. 1920, 1920-A, and 1920-B Compliance Filing of PJM Interconnection, L.L.C. and Request for Extension of Comment Period, Docket No. ER26-751-000," Federal Energy Regulatory Commission, December 12, 2025, <https://www.pjm.com/pjmfiles/directory/etariff/FercDockets/9298/20251212-er26-751-000.pdf>.
  39. Pfeifenberger, "Proactive Transmission Planning for a Clean Energy Transition."
  40. Chris Seiple and Ben Hertz-Shargel, "US Power Struggle: How Data Centre Demand Is Challenging the Electricity Market Model," Wood Mackenzie, June 2025, <https://www.woodmac.com/horizons/us-data-centre-power-demand-challenges-electricity-market-model/>.
  41. Neil Chatterjee, "Grid Technology Could Save Billions but for a Policy Vacuum," Utility Dive, March 25, 2024, <https://www.utilitydive.com/news/grid-technology-could-save-billions-Chatterjee/711068/>.

times.<sup>42</sup> Data centers caused \$7.3 billion, or 83 percent, of the increase in revenues in PJM Interconnection’s most recent capacity market auction, which the system operator uses to ensure it has sufficient generation capacity to meet peaks in electricity demand throughout the year; these revenues are paid by all PJM customers.<sup>43</sup> Smart meters that measure electricity usage in real time enable utilities and customers to send and respond to price signals, respectively. Electricity pricing must reflect the changing dynamics of generation and consumption.

**Financing:** Despite the clear need to manage ratepayer costs while upgrading and expanding transmission infrastructure, developers face major financing challenges. Transmission projects are typically funded using utility equity and debt, which are recovered via standard cost recovery mechanisms. Government and concessional financing can also play an important role in funding these large infrastructure projects. However, public resources and returns are limited for such projects, leaving insufficient incentive to attract private investors. Moreover, permitting and regulatory uncertainty, along with low thresholds for initiating judicial review, can increase project costs and further deter investors. Despite transmission development in the abstract having strong bipartisan support, there is still no bipartisan agreement on the type of support needed or the details, while the challenges continue to hinder timely project execution.

### Constrained supply chains for material components

Adding to the above challenges, supply chain bottlenecks and rising costs of material components pose major challenges for advancing the buildout of the US transmission system. These concerns are particularly applicable to the procurement of power transformers. Almost half the material by weight making up a power transformer is steel, of which 60 percent is grain-oriented electrical steel (GOES).<sup>44</sup> Today’s leading regions in

steel extraction are the Asia-Pacific and Central and South America, which produce 80 percent of global steel supply.<sup>45</sup> Worldwide demand for GOES will need to rise significantly to keep up with the expected growth in power transformer capacity, from an average 2.4 GW per year over the last decade to 3.5 GW and 4.9 GW under the announced pledges scenario and net-zero emissions scenario, respectively, between 2022 and 2030.<sup>46</sup> Under the announced pledges scenario, demand for GOES is expected nearly to double between 2031 and 2040 compared to the previous decade. To achieve net-zero emissions, demand would reach 13 million tonnes per year (Mt/year) between 2031 and 2040, up from 5 Mt/year in 2012–2021. Buyers are exposed to market rates for steel unless they can purchase scrap under contract.

Under any scenario, meeting the rise in demand for GOES will be a challenge. Power transformers have already suffered from supply chain bottlenecks. Shortages of GOES in the wake of the COVID-19 pandemic, Russia’s war in Ukraine, and the war in Gaza have, in part, caused procurement times for power transformers to increase from an average of eleven months to more than eighteen months globally.<sup>47</sup> Utilities in the United States have reported an average of a fourfold increase in the time it takes utilities to receive new power transformers.

Copper and aluminum are also crucial materials for transmission cables and lines. Aluminum extraction is concentrated in the Asia-Pacific and Africa, which account for more than 85 percent of global aluminum supply, with the majority of processing located in China.<sup>48</sup> Copper supply is more geographically diverse, with the three leading mining producers being Chile, Peru, and the Democratic Republic of the Congo, and the three largest refiners being China, Chile, and Germany, with China having 40 percent of global production capacity.<sup>49</sup> In the announced pledges scenario, demand for copper and aluminum for transmission lines, distribution grids, and transformers

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42. Josh Saul, et al., “AI Data Centers Are Sending Power Bills Soaring,” Bloomberg, September 29, 2025, <https://www.bloomberg.com/graphics/2025-ai-data-centers-electricity-prices/>.
43. Ethan Howland, “Data Centers ‘Primary Reason’ for High PJM Capacity Prices: Market Monitor,” Utility Dive, October 2, 2025, <https://www.utilitydive.com/news/data-centers-pjm-capacity-auction-market-monitor/801780/>.
44. Pablo Hevia-Koch, Brent Wanner, and Rena Kuwahata, “Electricity Grids and Secure Energy Transitions,” International Energy Agency, November 2023, [https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/electricity-grids-and-secure-energy-transitions\\_9559dcb0/455dd4fb-en.pdf](https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/10/electricity-grids-and-secure-energy-transitions_9559dcb0/455dd4fb-en.pdf).
45. Ibid.
46. Ibid.
47. “Israel-Hamas Conflict Sends Shockwaves through Steel Market,” Metal Miner, October 11, 2023, <https://oilprice.com/Commodities/Israel-Hamas-Conflict-Sends-Shockwaves-Through-Steel-Market.html>; “Analysing the Impacts of Russia’s Invasion of Ukraine on Energy Markets and Energy Security,” International Energy Agency, 2024, <https://www.iea.org/topics/russias-war-on-ukraine>; “How COVID-19 Disrupted the Renewable Energy Transition—and How the World Can Get Back on Track,” Johns Hopkins School of Advanced International Studies, December 12, 2022, <https://energy.sais.jhu.edu/articles/how-covid-19-disrupted-renewable-energy-transition/>; Hevia-Koch, et al., “Electricity Grids and Secure Energy Transitions.”
48. Ibid.; “Primary Aluminum Production,” International Aluminum, 2024, <https://international-aluminium.org/statistics/primary-aluminium-production/>.
49. “Mineral Commodity Summaries: Copper,” US Geological Survey, January 2024, <https://pubs.usgs.gov/periodicals/mcs2024/mcs2024-copper.pdf>.

in 2041–2050 will be nearly double that from 2012–2021.<sup>50</sup> Demand for copper is set to increase from an average of 5 Mt/year in 2012–2021 to 5.5 Mt/year in 2022–2030 and 9 Mt/year in 2041–2050. Demand for aluminum is set to increase from an average of 12 Mt/year in 2012–2021 to 13 Mt/year in 2022–2030 and to 21 Mt/year in 2041–2050. To achieve net-zero emissions, aluminum demand would need to reach an average of 27 Mt/year between 2041–2050, and copper demand to reach an average of 12 Mt/year in the same period.

Manufactured components for electrical systems—such as advanced conductors, power transformers, voltage switches, circuit breakers, and smart grid sensors—are increasingly difficult to procure reliably and affordably. Electricity grid components contain globally sourced materials and often have bespoke designs that limit standardization and scale. US domestic manufacturing capacity is insufficient to meet demand, which contributes to growing delays and escalating costs. For example, the lead time for a new power transformer has skyrocketed from fifty to 120 weeks between 2021 and 2024, with some large power transformers’ lead times as long as 210 weeks.<sup>51</sup> Electrical components are frequently imported: more than 80 percent of large power transformers are sourced internationally, many of them originating in Mexico or Canada.<sup>52</sup>

The United States’ issuance of reciprocal tariffs and the international community’s protectionist responses will impact the prices and delivery timelines of manufactured goods and, by extension, the cost and pace of the transmission buildout. Trump administration actions to raise steel and aluminum tariffs, including on finished products made with steel and aluminum, are having negative consequences on US developers’ ability to procure low-cost materials.<sup>53</sup> High tariffs and a lack of domestic manufacturing capacity to replace imports will cause manufactured component lead times and prices to escalate.<sup>54</sup> Higher component costs then escalate the cost of construction for energy infrastructure projects, which is ultimately borne by the consumer. Protectionist trade policies are common for metal commodities because of their strategic importance. However, imposing import tariffs when domestic supply cannot meet demand is a recipe for high prices.

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50. Hevia-Koch, et al., “Electricity Grids and Secure Energy Transitions.”

51. Sagar Chopra and Benjamin Boucher, “Supply Shortages and an Inflexible Market Give Rise to High Power Transformer Lead Times,” Wood Mackenzie, April 2, 2024, <https://www.woodmac.com/news/opinion/supply-shortages-and-an-inflexible-market-give-rise-to-high-power-transformer-lead-times/>.

52. Christoph Steitz, “Siemens Energy Targets US Transformer Production in 2027, Can Further Expand Factory,” Reuters, June 26, 2025, <https://www.reuters.com/business/energy/siemens-energy-targets-us-transformer-production-2027-can-further-expand-factory-2025-06-26/>.

53. Benjamin Boucher, “Tariffs and Supply Chain Dislocation Hamper US Power Projects,” Wood Mackenzie, October 17, 2025, <https://www.woodmac.com/news/opinion/tariffs-and-supply-chain-dislocation-hamper-us-power-projects/>.

54. “Fact Sheet: President Donald J. Trump Imposes Tariffs on Imports from Canada, Mexico and China,” White House, February 1, 2025, <https://www.whitehouse.gov/fact-sheets/2025/02/fact-sheet-president-donald-j-trump-imposes-tariffs-on-imports-from-canada-mexico-and-china/>; Herman K. Trabish, “Transformer Supply Bottleneck Threatens Power System Stability as Load Grows,” Utility Dive, February 12, 2025, <https://www.utilitydive.com/news/electric-transformer-shortage-nrel-niac/738947/>; Jasper Shi, et al., “The Tariff-Era Grid: A New Cost Reality for U.S. Regulated Utilities,” Morningstar DBRS, August 25, 2025, <https://dbrs.morningstar.com/research/461025>.

## IV. US federal government efforts to execute cost-lowering strategies

The authority to reform power grid policies and procedures is divided primarily between the DOE and FERC. Both have approved or proposed programs that would address many of the issues discussed above, although some of their proposals are being challenged in court. At the same time, Congress is considering major bipartisan legislation to address reforms in the permitting process.

### DOE initiatives

The US Department of Energy administers federal energy policy and thus plays a large role in managing the power grid. The DOE is responsible for ensuring a secure and reliable energy system while addressing environmental challenges. The DOE has several initiatives under way to improve transmission deployment outcomes.

One such initiative is the Interconnection Innovation e-Xchange (i2X), a program that engages stakeholders, collects and analyzes data, develops a strategic roadmap, and provides technical assistance to enable simpler, faster, and fairer interconnection to the grid. I2X produced the Transmission Interconnection Roadmap in April 2024, which has four goals: increase data access, transparency, and security for interconnection; improve the interconnection process and timeline; promote economic efficiency in interconnection; and maintain a reliable, resilient, and secure grid.<sup>55</sup>

The DOE has also been working on the National Transmission Needs Study and National Transmission Planning Study. Respectively, these two documents estimate the needed transmission buildout through 2040 and will indicate where potential projects with the greatest impact may be. The planning study estimates that every dollar spent on transmission would lower system costs by \$1.60 to \$1.80 and identifies high-opportunity transmission interfaces in the United States to help utilities plan the expansion of the power grid.<sup>56</sup>

The DOE Grid Deployment Office's Building a Better Grid Initiative is a program designed to develop new and upgraded high-capacity transmission lines and modernize the distribution system through three action pillars: collaborative planning, federal financing, and siting and permitting.<sup>57</sup> The DOE's National Interest Electric Transmission Corridor (NIETC) program could vastly accelerate the buildout of interregional transmission lines.<sup>58</sup> NIETC designates corridors within which the federal government will have enhanced power to override delays in approving permits and moderate costs—ten have been announced, and three will proceed to the next round of evaluation by the DOE.

DOE can also play a vital role in supporting transmission project via financing and technical assistance. The Transmission Facilitation Program is a \$2.5-billion revolving fund program that gives DOE access to capital to buy interregional transmission line capacity so developers have stable revenue. DOE can also provide direct loans to NIETC-designated projects via the Transmission Facility Financing Program.<sup>59</sup> DOE's Loan Programs Office (LPO) offers grants, loans, and guarantees to a broad suite of advanced energy projects, including transmission and other electricity-related technologies. These sorts of programs should be sustained and expanded where suitable, as the DOE's technical expertise is crucial to getting projects to the finish line.

### FERC rulemaking

FERC is the regulator of the power grid and system operators, and its mission is "to assist consumers in obtaining reliable, safe, secure, and economically efficient energy services at a reasonable cost through appropriate regulatory and market means and collaborative efforts."<sup>60</sup> FERC oversees wholesale transactions, interstate and interregional electric transmission infrastructure, transmission rates, safe and reliable operation of

55. "Interconnection Innovation e-Xchange," US Department of Energy, last visited November 22, 2024, <https://www.energy.gov/eere/i2x/interconnection-innovation-e-xchange>.

56. "The National Transmission Planning Study," US Department of Energy, last visited January 28, 2026, <https://www.energy.gov/gdo/national-transmission-planning-study>.

57. "Building a Better Grid Initiative," US Department of Energy Office of Electricity, January 12, 2022, <https://www.energy.gov/oe/articles/building-better-grid-initiative>; "Two Years of Building a Better Grid: What It Means for Communities," US Department of Energy Grid Deployment Office, January 12, 2024, <https://www.energy.gov/gdo/articles/two-years-building-better-grid-what-it-means-communities>.

58. "Initiation of Phase 2 of National Interest Electric Transmission Corridor (NIETC)," US Department of Energy Grid Deployment Office, May 8, 2024, <https://www.energy.gov/sites/default/files/2024-05/PreliminaryListPotentialNIETCsPublicRelease.pdf>.

59. "Transmission Facilitation Program," US Department of Energy, last visited January 28, 2026, <https://www.energy.gov/gdo/transmission-facilitation-program>.

60. "About FERC," Federal Energy Regulatory Commission, last visited February 12, 2026, <https://ferc.gov/what-ferc>.

the grid, and utility rates and planning. FERC recently passed orders to reform the generator interconnection process and long-term transmission planning. FERC's actions have a large impact on the power grid, and it has a great opportunity to assess and improve the system to identify transmission needs faster, accelerate project timelines, conduct proper environmental review and permitting, regulate markets effectively, and ensure reliability.

FERC's recent rulemaking, Order 1920-B, addresses long-term transmission planning, particularly at the interregional level, and will have significant implications for effective grid development in the United States. Under the order, regional transmission organizations must conduct long-term, twenty-year planning studies for regional transmission facilities, consider a broad range of benefits for new facilities, identify opportunities to upgrade existing line transfer capability to meet expected power flow needs but not overbuild (known as "right-sizing"), better methods for cost allocation to beneficiaries of the project, enhanced transparency, and improved interregional coordination.

Order 1920-B will help operators better anticipate future needs and size transmission infrastructure appropriately given long-term trends. This order should also help expedite permitting procedures for selected lines, reduce interconnection queues for potential generators, and incentivize the development of much-needed transmission wires. The order addresses key issues in transmission development—namely, transmission planning and expanding and modernizing the grid—but does not resolve all issues listed above. Long-term planning will allow utilities to better assess future needs, facilitating project development and reducing the chance of delays or cancellation. The order requires utilities to consider using advanced transmission technologies in their planning and to identify opportunities for right-sizing their lines to increase their transfer capability. FERC's order should be supplemented by the recommendations listed in the previous section, including reforms in the permitting process, energy efficiency improvements, innovative financing structures, demand response measures, national corridors, and continued technological innovation.

## The Permitting Council

The Permitting Council was established by Congress in 2015 as a specialized federal agency charged with coordinating interagency environmental reviews and expediting permit-

ting timelines for certain infrastructure projects.<sup>61</sup> The Permitting Council operates the FAST-41 program and the Federal Infrastructure Permitting Dashboard that tracks progress for covered projects.<sup>62</sup> FAST-41 is a federal program created under Title 41 of the Fixing America's Surface Transportation Act (FAST Act) that streamlines and coordinates the environmental review and permitting processes for qualifying major energy transmission and generation projects to accelerate project development, though the program also covers other infrastructure types such as surface transportation, pipelines, water infrastructure, and several others.<sup>63</sup>

## Proposed legislation

Legislative proposals could also have a significant impact on the speed and cost of the transition. The bipartisan Manchin-Barrasso Energy Permitting Reform Act of 2024 had aimed to reform the permitting process with provisions for transmission that will accelerate the infrastructure buildout. Had the bill passed, it would have reformed backstop siting authority for interstate lines, expedited federal authorization timelines and review of legal challenges, accelerated permitting processes, enacted a process to propose national interest projects, required interregional transmission planning, changed cost allocation for project benefits, and allowed FERC to approve compensation to communities for projects, among other provisions.

The proposed bill would have addressed several challenges involving transmission planning, permitting, reconductoring, and national interest corridors, and would have significantly expedited the transmission buildout. But Congress did not pass the bill, and it appears unlikely that an alternative will pass in 2026. There is also potential for a new, even more comprehensive package for transmission development. Ensuring a clean, affordable, reliable, and safe electricity grid will require additional transmission lines, and legislation could be critical in accelerating this development.

More comprehensive transmission legislation, which could be partly modeled on the recent bipartisan House permitting reform framework, could include specific provisions for additional advanced transmission technologies and data reporting, subsidies for buying green materials, funding for national transmission projects and project development efforts, provisions for local engagement and enhanced transparency, and a minimum interregional transfer capacity requirement.<sup>64</sup> The bill might also give FERC sole authority over the permitting and

61. "FAST-41 Program," Permitting Council, last updated December 11, 2024, <https://www.permitting.gov/projects/title-41-fixing-americas-surface-transportation-act-fast-41>.

62. "Project Map," Permitting Dashboard Federal Infrastructure Projects, last visited January 28, 2026, <https://www.permits.performance.gov/>.

63. "H.R.22—114th Congress (2015-2016): FAST Act," US Congress, December 4, 2015, <https://www.congress.gov/bill/114th-congress/house-bill/22>.

64. "Permitting Reform Framework," Problem Solvers Caucus, 2025, <https://problemsolverscaucus.house.gov/sites/evo-subsites/problemsolverscaucus.house.gov/files/evo-media-document/problem-solvers-caucus-permitting-reform-framework.pdf>.

approval of transmission projects. That authority is currently spread among several agencies. Consolidating that authority within FERC would streamline the lengthy permitting process and get projects to construction faster. A more comprehensive transmission package could also focus on planning of transmission lines, which would, in turn, enable faster permitting review and more cost-effective infrastructure.

### **The second Trump administration and the One Big Beautiful Bill Act**

Despite many setbacks, the Trump administration has taken several positive steps to advance transmission development, continuing the trend of bipartisan support. The DOE and other federal agencies have continued the NIETC process and are expediting permitting procedures. In April 2025, the White House released the executive order, “Strengthening the Reliability and Security of the United States Electric Grid,” which instructed agencies to expedite transmission development by,

among other actions, investing in grid modernization and establishing a uniform methodology for reserve margins.<sup>65</sup>

The OBBB will have a strong impact on the electricity grid, mainly due to rescissions of key tax credits that boosted renewable energy deployment, but specific legislative actions on electric power transmission infrastructure were absent. The House’s draft of the bill revoked funding for transmission programs and funding for interregional transmission planning, but the final version of the bill did not include these provisions, a signal that bipartisan consensus on upgrading and expanding the grid can be achieved.<sup>66</sup>

Although FERC, DOE, executive, and congressional actions have made progress toward grid improvements, a much more concerted effort is needed to ensure that the United States can transform its grid into a modern, reliable system that delivers power affordably across the country.

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65. “Strengthening the Reliability and Security of the United States Electric Grid,” White House, April 8, 2025, <https://www.whitehouse.gov/presidential-actions/2025/04/strengthening-the-reliability-and-security-of-the-united-states-electric-grid/>.

66. “Text—H.R.1—119th Congress (2025–2026): An Act to Provide for Reconciliation Pursuant to Title II of H. Con. Res. 14,” US Congress, July 4, 2025, <https://www.congress.gov/bill/119th-congress/house-bill/1/text/enr>.

## V. Strategies for lowering transmission project costs

Addressing the complex challenges to the modernization and expansion of the US transmission systems requires long-term, proactive planning of future electricity infrastructure and is vital to ultimately lowering costs.<sup>67</sup> Utilities and grid operators, together with policymakers and regulators, must create and implement long-term strategies to meet changing electricity demand affordably with an increasingly renewable power supply. The following are six key goals for US transmission reform and recommended actions to achieve these goals.

### Goal 1: Implement long-term, coordinated, multivariable system planning.

Most experts agree that proactive, long-term planning of electricity infrastructure would lower system costs, reduce permitting timelines, and mitigate other project barriers, thereby accelerating infrastructure development. Advanced planning also gives utilities, developers, and investors greater certainty that their projects will be built. To maximize the grid's potential, planners must consider variables beyond reliability when evaluating the need for upgrades and new infrastructure to more fully capture the costs and benefits of those projects. Furthermore, collaboration on planning between grid operators can unlock reliability benefits and cost savings. A 2021 study published in *Joule* estimated that interstate coordination and transmission expansion would reduce the system cost of electricity in a fully renewable US power grid by 46 percent compared to a state-by-state approach, highlighting the importance of coordination between states and, by extension, grid operating entities.

#### Recommended actions

##### Industry and system operators

- a. Grid operators could integrate a proactive, multivariable, cost-benefit analysis of transmission lines that is tied into long-term planning processes for generating assets following the guidance of FERC's Order 1920. The rule, released in May 2024, sets requirements for regional transmission planning and provides guidance on cost allocation, working closely with utilities, transmission owners, and other stakeholders in their service territory.<sup>68</sup> Planning can consider a wide array of technologies and alternatives on equal footing with new transmission lines and generators, including storage systems, energy efficiency upgrades, and demand response programs, to maximize cost and system efficiencies.<sup>69</sup> Utilities should also consider rate design and reforms that allow consideration of advanced transmission technologies in cost recovery.
- b. Operators could consider building regional and interregional transmission lines between service territories to better optimize resources in a larger market. Long-distance, high-capacity lines can be especially valuable, with a recent study finding that all transmission projects across interconnections achieved a value-cost ratio of at least 4:1, while interregional lines achieved an average of 1.6:1 and were all net positive.<sup>70</sup> Capturing this value requires coordination between operators. They must also coordinate with regulators and policymakers where there is overlap with government initiatives to construct interregional transmission projects.

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67. Johannes Pfeifenberger, "Ensuring Cost-Effective Transmission in Support of a Clean Energy Transition," Brattle Group, August 9, 2024, <https://www.brattle.com/wp-content/uploads/2024/08/Ensuring-Cost-Effective-Transmission-in-Support-of-a-Clean-Energy-Transmission.pdf>.

68. "Building for the Future through Electric Regional Transmission Planning and Cost Allocation Docket No. RM21-17-000, Order No. 1920," Federal Energy Regulatory Commission, May 13, 2024, <https://www.ferc.gov/media/e1-rm21-17-000>.

69. N. Enbar and J. Taylor, "Guidance on DER as Non-Wires Alternatives (NWAs)," Electric Power Research Institute, December 2018, <https://restservice.epri.com/publicdownload/000000003002013327/0/Product>.

70. Mulvaney Kemp, et al., "Electric Transmission Value and its Drivers in United States Power Markets," *Nature Communications* 16, 8055, August 28, 2025, <https://www.nature.com/articles/s41467-025-63143-5>.

### Regulators and policymakers

- a. In addition to collaboration between system operators to expand interregional capacity, the federal government can further expand on the effort by designating additional corridors for the NIETC initiative. The DOE announced three NIETCs out of ten initial proposed corridors that will proceed through the process, but the timeline is unclear beyond an initial release of reports on each corridor and their environmental reviews, which takes place sometime in 2026. These transmission corridors would accelerate the development of high-impact, long-distance projects and lower costs to consumers. The DOE could designate NIETCs in addition to the three initial selections, especially to build wires into the Mid-Atlantic to meet data center demand.<sup>71</sup> The government could go further by paying for a portion of the transmission line, which would help keep that portion of the line's costs from being charged to consumers while contributing to the national security imperative of a reliable electricity system.
- b. In coordination with federal efforts, state lawmakers could pass legislation to enable the buildout of energy infrastructure zones, modeled based on successful programs like California and Texas's respective Competitive Renewable Energy Zones (CREZ). Texas's initiative, primarily designed to bring onshore wind online, enabled the construction of 3,500 miles of transmission lines capable of transmitting around 18.5 GW.<sup>72</sup>
- c. Regulators should ensure that transmission costs are allocated according to the "beneficiary pays" principle, which states that those who benefit from the project should pay for it, and those who bear unfair cost burdens should be compensated.<sup>73</sup> Currently, this principle is not always followed. In the MISO and SPP regions, for example, LevelTen Energy noted that developers pay for more than 90 percent of the costs to upgrade and expand transmission lines to connect a single new generator, despite the addition of renewable energy benefitting ratepayers and other generators.<sup>74</sup> In other instances, consumers pay a disproportionate amount for transmission upgrades that primarily benefit data centers.<sup>75</sup>

## Goal 2: Fast track permitting to avoid project delays.

Current permitting processes slow down projects, with certain permits taking up to nine years to secure and some projects taking even longer. Removing unnecessary permitting barriers is a commonsense way to lower energy costs.

### Recommended actions

#### Industry and system operators

- a. Grid operators would benefit from investing early in community engagement and public outreach efforts, communicating clearly the justification for any upgrades or new projects as well as the timeline, potential benefits and harms, and impact on local spaces to mitigate local opposition and lawsuits that slow down development timelines.<sup>76</sup> Community engagement can reduce the risk of project delays arising from local opposition and legal challenges. Developers should also consider community benefit agreements, which are legally binding contracts between devel-

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71. "Initiation of Phase 2 of National Interest Electric Transmission Corridor (NIETC)."

72. "Transmission & CREZ Fact Sheet," Powering Texas, 2020, <https://www.poweruptexas.org/wp-content/uploads/2020/11/Transmission-and-CREZ-Fact-Sheet.pdf>.

73. Daniel Butt, "A Doctrine Quite New and Altogether Untenable": Defending the Beneficiary Pays Principle," *Journal of Applied Philosophy* 31 (2014), 336–348, <https://onlinelibrary.wiley.com/doi/10.1111/japp.12073>.

74. William Driscoll, "Interconnection Delays and Costs are the Biggest Barrier for Utility-Scale Renewables, Say Developers," *PV Magazine*, February 14, 2022, <https://pv-magazine-usa.com/2022/02/14/interconnection-delays-and-costs-are-the-biggest-barrier-for-utility-scale-renewables-say-developers/>.

75. Cathy Kunkel, "Projected Data Center Growth Spurs PJM Capacity Prices by Factor of 10," Institute for Energy Economics and Financial Analysis, July 30, 2025, <https://ieefa.org/resources/projected-data-center-growth-spurs-pjm-capacity-prices-factor-10>.

76. Natalie Manitus, "The Power of Engagement: Building Trust and Support for Clean Energy Projects," Clean Air Task Force, August 2025, <https://cdn.catf.us/wp-content/uploads/2025/09/03062433/CATF-Power-of-Engagement-Report.pdf>.

pers and local municipalities or communities outlining how the project will contribute local economic, environmental, or social benefits in exchange for community support.<sup>77</sup> Such agreements can help reduce opposition and build trust, and can also include impact mitigation measures such as relocation assistance, noise or visual buffers, and environmental restoration efforts.

- b.** Grid operators could incorporate AI and digital technologies to streamline the interconnection permitting process and reduce processing times. Digital technologies can automate time-consuming procedures such as initial document screening and application review and help operators see bottlenecks in processing times or gaps in applications. Meanwhile, digital portals could enable a one-stop shop for interconnection application notifications by providing real-time tracking of application status, automated notifications of required actions, and a centralized location for document submission. Digital technologies can reduce bureaucratic burden and accelerate permitting timelines but must be implemented without compromising the rigor of review. Operators should collaborate with permitting authorities to ensure AI tools are compatible with existing regulatory frameworks.<sup>78</sup>

### *Regulators and policymakers*

- a.** Government agencies could expand the use of expedited review processes for transmission projects that eliminate duplicative procedures and clarify procedures to applying entities, building on existing programs like the Permitting Council's FAST-41 program. Permitting authorities could work to centralize information sharing and create effective, consistent communication procedures with applicants. State permitting bodies could replicate the Permitting Council's online dashboards and tools at the state level to facilitate permitting and increase transparency.
- b.** State, local, and federal legislators could also formalize requirements for developers to engage communities. These requirements could specify minimum standards for public outreach, including the timing and frequency of community meetings, the breadth of stakeholder notification, and the methods used to solicit and incorporate public feedback. Specialized programs that are location- or community-specific should also be considered and implemented where appropriate, such as tribal consultation processes, community benefit agreements, local stakeholder advisory committees, participatory siting workshops, and multilingual outreach programs. Formalized engagement requirements create accountability and ensure that community voices are heard before significant project decisions are made, reducing the likelihood of opposition that might emerge late in the development process.
- c.** Agencies and policymakers must provide adequate resources and staff to regulatory bodies to process the high volume of incoming permitting applications and ensure that reforms that improve permitting efficiency are implemented before reducing resources or workforce. Without sufficient investment in permitting authorities' capacity to process applications, even well-designed streamlining reforms will fail to deliver meaningful improvements in project timelines. Regulatory agencies should incorporate AI and digital technologies, including cloud-based software, into the permitting process to streamline interagency coordination, increase transparency, and improve application processing efficiency. AI can help automate initial application review, extract key information from lengthy environmental documents, and help anticipate when projects might require intensive review. Digital technologies can be used to centralize application submissions, facilitate coordination and cooperation between the multiple regulatory agencies reviewing a project, and enable public-facing dashboards that increase transparency. AI and digital technologies can reduce processing times, make agency decisions more consistent, and enable staff to focus on more complex technical and policy considerations that require human expertise. Robust cybersecurity protections are a prerequisite to deploying digital technologies that can influence grid operations or reliability.

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77. "Community Benefits Agreements Database," Sabin Center for Climate Change Law, Columbia Law School, last visited January 28, 2026, <https://climate.law.columbia.edu/content/community-benefits-agreements-database>.

78. William Yancey Brown, "DOGE Should Use AI to Fix Environmental Review," Atlantic Council, January 27, 2025, <https://www.atlanticcouncil.org/blogs/energysource/doge-should-use-ai-to-fix-environmental-review/>.

### Goal 3: Reduce grid congestion by deploying proven technologies.

Many already available advanced transmission technologies (ATTs) would help reduce grid congestion. ATTs can unlock additional transmission line capacity, enhance reliability, and enable grid operators to leverage AI and identify inefficiencies in their system by receiving operational data in real time. These data can then help utilities make decisions about where to expand the system. Studies have demonstrated the significant value of ATTs in enabling more renewables to interconnect to the grid and reducing grid congestion, with ATTs for generator interconnection reducing national wholesale energy costs by more than \$5 billion per year and saving \$2–8 billion on grid congestion each year.<sup>79</sup>

#### Recommended actions

##### *Industry and system operators*

- a. Utilities and transmission owners could replace existing transmission wires with advanced conductors made from alternative materials rather than the conventional steel-core wire. Reconductoring would reduce the need for comparatively more expensive new transmission lines. One report found that reconductoring old transmission wires with advanced conductors could help quadruple projected transmission capacity expansion by 2035, which would unlock a 90-percent clean electricity system in 2035 and save \$85 billion in system costs in comparison to business as usual. Another study estimates consumer savings of \$140 billion from 2022–2032. These technologies increase the efficiency of the system and the quantity of energy that the grid can deliver, thereby lowering costs.
- b. Grid operators could encourage their state utilities commissions to consider a wide range of ATTs as being eligible for the rate base. These technologies help to monitor and optimize system performance, avoid more costly upgrades, improve grid resilience, and enhance market efficiency.<sup>80</sup> These technologies include advanced power transformers, advanced power flow controllers, dynamic line rating systems, adaptive networks, intelligent communication and control systems, transmission switching technologies, advanced metering infrastructure, and improved forecasting models. Advanced technologies can enable real-time monitoring and optimization to improve system performance and thus decrease the need for costly additional generating reserves.

##### *Regulators and policymakers*

- a. State governments could require utilities to integrate ATTs into grid planning decision-making. FERC has mandated that ATTs be considered in regional transmission planning and interconnection, but FERC authority only extends to interstate projects. Ten states have passed legislation requiring their consideration.<sup>81</sup>

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79. Chatterjee, “Grid Technology Could Save Billions but for a Policy Vacuum”; “GETting Interconnected in PJM,” Rocky Mountain Institute, 2024, <https://rmi.org/insight/analyzing-gets-as-a-tool-for-increasing-interconnection-throughput-from-pjms-queue/>; “Unlocking the Queue,” Brattle Group, February 2021, <https://watt-transmission.org/unlocking-the-queue/>.

80. Rich Glick and Neil Chatterjee, “FERC Paved the Way for Smart Grid Solutions. States Must Take the Next Step,” Utility Dive, August 15, 2025, <https://www.utilitydive.com/news/smart-grid-gets-grid-enhancing-hpc-states/757687/>.

81. Ibid.

## Goal 4: Dampen the rise in electricity demand to reduce the need for new power plants and transmission lines.

Keeping rising electricity demand in check will help reduce the need to build new power plants and install associated power lines and would thus moderate cost increases. Implementing demand-response programs and energy efficiency initiatives can contribute to this goal. These programs incentivize consumers to reduce their electricity usage to support grid stability, particularly during periods of peak electricity demand.

### Recommended actions

#### Industry and system operators

- a. Utilities could implement time-of-use (TOU) pricing, which prices electricity throughout the day based on demand and the cost of generation, as well as other pricing strategies that shift demand in a way that lowers system costs. TOU pricing is becoming more common in the United States to help manage peak demand, support integration of renewable energy, and enhance grid efficiency.<sup>82</sup> California has been a pioneer in using TOU pricing to flatten the so-called “duck curve” of electricity demand, in which net demand after renewable dispatch, and resulting price, peaks in the mid-morning and again in the evening.<sup>83</sup> Because renewable energy technologies generate electricity at a lower cost than fossil fuels, low price tends to correspond with high renewable generation and vice versa.

TOU pricing is effective in markets with a predictable load profile with high peak demand and flexible customer demand, and where infrastructure and weather conditions allow.<sup>84</sup> In some markets, TOU pricing might disproportionately burden low-income communities and could cause demand peaks at new times, which could shock the system and fail to lower, and sometimes increase prices.<sup>85</sup> In these cases, peak time rebates (in which customers receive a rebate for reducing consumption during utility-designated peak hours) or tiered rates (in which bills increase when consumption passes certain thresholds) might be more suitable. Other demand response measures that might be more appropriate to employ in certain markets include peak pricing, peak-time rebates, interruptible service, and real-time pricing, which can reduce the need for new infrastructure and lead to lower costs for end users.

- b. Utilities and operators could incentivize the construction of energy-efficient buildings and installation of energy-efficient alternatives and upgrades for lighting, heating and cooling, household appliances, and smart energy technologies, which can lower electricity bills, federal tax bills, and grid operational costs. Home automation technologies (smart plugs, smart thermostats, smart lighting, and integrated systems) can optimize household energy usage and thereby lower costs.<sup>86</sup> Advanced energy management systems are available for commercial and industrial facilities and behind-the-meter electricity assets including batteries, electric vehicles, and solar panels, which can help lower costs.<sup>87</sup> Energy efficiency programs could be modeled after existing programs. Examples of such programs include: ComEd’s rebate program in northern Illinois for energy-efficient building materials; Baltimore Gas and Electric (BGE) and Pepco’s retro-commissioning and

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82. Ahmad Faruqui and Ziyi Tang, “Time-Varying Rates Are Moving from the Periphery to the Mainstream of Electricity Pricing for Residential Customers in the United States,” *Handbook on Electricity Regulation*, Brattle Group, August 12, 2023, <https://www.brattle.com/wp-content/uploads/2023/07/Time-Varying-Rates-are-Moving-from-the-Periphery-to-the-Mainstream-of-Electricity-Pricing-for-Residential-Customers-in-the-United-States.pdf>.

83. James Fine, “Getting It Right with Time-of-Use Pricing in California,” Environmental Defense Fund, January 27, 2016, [https://www.edf.org/sites/default/files/factsheet\\_time-of-use\\_0.pdf](https://www.edf.org/sites/default/files/factsheet_time-of-use_0.pdf).

84. “Understanding Time of Use (TOU) Rates: What You Need to Know,” FranklinWH, March 25, 2024, <https://www.franklinwh.com/blog/understanding-time-of-use-rates>.

85. Paul Zummo, et al. *Moving Ahead with Time of Use Rates*, American Public Power Association, 2020, <https://www.publicpower.org/resource/moving-ahead-with-time-use-rates>.

86. Jen King, “Energy Impacts of Smart Home Technologies,” American Council for an Energy-Efficient Economy, April 2018, <https://www.aceee.org/sites/default/files/publications/researchreports/a1801.pdf>.

87. Margaret Mann, “Behind the Meter Storage Analysis,” National Renewable Energy Laboratory, August 25, 2021, <https://www.energy.gov/sites/default/files/2021-10/bto-peer-2021-behind-meter-storage-analysis.pdf>.

full-building tune-up services for commercial and residential customers; and Public Service Electric & Gas's program in New Jersey that provides free energy audits and finances 20 percent of the total cost of recommended improvements for small businesses in low-income municipalities.<sup>88</sup>

#### *Regulators and policymakers*

- a. Policymakers could pass legislation to create additional programs promoting energy efficiency, demand response, and low-cost generation to incentivize customers to reduce electricity usage or shift usage away from peak hours. State public utility commissions and legislatures should encourage utilities to implement pricing measures that enable demand response. Legislative initiatives for demand response, efficiency, and low-cost generation programs could be modeled after the federal government's now-retired Energy Efficient Home Improvement Credit and Residential Clean Energy Credit programs, which provided federal tax credits of up to \$1,200 for energy efficiency improvements and up to \$2,000 for heat pump installation, and 30 percent of the cost of a clean energy installation.<sup>89</sup>
- b. Policymakers should pass legislation that incentivizes the installation of smart technologies—which leverage AI to automatically adjust electricity usage in response to pricing signals—in homes and businesses or direct investment in this infrastructure by proving the cost savings over time.

### **Goal 5: Reduce consumers' cost burden of transmission upgrades with innovative financial instruments.**

To help reduce financing costs for projects and long-term energy costs for ratepayers, utilities and government actors should employ financial instruments, including government incentives and innovative financial arrangements.

#### **Recommended actions**

##### *Industry and system operators*

- a. Utilities and project developers could work with financial institutions and project developers to use innovative financial structures to keep additional costs out of the consumer rate base. For example, they could create a government-backed, tax-exempt "transmission bond," leveraging long-term returns of transmission infrastructure.
- b. Utilities and grid operators could actively pursue public-private partnerships (PPPs) for transmission projects, which can spread financial risk among public entities and private investors while potentially lowering projects costs. PPPs leverage private-sector efficiency, innovation, and access to capital markets, while public utilities or public authorities oversee project development and help ensure regulatory compliance and alignment with policy goals. PPPs can also enable utilities to undertake larger or more complex projects than they could finance independently, expanding the scope of possible grid improvements. Clear contractual frameworks that enumerate performance standards, cost allocation mechanisms, and public accountability measures are required to ensure PPPs provide adequate returns to attract private investment but do not burden ratepayers with higher costs. Utilities and grid operators should consider aggregating smaller transmission projects into larger investment portfolios to distribute project risks and attract institutional investors who might seek higher risk-return investments than transmission infrastructure projects typically offer. The portfolio approach can lower financing costs and expand developers' access to capital, reducing costs that would otherwise be passed on to consumers and facilitating expanded infrastructure investment. Portfolio approaches can also enable developers to

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88. "Local Utilities and Other Energy Efficiency Program Sponsors," Environmental Protection Agency, last updated March 11, 2025, <https://www.epa.gov/statelocalenergy/local-utilities-and-other-energy-efficiency-program-sponsors>; "Energy Efficiency Programs and Incentives," Energy Star, last visited January 28, 2026, <https://www.energystar.gov/buildings/save-energy-commercial-buildings/finance-projects/energy-efficiency-programs/>.

89. "Home Energy Tax Credits," Internal Revenue Service, last updated January 21, 2026, <https://www.irs.gov/credits-deductions/home-energy-tax-credits>.

achieve economies of scale in procurement, construction, and operations, lowering per-project costs through bulk purchasing, standardized designs, and shared administration.

#### *Regulators and policymakers*

- c. Government entities could work with financial institutions and utility project developers to arrange green bonds or loan guarantees to help lower the upfront capital cost of large transmission projects and, as a result, the cost to consumers. Identifying partners to sign long-term capacity contracts can help assure the revenue stream and lower the cost of financing.
- d. Government agencies with significant energy use, such as the General Services Administration or Department of Defense, could identify long-term capacity or revenue contracts with utilities or energy buyers to help secure project cash flow and lower financing costs.

## **Goal 6: Address constraints in material and component supply chains for transmission lines.**

The components needed for transmission systems are made with a range of materials, including critical minerals and steel, and their supply faces constraints shaped by geopolitical and domestic political realities. Stabilizing costs and securing supplies of these components while also maintaining environmental and social standards will require a cohesive strategy among multiple actors.

### **Recommended actions**

#### *Industry and system operators*

- a. Electric grid operators or other entities could procure scrap steel via contracts to insulate their supply from market prices. Sourcing scrap steel and turning it into transmission-related products, such as transformers, close to where such components are used can lower transportation costs.
- b. Utilities could research, standardize, and integrate new transmission component designs that use less material or different materials to reduce demand from unreliable supply chains. These strategies could lower the cost of materials acquisition. Power transformers, for example, are usually made from steel and aluminum. However, new designs that use different materials, such as carbon fiber, could help grid operators and developers alleviate supply chain bottlenecks.<sup>90</sup>
- c. Utility project developers should ensure a secure and diversified supply chain to mitigate risk and reduce costs and emissions from transportation. Long-term contracts for metals and components are one possible strategy that operators can use to reduce exposure to commodity price volatility.

#### *Regulators and policymakers*

- a. Government actors could establish a strategic reserve of key critical minerals and grid material components, including power transformers and conductors, to reduce US exposure to global markets while also providing manufacturers with a guaranteed buyer, giving them greater certainty when investing in and scaling production. Improved system planning by operators and utilities would also aid in projecting future manufacturing needs.
- b. The US government should also secure long-term minerals contracts with domestic suppliers or trusted foreign partners to decrease exposure to price volatility and ensure adequate supply amid competitive global market conditions.

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90. Ruby Nguyen, et al., “Electric Grid Supply Chain Review: Large Power Transformers and High Voltage Direct Current Systems,” US Department of Energy, February 24, 2022, <https://www.energy.gov/sites/default/files/2022-02/Electric%20Grid%20Supply%20Chain%20Report%20-%20Final.pdf>.

## VI. Conclusion

Building a grid capable of meeting the challenges of the twenty-first century requires robust transmission infrastructure to unlock the benefits of affordable, clean, reliable, and secure power. The cost of transmission will be a large determinant of utilities' ability to meet future demand and the speed of the transition to a fully clean, cheaper electricity system. Strategies to accelerate the transmission buildout and lower costs include better planning, faster permitting, reconductoring existing lines, establishing national transmission corridors, installing advanced transmission technologies, improving energy efficiency, using demand response measures, employing innovative finance, and reducing the cost of materials.

By utilizing the strategies discussed in this paper, utilities, project developers, and the government can help lower costs, improve reliability, and reduce pollution. In ten years, US electricity bills will not look the same as they do today. This paper projects that transmission costs will make up an increasing percentage of a consumer's electricity bill while the generation of electricity will become increasingly cheaper. Ensuring that transmission costs remain as low as possible will help accelerate the energy transition and ensure a secure, reliable, and affordable power grid.

## About the authors

**Ken Berlin** is a nonresident senior fellow with the Atlantic Council's Global Energy Center. He has devoted his career to leadership on environment, energy, and climate change issues. From 2014 to May 2022, Berlin was the president and chief executive officer of the Climate Reality Project, an organization founded and chaired by former US Vice President Al Gore. He built the project into an international organization with offices in eleven countries and 130 chapters in the United States. The Climate Reality Project is dedicated to building public support for addressing the climate crisis. It has led multiday trainings for more than forty thousand climate activists, gathered the activists into a powerful international grassroots network, and activated them to work on climate crisis issues and solutions.

Berlin was a co-founder with Reed Hundt in 2010 of the Coalition for Green Capital, an organization that works with governments at the international, national, state, and local levels to establish green bank finance institutions to accelerate the deployment of renewable energy, energy efficiency, and clean transportation. Prior to that, he chaired the environmental and climate change practices at the law firm Skadden Arps, where he was recognized as one of the leading climate change attorneys in the United States and internationally. He has extensive legal and policy expertise on US and international environmental issues including clean energy, corporate compliance, biodiversity, forestry, and environmental, social, and corporate governance.

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