

Modernizing the U.S. Electricity Grid for Resilience, Load Growth, the Clean Energy Transition, and Energy Security

Executive Summary





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Foreword

This paper is produced within the Energy Futures Finance Forum (EF³), a program within the EFI Foundation focused on increasing the investment quality of decarbonization assets.

Executive Summary

The value of a reliable, resilient, and modern grid has never been clearer than it is today. The United States private sector knows how to build new electric generation, project-by-project. But the U.S. is failing to proactively build the wires that allow that new generation to reach customers.

Investments in manufacturing, data centers, and electrification of buildings, transportation, and industry are causing demand for electricity to spike after a decade of stagnation. States from across the political spectrum are recognizing that their ability to ensure timely and cost-effective access to power is a competitive advantage for attracting jobs and investment spurred by the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA).

The United States electricity delivery system has struggled just to keep up with the repairs of its bulk transmission system. Even as states vie to attract industrial investments, they face intra- and inter-regional transmission system challenges that threaten not only economic growth but also the ability to meet the electricity needs of their residents, businesses, and public services.

This analysis targets one of the most serious financial roadblocks to ensuring access to reliable, affordable, and clean power: the inability to proactively maintain and expand transmission grid capacity to meet rapidly growing energy demand and enable a steady substitution of clean generation for high-emitting generation.

Why focus on transmission planning? Transmission must be planned to be built, and building transmission takes longer than building generation. New load that requires new power is growing today, but regional transmission typically takes at least a decade to build. New power capacity (including all kinds of generator technologies and storage systems) could deploy faster if transmission capital investments could be more quickly planned, agreed upon, and constructed by the nation's regional transmission system operators—particularly the large Regional Transmission Organizations (RTOs) and Independent System Operators (ISOs).

The federal government has major roles to play, including reform of how transmission investments are planned and how the costs of those investments are allocated to ratepayers; financial assistance for transmission capital expenditure; and technical assistance. In all three roles—regulatory, financial, and technical—the federal government can help address the concerns of stakeholders who fear that as the nation addresses the urgent challenge of modernizing the grid, states without clean energy requirements or policies that accelerate electricity load growth may be called upon to subsidize the economic and environmental policy ambitions of other states.

A lack of transmission capacity slows the rapid deployment of new generation and reduces access to reliable, affordable, and clean power.

New generators want to connect to the grid; they wait years to do so. At more than 2,000 gigawatts (GW) of potential capacity, the interconnection queue is nearly double the installed capacity of the entire existing U.S. bulk power system. Unfortunately, new generators must wait an average of five years from interconnection request to commercial operations.¹ The risk, expense, and delay of obtaining transmission service greatly increase the rate at which proposed clean energy projects fail.

While many projects are in the queue, financing them is getting harder because of time, uncertainty, and high interconnection costs. Projects often cannot secure financing until they have firm contractual assurance of the ability to transmit output to market. No grid access means no output delivered, which means no revenues earned, which means no source of funds to repay lenders and investors. Further, to connect to the grid, generators must shoulder ever-increasing costs for “network upgrades.”² As a result, projects that are otherwise economic are unable to bear the interconnection costs and withdraw from the queue.

Connecting to the grid takes years and is expensive because the transmission system lacks spare capacity. A lack of sufficient investment in regional-scale high-voltage lines means that when new generators seek to connect to a regional grid, there is not enough existing transmission capacity available to reliably deliver the power to customers. Thus, new generators are forced to pay for network upgrades that may be located hundreds of miles from the generation site, vastly complicating the development process. Until those network upgrades are done, which can take years, new generation projects are stuck in limbo.

The transmission system does not have spare capacity because planning efforts do not adequately account for future needs. Regions generally do not plan sufficiently far into the future—expert consensus suggests 20 years is appropriate—nor do they adequately account for the wide and varied benefits that transmission provides to ratepayers. Instead,

¹ U.S. Department of Energy, *Queued Up...But in Need of Transmission*, April 2022, [https://www.energy.gov/sites/default/files/2022-04/Queued Up...But in Need of Transmission.pdf](https://www.energy.gov/sites/default/files/2022-04/Queued%20Up...But%20in%20Need%20of%20Transmission.pdf).

² Network upgrades are upgrades required to maintain the reliability of the grid at or beyond the point of interconnection for the generator.

regions typically plan only a few years ahead, evaluate projects individually rather than as portfolios, and compare only a few specific benefits against costs. Even among the markets that have had success, the successful practices are not implemented consistently.

Because of how transmission projects are planned, disagreements erupt over how to pay for projects. Analyses of costs and benefits that can stand up to scrutiny can result in project portfolios in which costs and benefits are equitably distributed, thereby enabling broader support for proposed projects. Unfortunately, because planning processes generally do not include such analytical rigor, stakeholders are more likely to challenge plans when it becomes clear that costs are not commensurate with benefits, whether regionally or in particular parts of a given market. Such challenges often take the form of litigation to overturn entire plans as well as delays in siting and permitting projects deemed not to be in a particular jurisdiction’s interest.

The economic and reliability benefits are often sufficient to justify investments in new capacity. Decarbonization is an added benefit. A decade of underinvestment in transmission capacity means that economic and reliability benefits, like reduced congestion costs, access to lower cost generation, and mitigation of extreme weather events, outweigh the investment costs of new capacity. While additional transmission capacity certainly also provides decarbonization benefits, the economic and reliability benefits alone are sufficient to make the economic case for new capacity. The question is who pays for reliability and resilience within current rate structures?

The Federal Energy Regulatory Commission (FERC) has proposed a rule³ (referred to as the “May 2022 NOPR”) to improve regional electric transmission planning and cost allocation that incorporates many best practices. Its effectiveness will depend on the strength of the rule’s requirements. The best practices included in FERC’s proposed rule appear to have drawn heavily from recent regional precedents—successful and unsuccessful—for planning and implementing investments to meet transmission requirements over the long term. The proposed rule, however, can go further in requiring transmission planners to adopt successful practices.

Three major conclusions from this analysis should inform transmission planning and cost allocation:

- 1. Long-term regional planning of transmission is crucial for ensuring access to reliable, affordable, and clean power.** Planning for future needs over a 20-year time horizon is a crucial component of conventional annual capital budgeting for reliability and congestion. It is not about adding new bureaucracy or top-down industrial policy.

³ Notice of Proposed Rulemaking, *Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection*, 179 FERC 61,028 (May 2022).

2. **Transmission benefits ratepayers in a variety of ways, which should be accounted for when evaluating portfolios of projects.** Methodologies for quantifying those benefits should be analytically rigorous and analysis results must be transparent. This is particularly important if climate benefits are considered so that stakeholders who do not prioritize climate goals can trust that the non-climate benefits still exceed costs.
3. **Decisions about who pays for transmission can be simplified by integrating the planning process (i.e., identifying, evaluating, and selecting projects) and the cost allocation process (i.e., deciding how costs should be spread).** The cornerstone of planning is a comprehensive evaluation of the costs and benefits to participants and how those are distributed. Logically, a benefit-to-cost analysis cannot be performed conclusively if the method of assigning costs is indeterminate. The ideal scenario is one in which stakeholders reach a consensus *before evaluating and selecting potential projects* on the algorithm for how costs will be calculated and allocated sub-regionally once a portfolio of projects is selected.

Consensus also should be sought on the methodologies for quantifying benefits and how those benefits will be attributed. This approach is termed an *ex-ante* cost allocation and enables the cost allocation process to be tightly integrated with the planning process. In an *ex-post* approach, cost allocation is up for discussion *after* “planning” (including after project selection and benefit-cost analysis is completed). Such a disjointed decision-making process is bound to fuel contentious debates among stakeholders, especially state regulators. *To advocate for a coordinated ex-ante process is to advocate for the early involvement of state regulators—not for the disenfranchisement of state regulators.*

Recommendations to strengthen FERC’s proposed rule and inform its implementation at the regional level:

The Energy Futures Finance Forum’s (EF³) recommendations aim to inform four specific audiences: FERC, the regional stakeholders involved in transmission planning, the U.S. Department of Energy (DOE), and Congress.

- **FERC: Recommendations to strengthen the transmission planning and cost allocation rule.** FERC’s proposed rule includes many best practices that draw upon the real-world experience of ISOs and RTOs over the past decade—good and bad—and upon a wealth of expert techno-economic analyses addressing transmission planning/cost allocation. The four primary recommendations in this analysis build upon those components. (i) The recommendations support FERC’s emphasis on requiring 20-year planning horizons and the consideration of portfolios of projects, incorporating known changes in the generation resource mix and customer demand. (ii) They call for requiring consideration of at least a minimum set of benefits with benefit-cost methodologies that are transparent and clearly distinguish between climate and non-climate benefits. (iii) *Ex ante* cost allocation

methodologies should be published in transmission tariffs, and FERC should establish a backstop default methodology that regions can use if they are unable to reach consensus. (iv) Regarding methodologies, regions should be encouraged—even better, required—to evaluate benefits and costs not just regionally but also subregionally to ensure that costs and benefits are equitably distributed geographically. Without comprehensive subregional benefit-to-cost analysis, any ISO/RTO attempt to implement critically needed regional grid improvements is especially vulnerable to legal attack. Specifically, opponents will argue that costs have not been conclusively shown to be roughly commensurate with benefits across the ISO/RTO’s footprint.

- **Regional transmission stakeholders: Recommendations to inform effective implementation of the final rule.** FERC’s proposed reforms will spark debates about how to plan future transmission needs and how to evaluate costs and benefits. These recommendations propose that, where feasible, planning entities should coordinate 20-year load projections, resource planning, and transmission planning. Where such coordination is too logistically challenging—usually in multi-state markets where each state has its own resource planning timelines, requirements, regulations, etc.—those regions should at least publish assumptions, data, and methodologies used in developing future projections. The recommendations also call for large customers, particularly new customers with large data centers, to play a more active role in developing regional transmission tariffs.
- **Department of Energy: Recommendations for improving computational methods for long-term projections and enabling greater participation in planning processes.** FERC’s proposed rule would require planners to develop 20-year projections of load, generation, and transmission that are highly complex, both methodologically and computationally. DOE does not, nor should it, play a role in developing regulations under FERC’s jurisdiction. However, DOE does have technical expertise within its own offices and in the National Laboratories. Those experts could help ISOs/RTOs craft portfolios of transmission projects that are optimized and demonstrably equitable on a sub-regional basis. It is increasingly clear, based on ISO/RTO documents, that daunting computational issues exist in co-optimizing three types of interrelated models: (i) generation capacity expansion models (i.e. which generators are built), (ii) economic dispatch models (i.e., which generators are operated, when), and (iii) transmission system design/power flow models (i.e., how electricity reaches markets reliably). DOE’s National Transmission Planning Study’s mission includes tackling this triple challenge.

The expanded use of the DOE Transmission Facilitation Program and Transmission Facility Financing Program can also play an important role in facilitating long-term regional transmission planning and cost allocation. The ability of DOE to contract for currently unallocated transmission capacity will help ensure that adequate reserve capacity is planned for the longer term. It also will avoid cost allocation issues that might otherwise arise over uncertainties in the projections of future

requirements. DOE should assess the adequacy of existing funding for this program and seek additional funding as appropriate.

On a related note, these recommendations also encourage DOE to allocate funds made available through the IJJA and IRA to provide capacity funding to state and local agencies to participate in regional transmission planning and tariff-setting processes. Funding state and local participation is integral to establishing regional consensus that can streamline the regional planning/cost allocation process, including the establishment of *ex-ante* cost allocation algorithms.

- **Congress: Recommendations for additional federal financial assistance.**

Without some form of federal assistance, there are bound to be material effects on today's ratepayers as the U.S. seeks to build tomorrow's transmission system. The U.S. will be building transmission to accommodate future load growth and harden the system against increasingly catastrophic weather events—all in an environment of higher interest rates and commodity costs. Additional federal support could ameliorate the strain on ratepayers, whether through targeted grant programs or more broadly applicable Investment Tax Credits (ITC) for high-voltage regional transmission. Such support would fit in with a longstanding practice of the federal government supporting the buildout of infrastructure (especially interstate infrastructure) that provides widespread public benefits (e.g., economic development, reliability and resilience, environmental, clean energy transition, social equity).

A transmission ITC would make transmission spending less daunting and risky for stakeholders, especially if it includes the “direct pay” provisions of the IRA. An ITC, which cuts capital cost by 30%, instantly boosts computed project benefit-cost ratios. The 30% ITC would apply to high-voltage regional lines that are included in regional plans (i.e., selected for cost allocation) and whose costs are allocated in a manner approved by FERC.

Even for transmission project portfolios that can claim high benefit-cost ratios, costs tend to start immediately, whereas benefits grow over the 40- to 50-year life of a transmission line. Thus, this recommendation calls for additional funding for programs like the Transmission Facilitation Program and Transmission Facilities Financing Program. As noted above, these programs allow the federal government to absorb the “carrying cost” of major transmission capacity expansions until growing market demand absorbs excess capacity.