LARGE-SCALE TRANSMISSION DEPLOYMENT SAVES CONSUMERS MONEY

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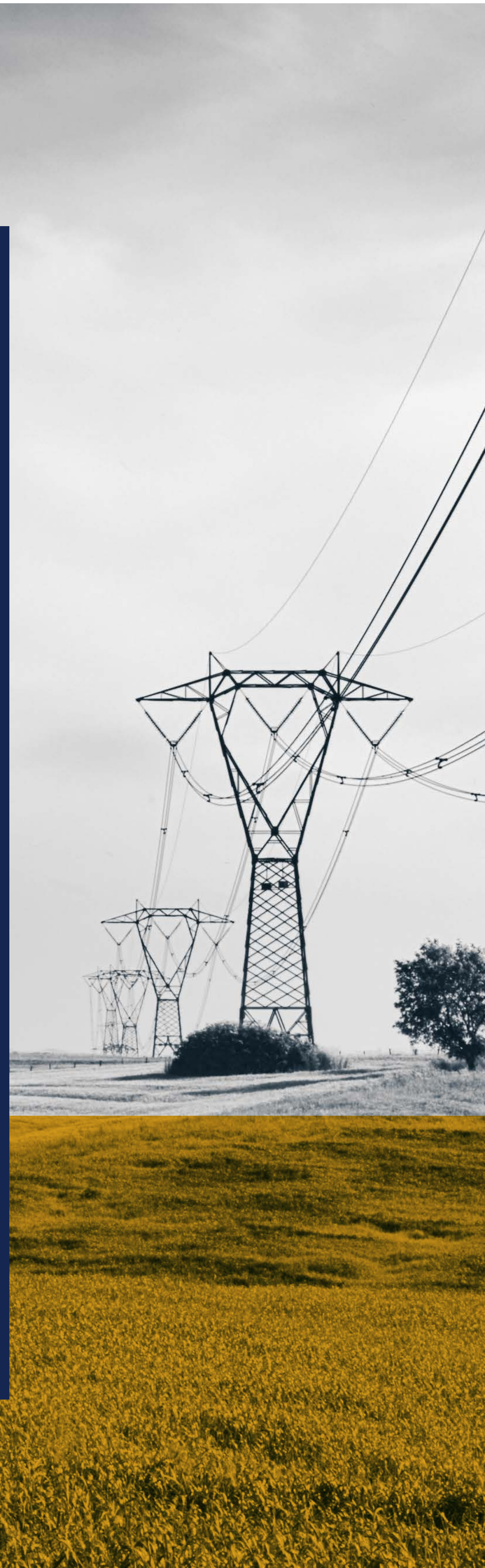
Americans for a
Clean Energy Grid



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EXECUTIVE SUMMARY

The electric grid is the backbone of the U.S. economy and essential to daily life. However, consumers are increasingly worried about rising electric bills. In addition, electricity demand is increasing, driven in part by new data centers and manufacturing. The nation's grid cannot keep pace and continue to reliably and affordably supply electricity to American homes and growing businesses without adequate investment in expanding and upgrading transmission infrastructure.

This report: highlights the need for transmission to meet growing demand; outlines common misconceptions about transmission; provides an overview of the key economic benefits of transmission; and explores the direct residential consumer electric bill savings provided by transmission. We find that comprehensively planned, high-capacity transmission saves consumers money on electric bills, reduces congestion on the grid, unlocks access to lower-cost generation, avoids costlier investments in new generation or lower-capacity transmission, and improves overall system efficiency.

Increased large-scale, proactive, and collaborative transmission planning and development is essential to capturing these electric bill savings for consumers. Proactive regional transmission planning reduces electricity costs by decreasing total needed generation and transmission investments and allows for more efficient operation of the grid. Rather than relying on a reactive, piecemeal approach to grid expansion that triggers costly, near-term transmission needs and solutions, proactive, regional transmission planning allows for the more holistic design of coordinated network solutions to multiple transmission needs that take advantage of economies of scale and facilitate more efficient and cost-effective generator interconnections. In other words, the affordability of electricity supply depends in no small part on the efficiency and cost-effectiveness of the associated transmission expansion.

Our analysis finds that investment in well-planned, high-capacity transmission could save residential consumers $6.3-10.4 billion per year across the United States *after* accounting for the cost of the transmission. Across residential, commercial, and industrial consumers, the national net

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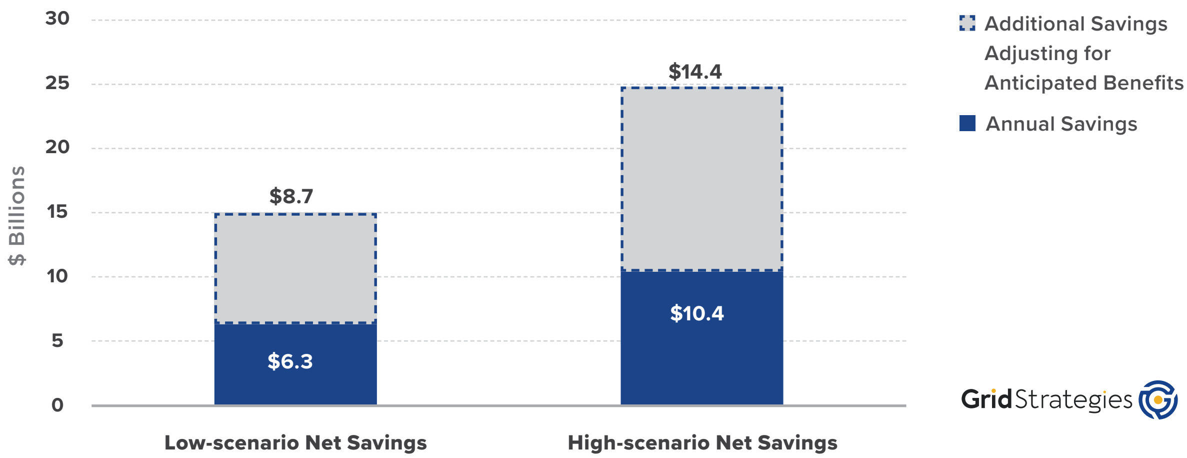
savings escalates to between $16.8-$27.7 billion annually. Additionally, our review of benefit-cost analyses finds that transmission planners often *underestimate* transmission benefits in initial planning studies, and that ex-post assessments of consumer savings are often 20–40% higher than initially projected. Applying this estimate to more accurately reflect potential annual net savings for residential consumers yields $8.7-$14.4 billion back in the pockets of Americans.

FIGURE 1 | National residential electric bill savings from expanded transmission



Our estimate for annual savings is based on recent transmission planning efforts in several regions of the country. But the samples available for the analysis do not necessarily reflect the optimal transmission buildout—meaning well-planned, coordinated, efficient, and cost-effective investments—in every region of the country. For one, the samples available do not include all regions as some regions have not and are not currently planning significant, regional or interregional transmission lines and/or conducting robust benefit-cost analyses of the transmission they are planning. In addition, some of the samples we studied are individual transmission lines as opposed to portfolios of projects. Extrapolating from a combined set of the recent portfolios planned by the Midcontinent Independent System Operator (MISO) discussed in this report, which are among the most robust examples of well-planned, high-voltage transmission, gives a better idea of the full savings consumers might see from more holistic, comprehensive transmission planning. This analysis reveals that *every* residential household in the country could expect over $100 in net savings on their annual electric bill if this type of planning were the norm nationwide. This totals to between $14 billion and $33 billion in annual net savings for everyday American households, a little over double the initial savings estimate even after netting the cost of the transmission itself. For all residential, commercial, and industrial consumers, we estimate these savings are between $38.3-$88.0 billion in annual net savings on electric bills.

At a societal level, transmission also provides a broad set of benefits beyond consumer cost savings. Transmission supports a more reliable, resilient, and competitive power system, which, in turn, benefits national security, particularly as countries compete to develop artificial intelligence (AI) capabilities using electricity-intensive data centers. Transmission directly creates jobs and economic development and enables further investment in new electricity generation that drives economic growth. Lack of sufficient transmission capacity can delay access to electricity for consumers, slowing economic growth and jeopardizing national goals.

While the upfront cost of transmission may raise concerns about electricity affordability, the alternative is accepting a less reliable and more expensive system. The results above highlight the *higher* costs to consumers from *not* building well-planned, high-voltage transmission. These costs are only increased when factoring in the impact of an unreliable electric grid, including more frequent and longer power outages. Estimates of the value of lost load (i.e., blackouts) for residential consumers are in the thousands of dollars per megawatt hour (MWh), making power outages hundreds of times more costly than the price ($/MWh) to consumers of any transmission investments we evaluate in this report. Because transmission can deliver outsized reliability value during critical hours, a line can recover half of its value in just 5% of the hours in a year, acting as an insurance policy during extreme weather events. In short, failing to develop well-planned, high-voltage transmission is far more costly than making needed investments in transmission to meet rising electricity demand and threats to the electric grid.

For individual households, our analysis of transmission benefit-cost studies show that with expanded investment in the grid, the average U.S. household could save between $2,221-$3,672 over the life of the transmission projects. These estimates are net savings, after accounting for the full cost of transmission construction.

TABLE 1 | Lifetime net savings for an average household customer in the United States

Scenario	Lifetime Net savings	Annual Net Savings
Low-scenario savings	$2,221	$44.42
High-scenario savings	$3,672	$73.44

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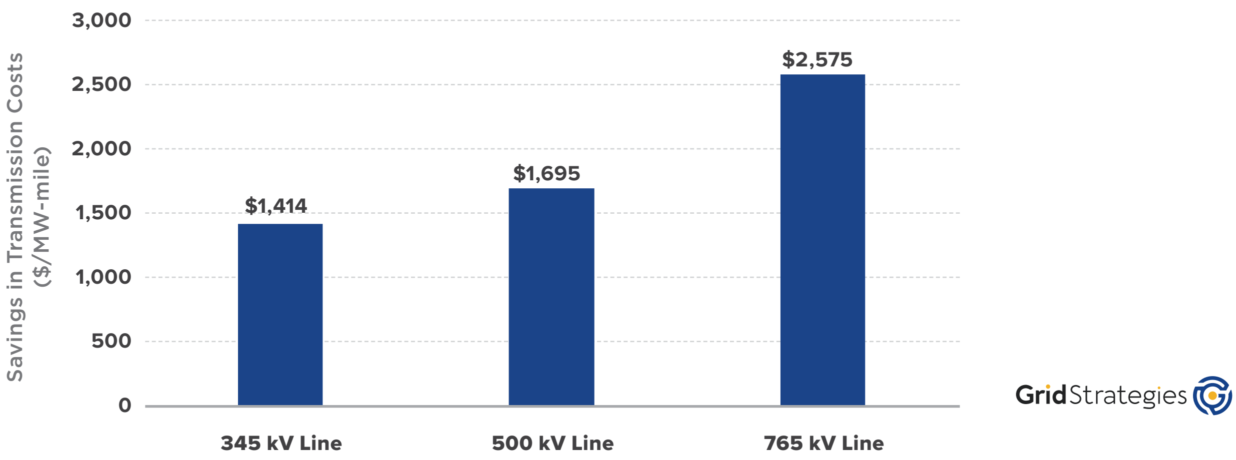
The math is simple. Well-planned, high-capacity transmission yields long-term savings that exceed upfront capital investments. In other words, the benefits outweigh the costs, to the advantage of consumers. Power must get from where it is produced to where it is consumed. With transmission, there are massive “economies of scale,” such that the same amount of power can be delivered for 75% less cost using high-capacity transmission (765 kilovolt, or kV) as compared to lower-capacity transmission (230 kV). Thus, high-capacity transmission reduces the cost per delivered megawatt (MW) of power. This cost flows directly into the bills paid by every American to power their homes and businesses.

FIGURE 2 Savings from deploying high-capacity transmission compared to 230 kV transmission lines

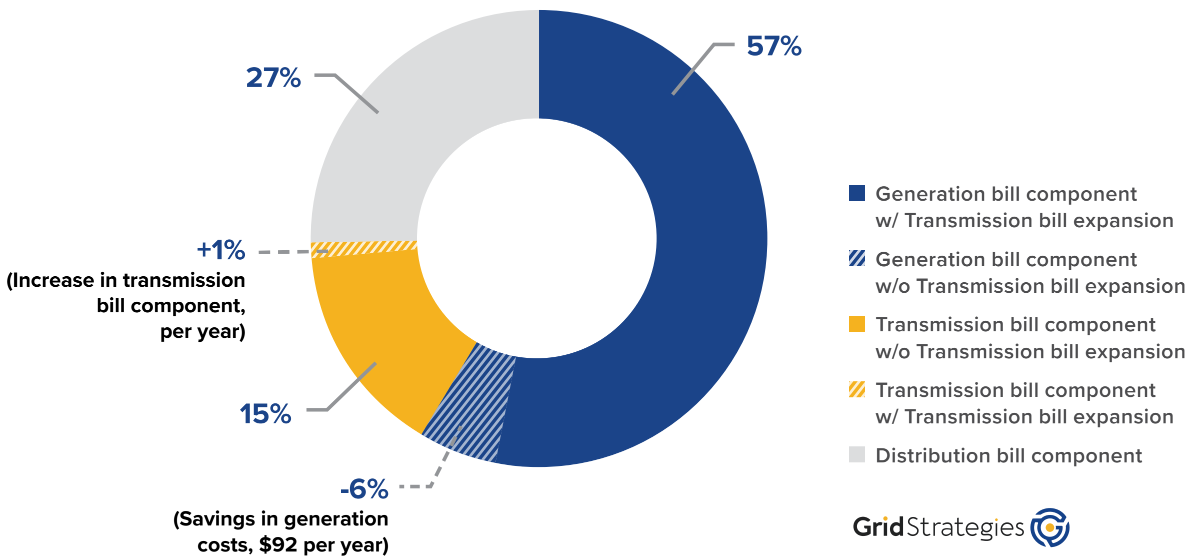


Across those we evaluated, the average benefit-to-cost ratio was between 3.8 to 4.7. This means that for every $1 invested in these transmission lines, consumers receive between $3.80 to $4.70 in benefits. Put another way, looking at all of the MISO Multi-Value Project (MVP) lines, for about $2 per month, residential consumers in MISO are receiving a little over $5 in monthly bill savings.

Much of the estimated retail electric bill savings are associated with production cost savings, the term used to describe savings from lowering the cost of the power supply, such as by accessing lower-cost generation. As can be seen from the figure below, we estimate well-planned, high-capacity transmission investments increase the transmission component of an average residential bill about 2% overall, which is a $19 increase annually. However, these transmission investments facilitate a 3% overall decrease in generation costs, which translates to $92 in savings annually for an average household. The figure below summarizes the expected costs and savings from expanded transmission for residential consumers on their annual bills.

Our analysis of transmission benefit-cost studies show that with expanded investment in the grid, the average U.S. household could save between $2,221-$3,672 over the life of the transmission projects.

FIGURE 3 Average annual U.S. household electric bills with and without well-planned transmission expansion



For this report, we evaluated economic and reliability metrics, which are commonly analyzed by transmission planners, in benefit-cost analyses from 16 transmission studies or plans developed by ISO New England (ISO-NE), New York Independent System Operator (NYISO), MISO, Southwest Power Pool (SPP), Electric Reliability Council of Texas (ERCOT), Southeastern Regional Transmission Planning (SERTP), and independent transmission developers. We then extrapolated from these studies to develop a national estimate of the savings transmission can provide to consumers.

We include two interregional lines in our analysis. Other studies have demonstrated that interregional lines are highly beneficial and produce high benefit-cost ratios.[1] Our analysis confirms that interregional lines provide significant "bang for their buck" to consumers with benefit-cost ratios nearly 5 to 1. However, because interregional lines tend to be individually planned rather than part of a more comprehensive regional (or interregional) transmission plan, the savings that they provide per individual consumer are smaller relative to the savings derived from larger regional transmission plans. To reflect that larger transmission investments yield larger total benefits, we only include the consumer savings results for interregional lines in the low-savings scenario. As a result, our minimum estimate of annual savings for an average U.S. consumer is likely conservative for what could be realized through a larger transmission expansion.

1 *See, e.g.*, M. Goggin, *et al.*, Grid Strategies LLC, *NERC's Recommended Grid Expansion Would Save Consumers Billions* (Feb. 2023), https://gridstrategiesllc.com/wp-content/uploads/GS_NRDC_NERCs-Recommended-Grid-Expansion-Report54.pdf ("NERC's Recommended Grid Expansion Would Save Consumers Billions").

TABLE 2 | Economic and reliability benefits quantified for electric bill savings estimate

Economic and reliability benefits quantified for direct consumer savings:	▸ Production cost savings ▸ Reduced grid congestion ▸ Avoided transmission facilities ▸ Reduced generation capacity needs ▸ Reduced transmission energy losses ▸ Reliability benefits and increased resilience to extreme weather events

Transmission also provides critical optionality to manage the many uncertainties facing the power sector and electricity customers today, including unpredictable load growth, volatile fuel prices, evolving policies, uncertain trajectories for costs of different types of generators, and extreme weather. In finance, these "real options" are quantifiable and are commonly incorporated into investment strategy. But electricity is an essential service, not just an investment. The reality is that price spikes can be crippling for electricity customers, even if they appropriately reflect market design and supply and demand fundamentals. As a commodity, electricity is different. It requires hedging and long-term planning that reflects the importance of the service to residential, industrial, and commercial customers as well as the relative degree of price inelasticity for American households. Well-planned, high-voltage transmission investment is an essential piece of this puzzle. It provides consumer savings under multiple future scenarios and helps mitigate rapidly rising electric bills and increasingly frequent power outages. Transmission provides optionality similar to the highway system, enabling efficient movement of electricity across regions, even when there is traffic or a road closure in one area.

The direct customer benefits of large-scale transmission are real and demonstrable. Yet, despite its clear value, misconceptions about transmission persist. Some argue that utilities should address rising electricity demand solely through adding new generation, or that the high upfront cost of transmission is simply too steep for consumers to bear. These claims overlook that no matter how or where load growth occurs, transmission supports the most efficient delivery of all generation types at the lowest cost to all consumers.

Fundamentally, well-planned transmission is one of the most effective policy tools to ensure affordable, reliable, and resilient electricity supply, especially to manage future uncertainty. The consumer savings are substantial, the benefits are well-documented, and the urgency is growing.

This report is organized as follows. First, we explain the motivation for this report, including rising demand, reliability needs, aging transmission assets, and the lack of efficient transmission development. Next, we rebut a couple of key misconceptions about transmission. Then we dive into the consumer benefits of transmission and why new transmission delivers results. And we finish with the results and discussion of our quantification of the consumer savings from transmission. The methodology we used is included in the Appendix.

No matter how or where load growth occurs, transmission supports the most efficient delivery of all generation types at the lowest cost to all consumers.

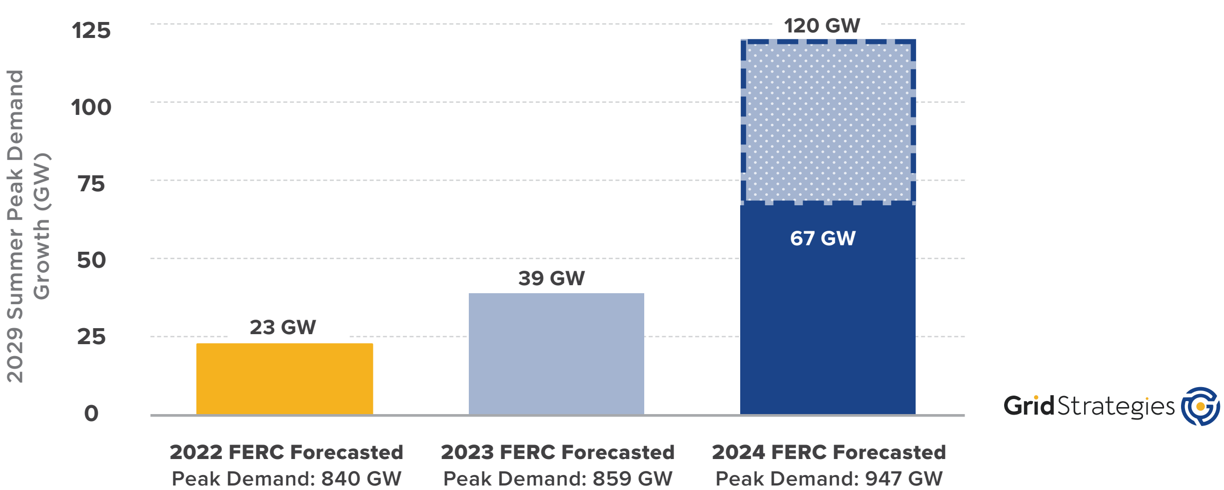
INTRODUCTION AND MOTIVATION

Transmission is essential for minimizing electricity costs for ratepayers, as it allows delivery of low-cost electricity from where it is generated to where it is consumed and allows for greater sharing of resources to lower the overall cost to ensure reliability. Rapid load growth, aging infrastructure, and rising threats from extreme weather are driving a need for new infrastructure, both generation and transmission. Providing affordable electricity to U.S. consumers while maintaining energy security and system resilience requires expanding and modernizing the nation's transmission network. As explained below, it is these needs that led to this report.

Transmission is needed to meet rapid load growth from data centers and manufacturing

After two decades of flat electricity demand, load now appears to be growing quickly. Utilities across the country are revising their demand forecasts upward. A recent analysis by Grid Strategies found that expected load growth has increased fivefold between 2022 and 2024. By 2029, peak demand is projected to rise by 15% from current levels. This surge is primarily being driven by industrial and manufacturing expansion and increasing demand from AI and other data centers.[2]

FIGURE 4 | 5-year load growth forecasts (2022-2024)[3]



Transmission planners are beginning to respond to this projected load growth. PJM Interconnection's (PJM) 2024 Regional Transmission Expansion Plan includes $6.7 billion in

2 J. Wilson, *et al.*, Grid Strategies LLC, *Strategic Industries Surging – Driving US Power Demand,* at 3 (Dec. 2024), https://gridstrategiesllc.com/wp-content/uploads/National-Load-Growth-Report-2024.pdf.

3 J. Wilson, *et al.*, Grid Strategies LLC, *Strategic Industries Surging – Presentation* (April 2025), at 2 (Apr. 2025), https://gridstrategiesllc.com/wp-content/uploads/National-Load-Growth-Report-2024-April-Update-Presentation.pdf ("Strategic Industries Surging (April 2025)").

upgrades specifically designed to manage growing load.[4] SPP approved a $7.7 billion plan driven by regional demand increases, and ERCOT received approval for $33 billion in new transmission to meet growing electricity needs, primarily to serve oil and gas development in the Permian Basin.[5] In the Pacific Northwest, the Bonneville Power Administration (BPA) announced $3 billion in new investments to serve rising load and support new generation interconnections.[6]

National studies confirm the need for transmission. In its 2023 National Transmission Needs Study, the U.S. Department of Energy (DOE) projected that regional transmission capacity must more than double by 2035 in a high load growth scenario.[7] In a separate 2024 National Transmission Planning Study, DOE found that the most cost-effective path for meeting future energy needs while maintaining reliability would require a 2.6 times increase in transmission capacity by 2050. The "high" load growth scenarios in these studies assumed demand growth that now closely mirrors current forecasts, such as Grid Strategies' updated 2024 load growth analysis, which projects a 5-year national average annual load growth of 2.8%.[8]

Transmission is needed to maintain reliability

One of the largest drivers of transmission need and of historic transmission investment is reliability. For example, in 2024, responding to a Congressional mandate, the North American Electric Reliability Corporation (NERC) developed a study to determine the interregional transmission capacity required to enhance the grid's reliability. For the study, NERC evaluated the national grid in 2033 against 12 years of weather data, including historic extreme weather events. Based on its analysis, NERC identified 35 gigawatts (GW) of new interregional transfer capacity required by 2033 to ensure reliability for the U.S. transmission system.[9] Since NERC's mandate is limited to reliability, it does not evaluate economics or consumer impact, but there are massive economic costs from power outages to the same homes and businesses that pay power bills.[10]

Aging transmission assets are driving a reinvestment cycle

The country's transmission system is aging and expanding too slowly and inefficiently to meet today's challenges. Much of the current power system was constructed in the mid-20th century. For example, in the West and Southwest, the Western Area Power Administration (WAPA) and Southwestern Power Administration (SWPA) built the backbone grid in the 1940s and 1950s

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4 E. Howland, Utility Dive, *PJM board approves $6.7B transmission expansion plan* (Feb. 2025), https://www.utilitydive.com/news/pjm-rtep-transmission-expansion-plan-aep-dominion-firstenergy/741097/.

5 *See* Southwest Power Pool (SPP), *2024 Integrated Transmission Planning Assessment* (Jan. 2025), https://www.spp.org/media/2229/2024-itp-assessment-report-v10.pdf; *see also* Electric Reliability Council of Texas (ERCOT), *2024 Regional Transmission Plan (RTP) 345-kV Plan and Texas 765-kV Strategic Transmission Expansion Plan Comparison* (Jan. 2025), https://www.ercot.com/files/docs/2025/01/27/2024-regional-transmission-plan-rtp-345-kv-plan-and-texas-765-kv-strategic-transmission-expans.pdf ("ERCOT 765 kV STEP").

6 E. Howland, Utility Dive, *BPA plans $3 billion in transmission projects, including 500-kV lines* (Oct. 2024), https://www.utilitydive.com/news/bpa-bonneville-transmission-projects-oregon-washington-edam/729978/#:~:text=from%20your%20inbox.-,BPA%20plans%20%243%20billion%20in%20transmission%20projects%2C%20including%20500%2DkV,power%20markets%20in%20the%20West.

7 U.S. Department of Energy, *National Transmission Needs Study*, at vii, viii (Oct. 2023), https://www.energy.gov/sites/default/files/2023-12/National%20Transmission%20Needs%20Study%20-%20Final_2023.12.1.pdf ("Needs Study").

8 *Strategic Industries Surging (April 2025)* at 3.

9 North American Electric Reliability Corporation (NERC), *Interregional Transfer Capability Study* (Nov. 2024), https://www.nerc.com/pa/RAPA/Documents/ITCS_Final_Report.pdf (ITCS).

10 *See generally* The Brattle Group, *Value of Lost Load Study for the ERCOT Region* (Aug. 2024), https://www.brattle.com/wp-content/uploads/2024/09/Value-of-Lost-Load-Study-for-the-ERCOT-Region.pdf.

to deliver hydropower and interconnect to adjacent systems.[11] Across the country, over 70% of the transmission and distribution system assets are past the midpoint of their 50-year life expectancy, with some components exceeding 100 years of age.[12] In PJM's system alone, two-thirds of bulk electric assets are more than 40 years old, and over one-third are more than 50 years old.[13] Old assets must be replaced, and the only question is whether high-capacity or low-capacity investments are made to replace them. Investments in high-capacity transmission (including any required new rights-of-way, upgrades of existing rights-of-way, and upgrades of substations, cables, and other associated assets) are much lower cost for consumers than investments in low-capacity transmission when looking out over the 50+ year life of the assets.

Efficient transmission is not being built

Despite the increasing urgency to modernize the grid, deployment of high-capacity transmission has slowed dramatically. The rates of new high-capacity transmission being built dropped from an annual average of 1,700 miles per year in the early 2010s to just 350 miles per year between 2020 and 2023, with a record low of only 55 miles in 2023 and increasing only slightly to 275 miles in 2024.[14]

At the same time, overall transmission spending is increasing.[15] That said, much of today's transmission spending is focused on low-capacity or simple replacement projects that address immediate local reliability issues or connect individual generators rather than on well-planned transmission portfolios that could efficiently increase capacity.[16] This piecemeal approach limits the potential for broader system optimization and is the most expensive way to expand transmission capacity.

TRANSMISSION MISCONCEPTIONS

Large-scale transmission projects are some of the most significant infrastructure projects built in the United States. These projects are paid for by consumers through electric bills and often come with seemingly large price tags, which invites public scrutiny. Misunderstandings about the value of transmission persist in policy conversations, usually slowing or complicating necessary investments. In this section, we address some of these misconceptions to support sound decision-making that prioritizes consumer affordability and overall system reliability.

11 American Society of Civil Engineers, *2021 Report Card for America's Infrastructure*, at 44 (Mar. 2021), https://infrastructurereportcard.org/wp-content/uploads/2020/12/National_IRC_2021-report.pdf.

12 J. Caspary & J. Schneider, ACORE and Grid Strategies LLC, *Advanced Conductors to Accelerate the Grid*, at 11 (Mar. 2023), https://acore.org/wp-content/uploads/2022/03/Advanced_Conductors_to_Accelerate_Grid_Decarbonization.pdf.

13 *Id.* (referencing PJM Interconnection, *The Benefits of the PJM Transmission System,* at 5 (Apr. 2019)).

14 N. Shreve, *et. al.,* ACEG and Grid Strategies LLC, *Fewer New Miles: The US Transmission Grid in the 2020s*, at 3 (July 2024), https://cleanenergygrid.org/wp-content/uploads/2024/07/GS_ACEG-Fewer-New-Miles-Report-July-2024.pdf.

15 The Brattle Group, *Annual U.S. Transmission Investments 1996-2023,* at 1 (June 2024), https://www.brattle.com/wp-content/uploads/2023/07/Annual-US-Transmission-Investments-1996%E2%80%932023.pdf.

16 *Id.*

FACT

Transmission benefits all generation technologies as well as all consumers

MISCONCEPTION: Transmission only benefits certain generation technologies. Transmission is resource-agnostic and technology-neutral. Once generators produce electricity, it is impossible to differentiate where the electricity originated, meaning the power grid supports the delivery of electricity from all types of generation, including, but not limited to, coal, geothermal, hydropower, natural gas, nuclear, renewables, or storage. In 2024, approximately 42% of electricity generation came from natural gas, 15% from coal, 18% from nuclear, and approximately 24% from wind, solar, and hydropower.[17]

Over the last five years, it happens to be the case that most of the new generation being developed was solar, wind, and storage. If it had been a different set of resources, similar transmission needs would have been identified. Similarly, now that significant new large loads are being added, new transmission is needed for that. And if we develop any other new generation or load, transmission will be needed for that as well. The fact remains that the grid is constrained, and consumers cannot add significant new load or generation without transmission.

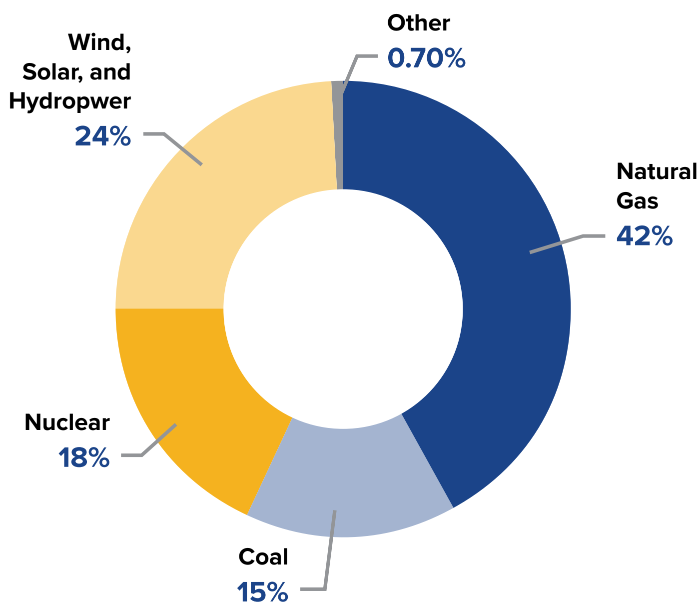


FIGURE 5 | 2024 energy generation by resource type
Data Source: Energy Information Administration[18]

Transmission is resource-agnostic and technology-neutral. Once generators produce electricity, it is impossible to differentiate where the electricity originated, meaning the power grid supports the delivery of electricity from all types of generation, including, but not limited to, coal, geothermal, hydropower, natural gas, nuclear, renewables, or storage. In 2024, approximately 42% of electricity generation came from natural gas, 15% from coal, 18% from nuclear, and approximately 24% from wind, solar, and hydropower.

MISCONCEPTION: Transmission only benefits certain consumers. Some regions of the country are reporting their existing spare transmission capacity will be fully subscribed by the end of the decade.[19] Transmission enables the most economical and reliable generation at any moment

17 Energy Information Administration (EIA), *Electric Power Monthly: Table 1.1. Net Generation by Energy Source,* https://www.eia.gov/electricity/monthly/ (last accessed May 16, 2025).

18 *Id.*

19 J. Wilson & Z. Zimmerman, Grid Strategies LLC, *The Era of Flat Power Demand is Over,* at 20 (Dec. 2024), https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf.

to be delivered to consumers, providing system-wide benefits including increased reliability, reduced congestion and fuel costs, reduced need for overall generation, decreased market power, and enhanced resilience to outages. These benefits accrue to all consumers regardless of the generation mix, making transmission a broadly beneficial public investment.

The broad benefits of a more interconnected transmission system for load, generation, and consumers have been apparent for most of the history of the utility industry. In the mid-1930s, the Federal Power Commission, the precursor to the Federal Energy Regulatory Commission (FERC), evaluated options to increase transmission connections between systems, stating: "[t]he FPC also investigated the feasibility of a system of high capacity transmission interconnections tying together the major power-market and industrial centers of the East to assure more economical use of existing capacity and less likelihood for interruption of service in any defense production area."[20] Similarly, in 1965, after a massive blackout in the Northeast, the official report to President Johnson concluded: "Isolated systems are not well adapted to modern needs either for purposes of economy or service" and recommended "an acceleration of the present trend toward stronger transmission networks within each system and stronger interconnections between systems in order to achieve more reliable service at the lowest possible cost."[21]

FACT

Transmission costs may rise, but overall, bills will be lower due to access to lower cost generation

Misconception: Transmission is expensive and only leads to rising electric bills. There has been significant recent discussion and concern over the rising cost of electric bills.[22] After many years of flat or slightly declining real prices of electricity, electric bills and the costs of the components of the electric power system are now rising faster than inflation. The first impulse may be pointing to the price tag of a transmission plan as evidence that transmission development harms consumers. However, transmission is currently only around 14% of residential electric bills. Generation comprises 60% of an average U.S. consumer's electric bill.[23] Well-planned transmission allows for greater access to lower cost generation, and more efficient dispatch of the existing portfolio of generation. Investing in well-planned large-scale transmission may cause a rise in the share of the total electric bill attributable to transmission, but that should be accompanied by a reduction in generation costs. Co-optimized generation and transmission development is key to lowering the total electricity price paid by consumers. In other words, singling out one component to blame for rising electric bills misses the forest for the trees.

20 Philip L. Cantelon, Federal History, *The Regulatory Dilemma of the Federal Power Commission, 1920–1977,* at 69 (2012), https://shfg.wildapricot.org/resources/Documents/FH%204%20(2012)%20Cantelon%202.pdf.

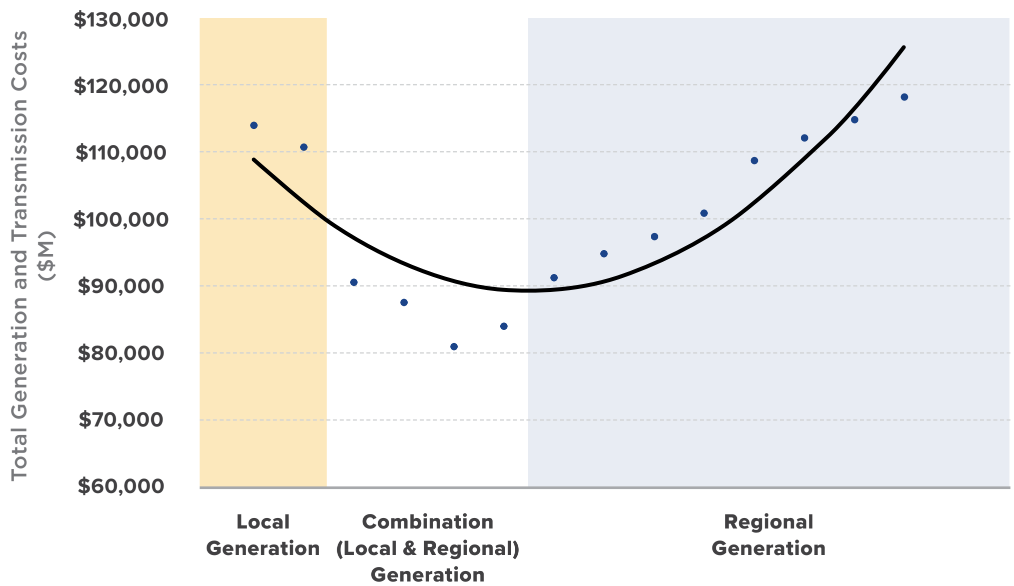
21 M. Chupka & P. Donohoo-Vallett, WIRES and The Brattle Group, *Recognizing the Role of Transmission in Electric System Resilience,* at 2 (May 2018), https://wiresgroup.com/wp-content/uploads/2020/06/2018-05-09-Brattle-Group-Recognizing-the-Role-of-Transmission-in-Electric-System-Resilience-.pdf (quoting Federal Power Commission, *Report to the President on the Power Failure in the Northeastern United States and the Province of Ontario on November 9-10, 1965,* at 43 (Dec. 6, 1965)).

22 *See* C. Hua, PowerLines, *Utility Bills Are Rising* (Apr. 2025), https://powerlines.org/wp-content/uploads/2025/04/PowerLines_Utility-Bills-Are-Rising_2025-1.pdf.

23 EIA, *Annual Energy Outlook 2025: Table 8. Electricity Supply, Disposition, Prices, and Emissions* (Apr. 2025), https://www.eia.gov/outlooks/aeo/tables_ref.php.

The alternative to a co-optimized system is the overbuild of generation resources closer to load, leading to a much more expensive system and higher overall electric bills. The figure below from MISO, known as the bathtub curve, illustrates this reality.[24] Based on studies of its grid, MISO realized that as investment in transmission decreases, more and higher-cost local generation is required to take the place of lower cost and more efficient generation located farther from load, which requires transmission to deliver the power.

FIGURE 6 | **Optimizing transmission and generation delivers lowest overall system costs for consumers** *Source: MISO*[25]



The analysis from MISO demonstrates that an optimal mix of transmission and local and regional generation can deliver power at 30% lower overall system costs to consumers. The figure above shows this relationship between the cost of the power system and the distance of generation from load. On the x-axis is the location of generation relative to load, while the y-axis represents all-in transmission and generation cost.

24 MISO, *MTEP17 MVP Triennial Review,* at 31 (Sept. 2017), https://cdn.misoenergy.org/MTEP17 MVP Triennial Review Report117065.pdf ("MTEP17").
25 *Id.*

CONSUMER BENEFITS OF TRANSMISSION AND WHY NEW TRANSMISSION DELIVERS RESULTS

There are many consumer benefits from transmission. High-voltage transmission plays a critical role in lowering consumer electricity costs by enabling reliable and efficient power delivery from the most cost-effective sources across a broader geographic area. Similar to how the interstate highway system facilitates the delivery of goods from regions where they are most efficiently produced (e.g., delivering oranges from Florida to the rest of the country), the transmission network delivers electricity from areas with lower generation production costs to where it is needed.

Although transmission projects often require substantial upfront capital, the long-term savings they generate—when well-planned—outweigh these initial investments. Studies consistently show that well-planned transmission reduces congestion on the grid, unlocks access to lower-cost generation resources, and improves overall system efficiency. By displacing more expensive or underutilized local generation, transmission reduces the cost of supplying electricity, ultimately leading to lower retail electricity prices for consumers.

Below we describe the benefits that we consider in our report: economies of scale from higher-capacity transmission investments; production cost savings; reduced need for generation; avoiding other, less efficient transmission investments; and reliability and resilience benefits.

TABLE 3 | Economic and reliability benefits quantified for electric bill savings estimate

Economic and reliability benefits quantified for direct consumer savings:	▸ Production cost savings ▸ Reduced grid congestion ▸ Avoided transmission facilities ▸ Reduced generation capacity needs ▸ Reduced transmission energy losses ▸ Reliability benefits and increased resilience to extreme weather events

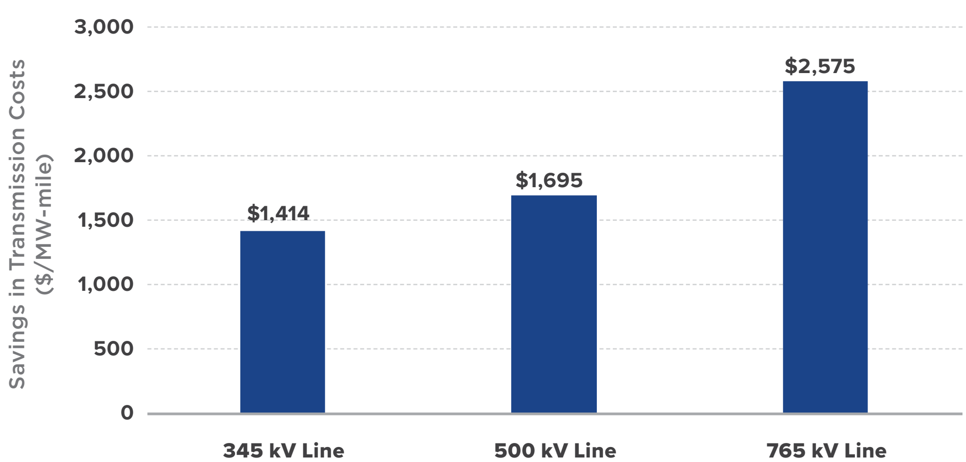
Note that transmission supports a range of additional benefits to consumers that are not always reflected in electric bills but are nevertheless important to acknowledge. These include promoting competition in electricity markets by enabling consumers to choose from many generators across wide geographic areas; and spurring economic growth by generating jobs, increasing tax revenues, and supporting industrial and other commercial development. Many of these benefits extend across utility territories and state boundaries, providing widespread value throughout the system. Over time, the specific benefits of transmission evolve as the system and economy change, underscoring the long-term value and adaptability of transmission investments. While these benefits are important for society, our report focuses on the benefits that directly impact consumer electric bills.[26]

Economies of scale drive consumer savings

Higher-voltage transmission lines significantly reduce consumer costs by capturing economies of scale. By moving larger volumes of electricity more efficiently across long distances, higher-voltage transmission reduces power losses and minimizes the need for more expensive, piecemeal investments in lower-voltage transmission.

High-capacity transmission is a quarter of the cost of low-capacity options, resulting in 75% savings to consumers over the life of the investment. Cost comparisons for power delivery on a per-MW-mile basis underscore this advantage for higher-voltage transmission. For instance, using data from MISO summarized in the table below, 765 kV lines deliver power at just $855 per MW-mile, compared to $3,430 per MW-mile for 230 kV lines. While higher-voltage lines may have a slight upfront premium, these differences highlight the long-term ratepayer savings made possible through investment in higher-capacity infrastructure.

FIGURE 7 | Savings from deploying high-capacity transmission compared to 230 kV transmission lines *Data Source: MISO*[27]



ERCOT recently demonstrated the savings achieved by using 765 kV transmission lines compared to 345 kV. ERCOT is experiencing significant load growth in the Permian Basin and, at the request of the state legislature, developed a transmission plan to meet the forecasted load growth. While creating the plan, ERCOT developed two scenarios: one using 345 kV lines, and the other using 765 kV lines. ERCOT found that while the 345 kV plan cost $2.24 billion less than the 765 kV plan, the 765 kV plan provided significant additional savings to Texas consumers because 765 kV

26 The Brattle Group provides an extensive discussion on the numerous benefits transmission can provide. *See e.g.* J. Chang, *et al.,* The Brattle Group, *The Benefits of Electric Transmission: Identifying and Analyzing the Value of Investments,* at 54 (July 2013), https://www.brattle.com/wp-content/uploads/2021/06/The-Benefits-of-Electric-Transmission-Identifying-and-Analyzing-the-Value-of-Investments.pdf ("The Benefits of Electric Transmission").

27 MISO, *Transmission Cost Estimation Guide for MTEP24* (May 2024), https://cdn.misoenergy.org/MISO%20Transmission%20Cost%20Estimation%20Guide%20for%20MTEP24337433.pdf ("Transmission Cost Estimation Guide"). Table 1 was prepared using the reported Power rating (MVA) capacity data in Table 3.1.5 on page 33 and the average estimated costs for transmission across all MISO states reported in Tables 4.1.1 and 4.1.2 on pages 38–39. The Power rating (MVA) capacity data for the Double Circuit are twice the capacity for the Single Circuit.

lines deliver power at 40% of the cost of 345 kV lines.[28] The 765 kV plan achieved $229 million more in annual consumer energy cost savings, $28 million more in annual production cost savings, and reduced construction-related outage costs by $890 million compared to the 345 kV plan.[29] ERCOT also estimated that the 765 kV plan reduced energy losses by 560 GWh annually. ERCOT did not quantify the value of those reductions;[30] however, efficiency savings are particularly valuable because they are highest during periods of peak grid congestion, when transmission lines are near maximum capacity, which increases losses because the transmission lines are running hot. ERCOT also found that the 765 kV plan increased transfer capabilities and required 1,443 fewer miles of upgrades to existing lines, though ERCOT did not calculate these economic savings.[31] Nevertheless, the ERCOT example clearly demonstrates the economies of scale to be gained through prioritizing high-voltage transmission investments over lower-voltage ones.

The 765 kV plan achieved $229 million more in annual consumer energy cost savings, $28 million more in annual production cost savings, and reduced construction-related outage costs by $890 million compared to the 345 kV plan.

Production cost savings

Access to lower-cost electricity is the easiest and most commonly quantified benefit of transmission, usually referred to as production cost savings. Transmission lowers consumer electricity costs by enabling access to the most affordable power sources. This system-wide optimization allows grid operators to dispatch more efficient and lower-cost generation resources, displacing costlier alternatives. As a result, fuel and other variable generator operating costs and wholesale power prices are reduced, decreasing retail electricity rates.

Examples from across the United States illustrate these benefits. The Brattle Group (Brattle) released a study in April 2025 reviewing regional transmission planning in the Southeast. To demonstrate the value for regional transmission, Brattle performed a high-level analysis of three 500 kV upgrades SERTP identified as potential transmission solutions in its 2024 process.[32] Based on their analysis, Brattle estimated the three lines, if built, would provide between $2–3.6 billion in production cost benefits over the life of the lines.[33] Brattle conducted a limited analysis but still found significant consumer benefits if the lines were constructed, estimating that for every $1 invested in the 500 kV lines, consumers would receive approximately $1.60 in benefits.[34] Similarly, SPP projected $1.3 billion in adjusted production cost savings from its priority transmission projects, approximately 62% of the cost of the lines.[35] These examples underscore the tangible economic value transmission investments provide by enabling more flexible, cost-effective dispatch of the power system. Discussed in more depth later in the

28 ERCOT 765 kV STEP at vii.

29 *Id.*

30 *Id.*

31 *Id.*

32 J. Michael Hagerty, *et al.*, The Brattle Group, *Modernizing Southeast Grid Investments: How Enhanced Regional Transmission Planning Supports a Growing Economy*, at 47-48 (Apr. 2025), https://www.brattle.com/wp-content/uploads/2025/04/Modernizing-Southeast-Grid-Investments-How-Enhanced-Regional-Transmission-Planning-Supports-a-Growing-Economy.pdf ("Modernizing Southeast Grid Investments").

33 *Id.*

34 *Id.*

35 SPP, *SPP Priority Projects Phase II Report, Rev. 1*, at 23 (Apr. 2010), https://www.spp.org/documents/11467/priority%20projects%20phase%20ii%20report.pdf.

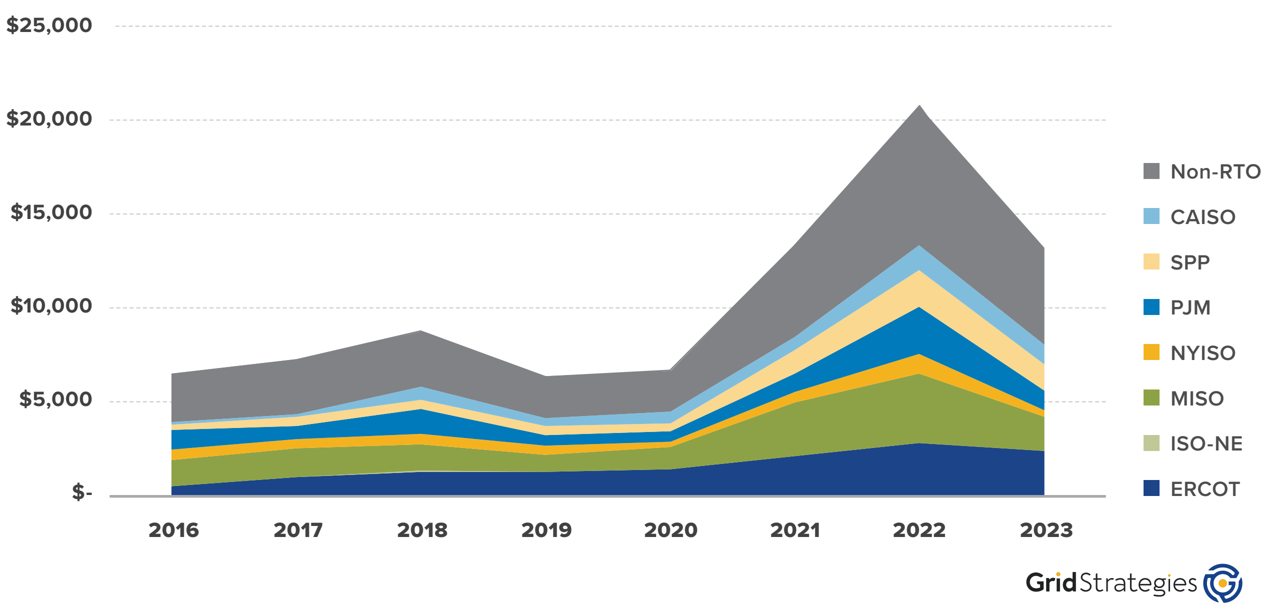
results section, access to lower-cost electricity is generally the largest benefit calculated for transmission expansion plans. For example, over 90% of the benefits of the MISO MVP lines, $20.1 billion out of $22.1 billion, are from "congestion and fuel savings," which translates to access to lower cost energy.[36]

Reduction in grid congestion

Limited transmission capacity restricts the flow of the lowest-cost electricity to consumers, resulting in higher electricity prices. This inefficiency is quantified in studies through congestion costs, which are a sub-benefit of accessing lower cost energy described above and reflect the added expense of relying on more expensive local generation when cheaper power cannot reach consumers.

Consumers can realize significant savings from congestion reduction. Organized markets publicly track congestion costs in two-thirds of the country (everywhere but the Southeastern and Western United States). In 2023 alone, reported congestion costs increased electricity prices by $8 billion in organized markets, which serve two-thirds of U.S. consumers, with national estimates of congestion reaching $11.5 billion in increased energy prices when scaled to total U.S. demand.[37]

FIGURE 8 | **Estimated transmission congestion costs for the U.S.**[38]



Several regions have demonstrated the value of transmission investment to reduce congestion costs. For instance, ISO-NE saw congestion costs fall from over $700 million annually in 2005

36 MTEP17 at 23.

37 N. Shreve, *et. al.*, Grid Strategies LLC, *2023 Transmission Congestion Report*, at 4 (Sept. 2024), https://gridstrategiesllc.com/wp-content/uploads/Grid-Strategies_2023-Transmission-Congestion-Report.pdf.

38 *Id.*

and 2006 to under $100 million annually for the past decade after targeted transmission deployment came online.[39] Similarly, in a 2019 report evaluating the benefits of its transmission system, PJM found that its new transmission investments were expected to lower congestion costs by nearly $300 million annually.[40]

High-capacity transmission is a quarter of the cost of low-capacity options resulting in a 75% savings to consumers. Cost comparisons for power delivery on a per-MW-mile basis underscore this advantage for higher-voltage transmission.

Reduction in need for generation

Transmission reduces the need for excess power plant capacity. Transmission ties allow utilities to tap into diversity in the timing of peak electricity demand and supply shortfalls among their footprints, so each utility can achieve the same level of resource adequacy with a lower planning reserve margin. The reduction in generation needs lowers overall system costs for consumers.

During extreme weather events, some regions may face generation shortfalls while others have excess capacity. The table below illustrates each region's net load as a percentage of its peak net load over a nine-year period. Regions with high percentages (near or at 100%) are under significant strain, while those with lower percentages typically have surplus capacity. Additional investments in transmission can help mitigate these stressed conditions by transferring electricity from areas with available supply to those experiencing shortages, thereby reducing the overall need for individual regions to invest in generation and enhancing system reliability during critical periods.

FIGURE 9 | Regional load as a percentage of maximum load (2014-2022)[41]

	ERCOT	SPP	MISO S	TVA	MISO N	PJM	NYISO	ISO-NE	Carolinas	SOCO	Florida
1/17/2014 7 AM ET	58%	60%	74%	86%	75%	100%	68%	64%	88%	87%	60%
1/17/2018 10 AM ET	60%	67%	100%	81%	61%	70%	61%	63%	56%	85%	61%
1/18/2018 6 AM ET	58%	50%	65%	76%	55%	66%	51%	55%	63%	100%	79%
2/15/2021 10 AM ET	100%	99%	83%	61%	69%	63%	56%	59%	58%	68%	55%
12/23/2022 6 PM ET	68%	87%	88%	99%	86%	85%	60%	56%	88%	91%	65%
12/24/2022 6 AM ET	63%	87%	87%	91%	77%	85%	49%	50%	100%	95%	66%

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39 ISO-NE, *On the Horizon: 2022 Regional Electricity Outlook*, at 28 (June 2022), https://www.iso-ne.com/static-assets/documents/2022/06/2022_reo.pdf.

40 *See* PJM, *PJM Value Proposition* (2019), https://www.pjm.com/-/media/DotCom/about-pjm/pjm-value-proposition.pdf ("Benefits of the PJM Transmission System").

41 M. Goggin, *et al.*, ACEG and Grid Strategies LLC, *Quantifying a Minimum Interregional Transfer Capability Requirement*, at 4 (May 2023), https://gridstrategiesllc.com/wp-content/uploads/2023/05/GS_Interregional-Transfer-Requirement-Analysis-final54.pdf.

While not always calculated, interregional transmission lines provide some examples where regions can reduce their planning reserve margin or add new capacity. Xcel Energy in Colorado reduced its reserve margin from 19.2% to 16.3% with just 200 MW of interregional transmission.[42] Grid United is developing two major interregional transmission lines—North Plains Connector and Three Corners Connector—that, based on studies from Astrapé Consulting, are able to provide firm, bi-directional capacity across the Eastern and Western Interconnections. According to the analysis, North Plains Connector will provide 2,500 MW of capacity, which we estimate will yield approximately $280 million in annual capacity benefits to consumers.[43] Three Corners Connector will provide about 2,000 MW in capacity, which represents $165 million in annual capacity benefits.[44] In addition, looking at analysis of interregional ties to PJM, those increased connections have contributed $1.3 to $1.7 billion in annual savings.[45]

The examples above are focused on interregional transmission, but real-world regional studies demonstrate the value of this benefit as well. In SPP, 8% of its $1.354 billion in net present value benefits stem from transmission, reducing the need for generation capacity by 2%.[46] PJM saved $3.78 billion annually by reducing capacity needs by more than 33 GW and lowering its planning reserve margin from 22% to 15.7% as a result of transmission.[47] And the Brattle report, discussed above, found that the load diversity cost savings from the three lines in the Southeast that Brattle studied provide approximately $3.3 billion in benefits.[48]

Avoided transmission investments

Proactive regional transmission planning can also significantly reduce electricity costs by reducing transmission investments. Rather than relying on a reactive, piecemeal approach that triggers costly near-term transmission needs and solutions, proactive regional transmission planning allows for the more holistic design of coordinated network solutions to multiple transmission needs that take advantage of economies of scale and facilitate more efficient and cost-effective generator interconnections.

Studies in MISO reflect these efficiencies. In 2017, interconnection costs for individual generators in the interconnection queue of the western region of MISO exceeded $750 per kW, while MISO estimated the proactively planned MVPs could interconnect new generation at costs closer to $400 per kW. A 2014 study from MISO went even further, demonstrating that a $2,567 billion regional transmission buildout could integrate 17,245 MW of least-cost generation at only $149 per kW.[49] These examples illustrate that proactive planning of large-scale transmission results in more efficient outcomes and delivers significant benefits to consumers.

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42 Ventyx, *Analysis of "Loss of Load Probability" (LOLP) at various Planning Reserve Margins,* at 2-9 (Dec. 2008), https://www.xcelenergy.com/staticfiles/xe/Regulatory/Regulatory%20PDFs/PSCo-ERP-2011/Attachment-2.10-1-LOLP-Study.pdf.

43 A more detailed discussion of the capacity and production cost savings benefits calculations for the North Plains Connector can be found in the methodology section of the report. *See* Astrapé Consulting, *North Plains Connector (NPC) Evaluation,* at 6 (May 2024), https://www.gridunited.com/wp-content/uploads/2024/06/North-Plains-Connector-Evaluation_Final-Report_Astrape-Reviewed_FINAL.pdf ("North Plains Connector ELCC Study").

44 Astrapé Consulting, *Three Corners Connector Project Evaluation, PowerGEM,* at 5-6 (Dec. 2024), https://www.dora.state.co.us/pls/efi/efi_p2_v2_demo.show_document?p_dms_document_id=1039334&p_session_id= ("Three Corners Connector ELCC Study").

45 Benefits of the PJM Transmission System at 21.

46 SPP, *The Value of Transmission,* at 16 (Jan. 2016), https://www.spp.org/documents/35297/the%20value%20of%20transmission%20report.pdf ("SPP Value of Transmission").

47 Benefits of the PJM Transmission System at 21.

48 Modernizing Southeast Grid Investments at 48.

49 GE Energy Consulting with MISO, *Minnesota Renewable Energy Integration and Transmission Study: Final Report,* at 4-21 (Oct. 2014), https://mn.gov/commerce-stat/pdfs/mrits-report-2014.pdf.

Reliability and resilience benefits

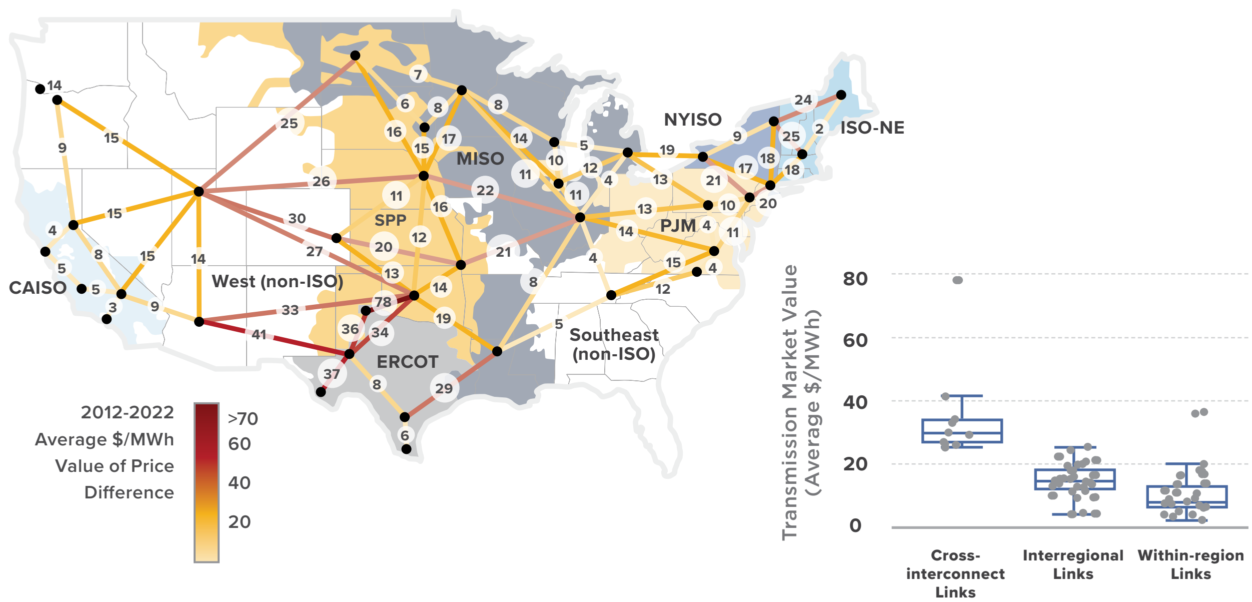
Investments in large-scale transmission also improve grid reliability and resilience by limiting load shedding (i.e., power outages) during extreme weather events and increasing access to resources of neighboring regions during periods of high grid stress. The reliability and resilience benefits of transmission not only lead to fewer power outages, but also shorter ones. Extreme weather events, particularly winter storms, can significantly stress the grid due to unplanned outages from generators and potentially higher than anticipated electricity demand. These grid conditions can lead to high congestion and price spikes as grid operators look to generation imports and, where lower-cost imports cannot meet the need, to dispatching more expensive, less efficient generation within the more local area to avoid blackouts. Where the need cannot be met, grid operators have no choice but to shed load to avoid a more widespread system failure.

Transmission can prevent rate shock or widespread blackouts during rare but catastrophic weather events, providing particular value for vulnerable customers by powering needed heating and cooling resources and refrigeration for food and medication.

Price spikes can be devastating for consumers, especially small businesses, retail customers, and low-income households. Mere hours of extreme weather can lead to skyrocketing electric bills, on top of losses from service disruptions. Although extreme conditions may occur only a few days per year, the economic and reliability value of transmission during these events can be enormous. Transmission can prevent rate shock or widespread blackouts during rare but catastrophic weather events, providing particular value for vulnerable customers by powering needed heating and cooling resources and refrigeration for food and medication.

The cost of extreme weather events is backed up by analysis from the Lawrence Berkeley National Laboratory (LBNL), which found that the benefits of transmission are often concentrated in a small number of hours. LBNL found that 50% of the value from a typical transmission line accrued in just 10% of hours, and 37% of the value came from only 5% of hours.[50] Although this was slightly less concentrated than in prior years, the trend underscores how a small number of high-stress periods account for a disproportionate share of transmission's reliability value. The figure below from LBNL shows the market value of transmission based on average wholesale prices across the country. As wholesale prices rise, so too does the value of transmission.[51]

FIGURE 10 | Value of transmission (2012-2022) ***Source: LBNL with modifications***[52]



In addition, analysis by Grid Strategies of extreme weather events, such as Winter Storms Elliott and Uri, reinforces LBNL's findings. During Winter Storm Elliott, a 1 GW transmission line between ERCOT and the Tennessee Valley Authority (TVA) could have delivered nearly $95 million in value, primarily to TVA customers.[53] That same line flowing towards Texas two years earlier during Winter Storm Uri would have provided Texans with close to $1 billion in benefits.[54] Based on rough transmission cost estimates, the benefits from these two events over a two year period would have recovered the cost of the transmission line between the regions.[55]

50 D. Millstein, *et al.*, Lawrence Berkeley National Laboratory, *The Latest Market Data Show that the Potential Savings of New Electric Transmission was Higher Last Year than at Any Point in the Last Decade*, at 3 (Feb. 2023), https://eta-publications.lbl.gov/sites/default/files/lbnl-transmissionvalue-fact_sheet-2022update-20230203.pdf.

51 *Id.*

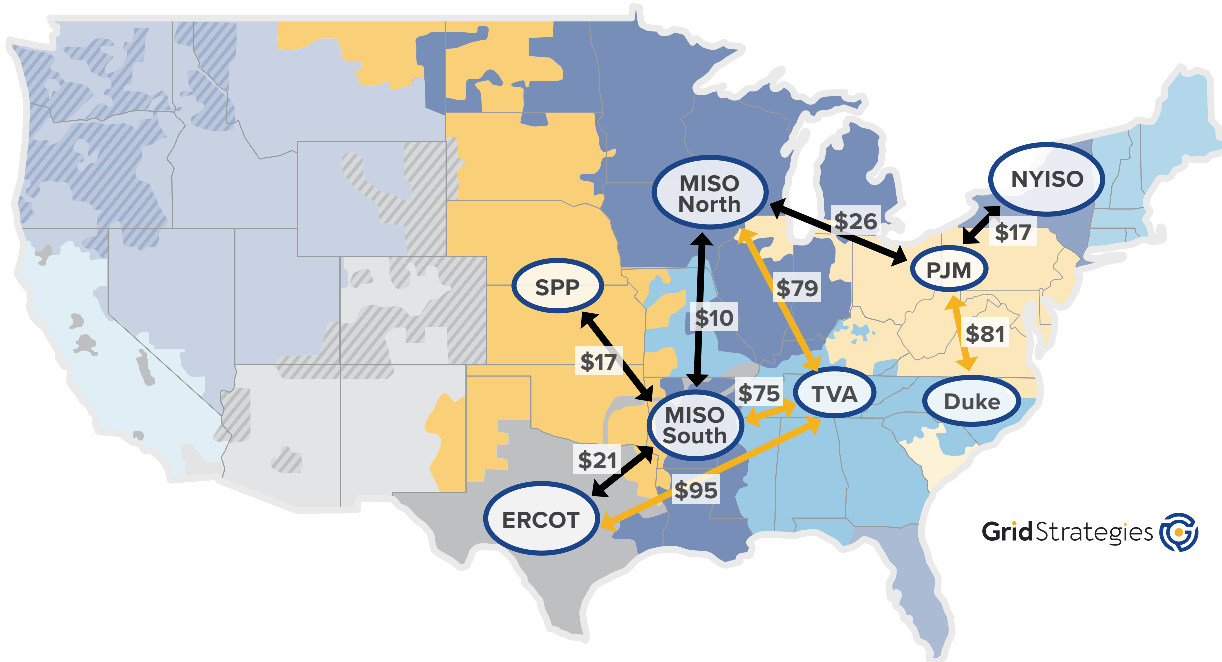
52 D. Millstein, *et al.*, Preprint under review at Nature Portfolio, *Electric transmission value and its drivers in United States power markets*, at 4, https://assets-eu.researchsquare.com/files/rs-3957695/v1_covered_923cf4c7-f439-4b96-8bec-7a54e5fd6f8f.pdf?c=1711684805 (last accessed May 27, 2025) ("Electric transmission value and its drivers").

53 M. Goggin & Z. Zimmerman, ACORE and Grid Strategies LLC, *The Value of Transmission During Winter Storm Elliot*, at 1-2 (Feb. 2023), https://acore.org/wp-content/uploads/2023/02/The-Value-of-Transmission-During-Winter-Storm-Elliott-ACORE.pdf ("Value of Transmission During Winter Storm Elliot").

54 *Id.*

55 *See* Transmission Cost Estimation Guide.

FIGURE 11 | Value of transmission during Winter Storm Elliott in millions of dollars[56]



London Economics analysis of transmission under constrained conditions similarly finds that a hypothetical 1,300 MW transmission project between MISO and PJM could save consumers up to $1.3 billion annually in PJM and $740 million in MISO under constrained conditions.[57] In the Western United States, London Economics estimated a hypothetical transmission line from Colorado to California would produce more than $100 million in yearly savings from improved resilience.[58] Additionally, by reducing the frequency and severity of blackouts and large-scale outages, the projects could yield an extra $500 million in annual economic benefits in each region, totaling $1.5 billion per year, per London Economics.[59]

The same 765 kV plan from ERCOT discussed above not only found significant consumer savings; it also estimates the higher-voltage transmission plan improves stability limits by 13% compared to the 345 kV plan.[60] Lines operating at 765 kV also experience fewer outages than lower-voltage lines.[61] Data from American Electric Power shows that 765 kV lines average just one forced outage per 100 mile-years, compared to 1.4 for 500 kV lines,[62] with NERC Transmission Availability Data reinforcing this finding, showing that higher-voltage infrastructure is more dependable.[63]

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56 Value of Transmission During Winter Storm Elliot at 1.

57 J Frayer, *et al.,* London Economic, *How does electric transmission benefit you?*, at 18, 20-43 (Jan. 2018), https://web.archive.org/web/20190613130806/https://wiresgroup.com/docs/reports/WIRES_LEI_TransmissionBenefits_Jan2018.pdf.

58 *Id.* at 19, 20-43.

59 *Id.*

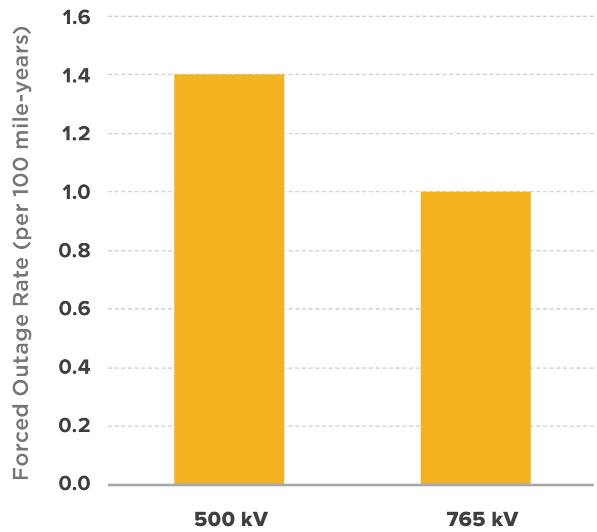
60 ERCOT 765 kV STEP at vii.

61 One reason for this benefit is higher-voltage lines often include multiple circuits that reduce the likelihood of service interruptions due to single-phase faults.

62 AEP, *AEP Interstate Project: I-765 Technologies for 21st Century Transmission,* at 2 (Apr. 2006), https://www.scribd.com/document/157394211/765-kV-Interstate-Project-of-AEP.

63 NERC, *Transmission Availability Data System (TADS),* https://www.nerc.com/pa/RAPA/tads/pages/default.aspx (last accessed May 27, 2025).

FIGURE 12 AEP's forced outage rates for transmission lines by voltage (per 100 mile-years)



Rather than a reason to scale back investment, the infrequency of extreme events underscores the need for proactive grid planning. Just as individuals invest in health, home, or life insurance to protect against infrequent but high-impact risks, transmission infrastructure serves as a form of financial and physical insurance for the grid. The upfront investment is justified not only by routine efficiency gains but also by the protection it offers during critical hours, when the stakes for consumers are highest. In short, transmission can seem expensive, but as electricity demand continues to rise, and threats to the electric grid continue to grow, failing to invest in well-planned, high-voltage transmission will cost more.

RESULTS AND DISCUSSION OF CONSUMER SAVINGS FROM TRANSMISSION

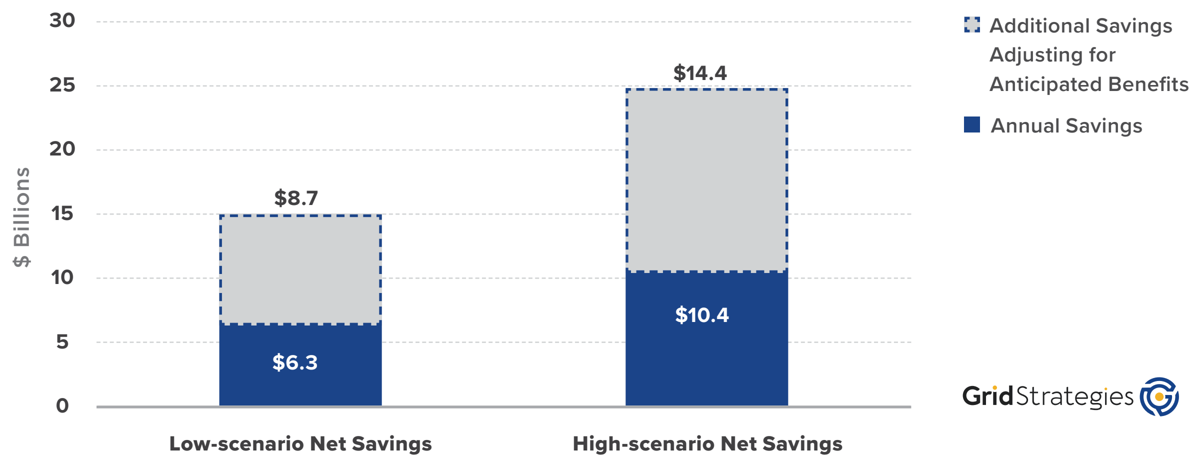
Well-planned transmission delivers measurable cost savings to electricity consumers. Our review of regional and national benefit-cost analyses shows that expanding transmission infrastructure can significantly reduce electric bills by enabling more efficient system operation, lowering production costs, and increasing access to low-cost generation. In addition, these benefits are often underestimated, as most benefit-cost analyses we analyzed only account for a few transmission benefits, and only over the first 20 years of a transmission asset's life, despite the fact that such infrastructure frequently remains in service for 40 to 50 years or more.

In this section, we detail the results of regional transmission plans and their impacts on consumer bills based on a synthesis of more than 15 regional benefit-cost analyses across various transmission planning authorities and regions, including MISO, SPP, ERCOT, NYISO, ISO-NE, SERTP, and independent transmission developers. We then highlight the findings from national studies showing the additional value of more coordinated and large-scale transmission development. Together, this analysis underscores that strategic transmission investment reduces energy costs for consumers across all regions.

Consumers save money on their electric bills from well-planned transmission

Our analysis finds that investment in transmission could save residential consumers $6.3-10.4 billion per year on electric bills across the United States, even after accounting for the cost of the transmission. The national savings estimate for consumers is based on results from regional and interregional transmission plans and associated benefit-cost analyses, which we discuss further in the next subsection.[64]

FIGURE 13 | National residential electric bill savings from expanded transmission



When accounting for all electricity consumers in the United States—residential, commercial, and industrial—we estimate that annual net electric bill savings from transmission rise to between $16.8 billion and $27.7 billion. This increase reflects the fact that, on average, residential consumers account for just over one-third of total electricity consumption, while commercial and industrial users make up the remaining two-thirds.[65] The reality is that commercial and industrial savings are passed onto consumers indirectly through lower prices for the products that these users produce.

Our estimate of annual savings from well-planned, high-voltage transmission is likely an underestimate because it does not reflect an optimized transmission buildout across the country. Our analysis is based on benefit-cost analyses from recent transmission planning efforts in several regions of the country. However, as discussed earlier in the report, holistic transmission planning has been limited, contributing to the decline in miles of planned and constructed high-voltage transmission over the last decade. As a result, there is a limited sample set of well-planned, cost-effective regional transmission plans to analyze. Benefit-

64 For a more detailed discussion of the methodology, please see the appendix.

65 EIA, *Table 6: EIA-861 Annual sales to ultimate customers by state and sector*, https://www.eia.gov/electricity/data/state/xls/861/HS861%202010-.xlsx (last accessed May 2025) ("EIA-861 Table 6").

cost analyses or even proactive, multi-value transmission plans are not available in all regions as some regions have not and are not currently planning significant regional or interregional transmission lines and/or conducting robust benefit-cost analyses of the transmission they are planning. In addition, some of the samples we studied are individual transmission lines as opposed to portfolios of projects, which do not reflect the optimal transmission buildout in every region of the country. This means these regions are forgoing many of the tangible benefits transmission can provide.

To estimate what nationwide savings from well-planned, high-capacity transmission could be, we combined the savings from MISO's MVP, MISO LRTP Tranche 1, and MISO LRTP Tranche 2.1 transmission plans, which are the closest real-world examples in United States of optimized transmission planning that include robust benefit-cost analyses. Stacking these savings and extrapolating the benefits across the country provides an idea of the full savings consumers might see from more holistic, comprehensive transmission planning.

Based on our analyses, we estimate an optimal transmission buildout would provide each household in United States with $102 in savings on their annual electric bill after accounting for the cost of the transmission buildout, which translates to $14 billion-$33 billion in national annual net savings. For all residential, commercial, and industrial consumers, we estimate these savings are between $38.3-$88 billion in annual net savings on electric bills. This estimate means an optimal transmission buildout could double the initial national net savings we estimated, even after netting the cost of the transmission itself.

Taking the national savings and focusing on individual households, the benefits from comprehensive transmission expansion include tangible savings on residential electric bills. Based on our evaluation of benefit-cost analyses detailed below, we estimate that with well-planned, expanded grid investment, the average U.S. household could save between $2,221-$3,672 over the life of the transmission projects. These estimates are net savings, after accounting for the full cost of transmission construction.

TABLE 4 | Lifetime net savings for an average household customer in the United States

Scenario	Lifetime Net savings	Annual Net Savings
Low-scenario savings	$2,221	$44.42
High-scenario savings	$3,672	$73.44

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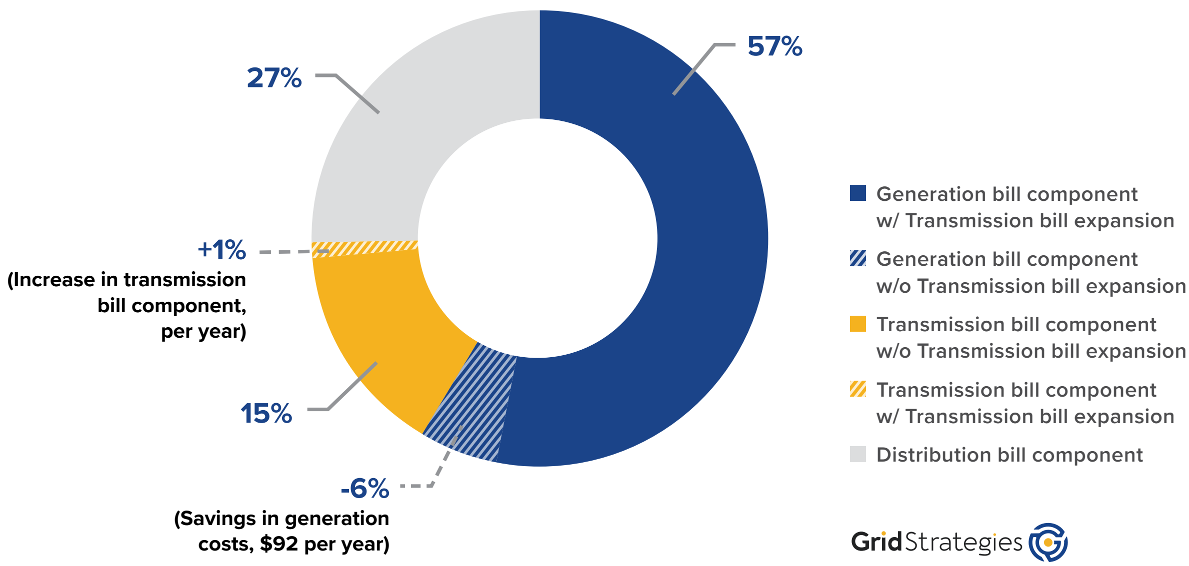
Most of our estimated residential electric bill savings are associated with production cost savings, which means these savings are realized through the generation component of an electric bill. As discussed previously in the report, the generation component is the largest portion of a household's electric bill, so while households may see the transmission component of their bill rise, the generation portion of the bill will decrease, providing overall savings on the total bill amount.

FIGURE 14 | Average annual U.S. household electric bills with and without transmission



As can be seen in the figure above, we estimate well-planned, high-capacity transmission investments decrease generation costs by 3% overall compared to the current national average share of an electric bill, which translates to $92 in savings annually for an average household. These generation savings are facilitated by an estimated increase in the transmission component of an average residential bill of about 2% overall compared to the current national average share of an electric bill, which is a $19 increase annually. The figure below summarizes the expected costs and savings from expanded transmission deployment for residential consumers on their annual bills.

Estimated regional consumer savings from transmission

For our analysis, we evaluated economic and reliability metrics, which are commonly analyzed by transmission planners, in benefit-cost analyses from 16 transmission studies or plans developed by ISO-NE, NYISO, MISO, SPP, ERCOT, and SERTP. We include two interregional lines in our analysis as well.

Across the transmission plans we evaluated, the average benefit-to-cost ratio was between 3.8 to 4.7. This means that for every $1 invested in these transmission lines, consumers receive between $3.80 to $4.70 in benefits. We summarized the results from the analyses of the regional and interregional plans we evaluated in the table below. We discuss the results and individual benefit-cost analyses in further detail below the table.

TABLE 5 | Residential retail electric savings from large-scale regional and interregional transmission

Large-Scale Regional and Interregional Transmission Expansion	Lifetime net savings	Annual net savings
MISO MVP (min)	$1,453	$29
MISO MVP (max)	$2,521	$50
MISO LRTP Tranche 1 (min)	$1,851	$37
MISO LRTP Tranche 1 (max)	$2,470	$49
MISO LRTP Tranche 2 (min)	$1,754	$35
MISO LRTP Tranche 2 (max)	$6,613	$132
ERCOT CREZ	$9,178	$184
SPP 2024 ITP	$6,330	$127
SPP 2023 ITP	$198	$4
SPP RCAR III	$4,512	$90
NYISO PPTN Seg. A & B	$274	$5
NYISO PPTN Propel	$74	$1.47
ISO-NE – NECEC (MA)	$1,243	$25
ISO-NE – NECEC (ME)	$1,243	$25
Brattle SERTP Report	$224	$4
North Plains Connector (MISO)	$455	$9
North Plains Connector (SPP)	$522	$10
North Plains Connector (Northwest)	$500	$10
Three Corners Connector (CO)	$347	$7

GridStrategies

MISO

For savings across the MISO footprint, we evaluated a major transmission deployment, and two major transmission plans MISO has developed over the last 15 years.

The first transmission deployment we reviewed in MISO was the MVPs. MISO approved the initial MVPs in 2011, which consisted of 17 transmission lines expected to enable 25 GW of new generation and totaling just over $10 billion.[66] In 2017, MISO conducted a benefit-cost analysis

66 MISO, *Regionally Cost Allocated Project Reporting Analysis: 2011 MVP Portfolio Analysis Report* (Apr. 2025), https://cdn.misoenergy.org/MVP%20Dahboard117055.pdf?v=20240131144844.

of the projects, and found that for every $1 spent on the transmission lines, consumers in MISO would receive an estimated $2.20 to $3.40 in benefits or $12 to $53 billion in total benefits after accounting for the investment in the new transmission lines.[67] Using this benefit-cost analysis, we estimate that the MISO MVPs are providing approximately $30 in annual retail electric bill net savings to the average MISO North and Central[68] residential consumer. These savings represent 2% savings on the average MISO residential electric bill. Over the life of the MVPs being in service, MISO residential consumers can expect to save on net approximately $1,453 per household.

For the MVPs, the benefit-cost analysis showed that most of the savings to consumers come from production cost savings, specifically fuel and congestion savings. Over 90% of the savings to consumers from the MVPs—$20.1 billion out of $22.1 billion—are fuel and congestion savings that are achieved through more efficient grid operations. The remaining 10% of benefits come from lower power losses across the system ($234 million), avoided transmission investments ($299 million), and more efficient siting of new generation ($1.3 billion).[69]

Despite the 25 GW of new generation enabled by the MVPs, this newly developed grid capacity was quickly consumed. With interconnection costs rising and facing future load growth, resource retirements, and new generation resources coming online, MISO began what it called the Reliability Imperative. Under the Reliability Imperative, MISO initiated a Long-Range Transmission Planning (LRTP) process with four planned tranches of transmission lines expected to ensure a reliable and affordable grid for the future.

MISO's first plan under the LRTP process, Tranche 1, included 18 transmission lines sized at 345 kV that facilitate the interconnection of 53 GW of new generation and cost approximately $10.3 billion.[70] MISO expects to place the Tranche 1 lines in service between 2028 and 2030 and once online, they will provide $2.60 to $3.80 in benefits after accounting for the investment in the new transmission lines.[71] Our estimate, without emissions benefits, translates to retail electric bill net savings for an average MISO residential consumer of $37 annually and $1,851 over the life of the transmission lines being in service.[72]

Similar to the MVPs, one of the largest benefits to consumers of the Tranche 1 lines comes from congestion and fuel savings. MISO estimates that the more efficient operation of the grid will provide $13.1 billion in benefits, or 35% of the total benefits to consumers. However, the largest benefit of the LRTP Tranche 1 portfolio is avoiding higher costs from otherwise building less efficient generation. MISO estimates the avoided additional capital investments to be $17.5 billion, or 47% of the total consumer benefits. The remaining 18% of benefits came from avoided

67 MTEP17 at 4-6.

68 MISO operates the electric transmission system in portions of 15 states in the Midwest and the South, plus the Canadian province of Manitoba. MISO North and Central includes all states not in the MISO South region, which includes parts of Arkansas, Mississippi, Louisiana, Texas. MISO added the South region in 2013 after the approval of the MVP portfolio. FERC, *Participation in Midcontinent Independent System Operator (MISO) Processes* (Apr. 2024), https://www.ferc.gov/participation-midcontinent-independent-system-operator-miso-processes.

69 MTEP17 at 23.

70 E. Howland, Utility Dive, *MISO board approves $10.3B transmission plan to support 53 GW of renewables* (July 2022), https://www.utilitydive.com/news/miso-board-transmission-plan-midcontinent-renewables/628108/.

71 MISO, *MTEP 2021 Report Addendum: Long Range Transmission Planning Tranche 1* (May 2025), https://cdn.misoenergy.org/MTEP21%20Addendum-LRTP%20Tranche%201%20Report%20with%20Executive%20Summary625790.pdf ("MTEP 2021").

72 As a part of its benefit-cost analysis for LRTP Tranche 1, MISO quantified the value of emissions reductions. However, this benefit does not directly impact consumers' electric bills. For our analysis, we removed the benefits associated with emissions reductions to estimate consumer savings on electric bills. Even without counting emissions reduction benefits, the Tranche 1 transmission lines still provide between $2.40 and $3.08 in benefits to MISO consumers for every $1 invested.

transmission investments ($1.3 billion), resource adequacy savings ($600 million), avoided power outages ($1.2 billion), and reduced emissions ($3.5 billion), the last of which we did not include in our analysis.[73]

The second phase of MISO's LRTP process, Tranche 2.1, led to the approval of a 24-project, $21.8-billion portfolio that includes 1,800 miles of 765 kV transmission lines that MISO expects to facilitate the interconnection of approximately 115 GW of new generation.[74] MISO estimates the lines will be in service between 2032 and 2034 and, once energized, will provide between $1.80 to $3.50 in benefits to MISO consumers per every $1 invested.[75] We estimate these benefits translate to electric bill net savings for an average MISO residential consumer of $35 annually and $1,754 over the life of the transmission lines being in service, after accounting for the cost of the transmission lines.[76]

For the LRTP Tranche 2.1 transmission lines, MISO evaluated additional reliability benefits, resulting in the second largest benefit to consumers, making up 29% of the total, of $14.8 billion in savings from power outage reductions. The single largest benefit MISO estimated was avoided generation investments of $16.3 billion, or 32% of the total consumer benefits. Congestion and fuel savings were the third largest benefit at 16% of the total benefits of $8.1 billion. The remaining benefits represent 22% of the total benefits and include savings from more efficient transmission lines ($3.5 billion), reduced impacts from extreme weather ($400 million), avoided investments in transmission lines ($1.2 billion), and reduced emissions ($7.2 billion), the last of which we did not include in our analysis.[77]

Taken as a whole, across all three portfolios evaluated, we estimate MISO residential households will save on average between $101-$232 on their annual electric bills after accounting for the cost of the transmission projects. These annual savings translate to $10,203-$16,474 in lifetime net savings for households in MISO. When estimating the benefits for new transmission, planners account for the addition of previously approved transmission lines, which means the benefits from each plan stack, creating cumulative savings over the life of all the transmission projects. As discussed above, MISO's plans are among the most robust examples of well-planned, high-voltage transmission, and give a better idea of the full savings consumers might see from more holistic, comprehensive transmission planning across the country. Using these estimated savings, we were able to extrapolate a national estimate of savings, providing a better idea of the full savings consumers might see from more holistic, comprehensive transmission planning.[78]

ERCOT

For ERCOT, we evaluated the Competitive Renewable Energy Zone (CREZ) projects, which

73 MTEP 2021 at 3.

74 MISO, *MTEP 2024 Transmission Portfolio,* at 159-162 (Dec. 2024) https://cdn.misoenergy.org/MTEP24%20Chapter%202%20-%20Regional%20Long%20Range%20Transmission%20Planning658124.pdf ("MTEP 2024").

75 *Id.*

76 For LRTP Tranche 2.1, MISO again quantified the value of emissions reductions, which we removed from our savings estimate on electric bills. Even without counting emissions reduction benefits, the Tranche 2.1 transmission lines still provide between $1.56 and $2.54 in benefits to MISO consumers for every $1 invested.

77 MTEP 2024 at 159-162.

78 *See* the appendix for a more detailed discussion of the methodology.

ERCOT began planning in 2005 and completed in 2013. The CREZ portfolio includes more than 3,500 miles of 345 kV transmission lines, which enabled the interconnection of 18.5 GW of new generation and cost $6.9 billion.[79] In 2018, the PA Consulting Group estimated that the CREZ projects had already provided almost $6 billion in benefits to consumers and would provide an additional $78 billion to consumers through 2037.[80] Using the results from this analysis, we found that the average residential consumer in ERCOT saved on net $918 on their electric bills over the first 5 years of the projects being in service, and are expected to save an additional $192 each year through 2037 after accounting for the cost of the lines. These savings come from two benefits: production cost savings from more efficient power grid operation and the addition of lower-cost energy. Production cost savings represent about 44% of the total benefits, or $36.7 billion, while lower energy costs are the remaining 56%, or $47.5 billion.[81]

SPP

For SPP, we reviewed three benefit-cost analyses, including the Regional Cost Allocation Review (RCAR) III, the 2023 Integrated Transmission Plan (ITP), and the 2024 ITP.

In the RCAR III, SPP reviewed all projects under its Highway/Byway Cost Allocation Methodology[82] that SPP approved for construction after 2010 and placed in service before 2020. SPP found these lines to be highly beneficial to SPP consumers, estimating total benefits over 40 years to be around $42 billion, with $5.76 in benefits provided to consumers for every $1 invested.[83] Based on these findings, the projects SPP evaluated in its RCAR III would provide the average consumer in SPP with $90 in annual retail electric bill net savings which is $4,512 in net savings per household over the life of the transmission projects. In the RCAR III study, 88% of the benefits come from what SPP calls "Operational Results," which include the benefits from a more efficient grid, such as fuel cost and congestion savings.[84]

SPP's 2023 and 2024 ITPs provide similar savings to consumers. The 2023 ITP portfolio was smaller, with only 51 new miles of 345 kV transmission, costing $735.5 million.[85] SPP estimates the 2023 ITP projects will still reduce production costs by $2.61 to $2.98 billion over 40 years, resulting in benefits of $2.29 to $2.61 for consumers for each $1 invested.[86] The net impact to residential consumers is an estimated $0.33-$0.37 savings on the average retail residential monthly electric bill. These monthly savings translate to $3.96-$4.44 in annual net savings and $198-$222 in savings over the life of the projects. According to SPP, "[t]he recommended consolidated portfolio is expected to be cost beneficial within the first year of being placed in-

79 Powering Texas, *Transmission & CREZ Fact Sheet,* https://www.poweruptexas.org/wp-content/uploads/2020/11/Transmission-and-CREZ-Fact-Sheet.pdf (last accessed May 27, 2025).

80 PA Consulting Group, *The Long-Term Impact of Marginal Losses on Texas Electrical Retail Customers,* at 6 (Apr. 2018), https://interchange.puc.texas.gov/Documents/47199_93_977285.PDF ("PA Consulting Group").

81 *Id.*

82 SPP has a hybrid cost allocation methodology where it allocates the costs of high-voltage transmission facilities (300 kV+) regionally on a postage-stamp basis. For lower-voltage transmission facilities (100 kV-300kV), 33% of the costs are still allocated regionally on a postage-stamp basis, while 67% of the costs are allocated to the SPP pricing zone in which the facilities are located. Under 100 kV, costs are allocated entirely to the SPP pricing zone in which the facilities are located. *See Sw. Power Pool, Inc.*, 187 FERC ¶ 61,123 (2024), https://spp.org/documents/71722/20240531_order%20-%20byway%20facilities%20allocated%20on%20a%20region-wise%20basis_er24-1583-000.pdf.

83 SPP, *Regional Cost Allocation Review (RCAR III) Final Report,* at 42 (Jan. 2023) https://www.spp.org/documents/71083/rcar%20iii%20report%20final%2020230130.pdf.

84 *Id.*

85 SPP, *2023 Integrated Transmission Planning Assessment Report,* at 1 (Nov. 2023), https://spp.org/documents/70584/2023%20itp%20assessment%20report%20v1.0.pdf ("SPP 2023 ITP").

86 *Id.*

service and to pay back the total investment within the first 10 years."[87]

SPP's 2024 ITP is a larger plan that adds nearly 1,500 miles of 345 kV lines and almost 300 miles of 765 kV lines, costing $7.68 billion.[88] Though higher cost, the plan likewise yields higher benefits. SPP estimates the 2024 ITP projects will lower production costs by $88.7 to $95.7 billion over 40 years, resulting in $8.23-$8.88 in benefits to consumers for every $1 invested.[89] The estimated net impact to SPP consumers is a savings of $10.55-$11.47 on the average retail residential monthly bill. These monthly savings translate to $127 to $138 in annual net savings and $6,330-$6,882 in net savings over the life of the projects.

As with the RCAR evaluation, the main benefit in SPP's 2023 and 2024 ITPs was production cost savings. In the 2023 and 2024 ITPs, production cost savings accounted for 85% of the total benefits to SPP consumers.[90]

Similar to MISO, the benefits from all three analyses can be stacked to estimate the cumulative savings SPP's transmission plans provide consumers. Combining the benefit from all three plans we evaluated, we estimate residential households in SPP will net $285 in annual electric bill savings and $14,271 in savings over the life of the projects.

NYISO

For NYISO, we evaluated the benefit-cost analyses for two of NYISO's Public Policy Transmission Needs (PPTN) plans. The first was the AC Public Policy Transmission Needs Segments A and B, which NYISO approved in 2017 and placed in service in late 2023. NYISO estimated the two projects would cost New York consumers an estimated $1.1 billion and provide between $1.7 and $2.8 billion in benefits, meaning that for every $1 invested in these two lines, New York consumers receive between $1.54 and $2.54 in benefits.[91] Based on these findings, we estimate that the construction of Segments A and B would provide the average residential consumer in New York with $5.48 in annual net savings on their electric bill and $274 in lifetime savings. The benefits to New York consumers are relatively evenly split between production cost savings (45%), avoided generation investments (22%), and avoided transmission investments (33%).[92]

The second plan we evaluated was the Long Island PPTN Propel New York lines. NYISO approved the plan in 2023, and the lines are expected to be in service by 2030.[93] The $3.26 billion plan is expected to facilitate access to 3 GW of new generation and consists of three underground 345 kV transmission lines connecting Long Island with the rest of New York and a 345 kV transmission backbone across western/central Long Island.[94] NYISO estimated that

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87 *Id.* at 4.

88 SPP, *2024 Integrated Transmission Planning Assessment Report,* at 1 (Jan. 2025), https://www.spp.org/media/2229/2024-itp-assessment-report-v10.pdf ("SPP 2024 ITP").

89 *Id.*

90 SPP 2023 ITP at 160; SPP 2024 ITP at 185.

91 NYISO, *AC Transmission Public Policy Transmission Plan,* at 39, 69, 130 (Apr. 2019), https://www.nyiso.com/documents/20142/5990681/AC-Transmission-Public-Policy-Transmission-Plan-2019-04-08.pdf/23cbba74-a65e-66c2-708e-eaa0afc9f789.

92 *Id.* at 39, 69, 130.

93 NYISO, *Long Island Offshore Wind Export Public Policy Transmission Plan,* at 2, 19, 78 (June 2023), https://www.nyiso.com/documents/20142/38388768/LI-PPTN-Info-Packet.pdf/fc1b48f8-121e-052b-920e-6ce2fdde777b.

94 *Id.* at 2, 19, 78.

for every $1 invested in Propel NY, New York consumers would receive $1.12 in benefits.[95] Based on these findings, we estimate that the construction of Propel NY would provide the average residential consumer in New York with $1.47 in annual net savings on their electric bill and $74 in lifetime electric bill savings. In this case, the benefits to New York consumers were heavily weighted towards capacity savings, which were estimated to be $3.03 and accounted for 83% of the total benefits. Production cost savings were $609 million and accounted for the other 17% of the benefits.[96]

ISO-NE

For ISO-NE, we reviewed the New England Clean Energy Connect (NECEC) transmission line. The project is a 150-mile high-voltage direct current (HVDC) line from Canada into New England estimated to cost $1.5 billion and deliver 1.2 GW of generation.[97] Based on an analysis by Daymark Energy Advisors performed for Central Maine Power Company, the NECEC is estimated to provide between $454 and $496 million in net benefits to Maine consumers over 20 years.[98] Using these results and average retail electric sales in Maine, the net savings on the average residential electric bill would be $25 to $26 annually and $1,243 to $1,278 while the line is in service.

In Massachusetts, an average consumer can expect to save around $18-$20 a year on their electric bill.[99] Eversource residential consumers can expect to save on net approximately $1.35 a month. National Grid residential consumers can expect to save on net approximately $1.52 a month, and Unitil residential customers will save on net roughly $1.63 a month.[100]

The only benefit calculated by Daymark Energy Advisors for the line was a reduction in wholesale electricity prices from access to lower-cost generation. The range of benefits comes from including the energy imported by the full capacity of the line and its reductions to wholesale energy prices.[101]

Southeast

In April 2025, Brattle performed a benefit-cost analysis for three potential transmission solutions that resolved some of the needs from a 2024 SERTP economic study.[102] SERTP did not move forward with the solutions, but it included three 500 kV lines between TVA, Duke Energy Carolinas, Duke Energy Progress, and Southern Company.[103] These three lines would cost about $5 billion dollars, and for every $1 invested in the lines, the Southeastern consumers would

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95 *Id.*

96 *Id.*

97 D. Peaco, Daymark Energy Advisors, *NECEC Transmission Project: Benefits to Maine Ratepayers,* at i (Sept. 2017), https://www.energy.gov/sites/prod/files/2020/10/f79/2020-2-14%20ATTACHMENT%20E%5B11727752v1%5D%20%282%29.PDF ("Daymark NECEC").

98 *Id.* at ii, iii.

99 Massachusetts Department of Public Utilities, *DPU Approves Settlement for New England Clean Energy Connect* (Jan. 2025), https://www.mass.gov/news/dpu-approves-settlement-for-new-england-clean-energy-connect.

100 B. Mohl, *Mass. ratepayers to pay $521m more for hydroelectricity because of Maine political delays* (Oct. 2024), https://commonwealthbeacon.org/energy/mass-ratepayers-to-pay-521m-more-for-hydro-electricity-because-of-maine-political-delays/#:~:text=Under%20terms%20of%20the%20power,to%20just%20over%20$1.5%20billion.

101 Daymark NECEC at ii.

102 *See* Modernizing Southeast Grid Investments.

103 *Id.* at 7.

receive $1.56 in benefits.[104] Based on these findings, we estimate that the construction of these lines would provide the average residential consumer in southeast with $4.47 in annual net savings on their electric bill and $224 in lifetime electric bill savings. Brattle quantified three benefits in their analysis: production cost savings, load diversity, and resilience benefits. Brattle estimates production cost savings to be $2.8 billion or 36% of the benefits, load diversity cost savings to be $3.3 billion or 43% of the benefits, and resilience benefits to be $1.6 billion or 21% of the benefits.[105]

The high benefit-cost ratios for the North Plains Connector and Three Corners Connector projects demonstrate consumers are getting their biggest "bang for their buck" with interregional transmission lines compared to other type of transmission investment.

Interregional Transmission Lines

Many studies have demonstrated that interregional transmission lines have some of the highest benefit-cost ratios of any type of transmission project due to significant savings from reductions in generation needs, access to lower cost energy due to greater resource diversity, and significant reliability benefits during extreme weather.[106]

Our analysis of two interregional transmission lines, North Plains Connector and Three Corners Connector, both being developed by Grid United, further reinforce the high benefit-cost ratios for interregional transmission lines. The North Plains Connector is a 3 GW, $3.6 billion, 420-mile 525 kV HVDC transmission line connecting the Western Interconnection with MISO and SPP in the Eastern Interconnection.[107] Three Corners Connector is a 3 GW, $2 billion, 300-mile, 525 kV HVDC transmission line connecting Colorado and SPP.[108]

We estimate that North Plains Connector has a benefit-to-cost ratio of almost 5 to 1 and Three Corners Connector has a benefit-to-cost ratio of over 3 to 1. The high benefit-cost ratios for the North Plains Connector and Three Corners Connector projects demonstrate consumers are getting their biggest "bang for their buck" with interregional transmission lines compared to other type of transmission investment. In addition, the impact on consumers is minimal because the projects are relatively smaller investments compared to the consumers benefitting from the lines. Because of the relatively smaller consumer impacts, we only included the results for North Plains Connector and Three Corners Connector in the low-savings scenario, meaning the estimate of $2,221 in annual savings for an average U.S. consumer is likely a conservative result.

Based on our analysis, for every $1 dollar invested in the North Plains Connector project, consumers will receive $4.86 in benefits. Based on these findings, we estimate that the construction of these lines will provide the average residential consumer with $9.10 in annual net savings on their electric bills in MISO, $10.44 in SPP, and $9.99 in the Northwestern United States. These annual net savings translate to savings over the life of the line of $455, $522, and

104 *Id.*
105 *Id.*
106 *See generally* NERC's Recommended Grid Expansion Would Save Consumers Billions.
107 *See* Grid United, *North Plains Connector*, https://northplainsconnector.com/ (last accessed May 27, 2025).
108 *See* Grid United, *Three Corners Connector*, https://threecornersconnector.com/ (last accessed May 27, 2025).

$500, respectively. Production cost savings are 80% of the total benefits, with capacity savings providing 20% of the benefits.

For the Three Corners Connector project, we estimate that for every $1 invested, consumers will receive $3.32 in benefits. Based on these findings, we estimate that the construction of this line would provide the average residential consumer in Colorado with $6.94 in annual net savings on their electric bills and $10.23 in SPP. These annual net savings translate to savings over the life of the line of $347 and $512, respectively. Production cost savings were approximately two-thirds of benefits, with capacity savings providing the other third of the benefits.

National Models of Transmission Deployment

Another way to evaluate the savings transmission provides to U.S. consumers is by evaluating national power system studies. These studies optimize the buildout of the generation and transmission system to find the lowest overall power system costs for consumers.

A few recent studies, two national and one of the eastern United States, provide estimates of the savings additional transmission deployment can provide consumers. Comparing these studies, we find that the optimal buildout of transmission identified in the models could save on net U.S. consumers between $1.83 and $30 per MWh, on average, or between $19 and $300 annually on electric bills. Our results are based on the U.S. Department of Energy's 2024 National Transmission Planning Study, Massachusetts Institute of Technology's (MIT) 2021 Interregional Transmission Macro Grid Analysis, and Americans for a Clean Energy Grid's (ACEG) 2020 Benefits of Electricity Expansion in the Eastern U.S. study. The table below summarizes our results across the three studies.

TABLE 6 | Savings to consumers based on national transmission studies

National Studies	20-year savings	Annual savings
DOE National Transmission Planning Study	$375	$18.76
MIT Macro Grid Study	$6,158	$308
ACEG Eastern Interconnection Study	$6,000	$300

GridStrategies

In its 2024 National Transmission Planning Study, DOE attempted to develop national, grid-scale planning tools, and identify highly beneficial transmission investments that could help inform regional and interregional transmission planning processes. DOE evaluated the U.S. power system through 2050 and found that accelerated and coordinated transmission development could provide between $270 and $490 billion in net benefits to consumers, with between $1.60 to $1.80 in benefits for every $1 spent under these scenarios.[109] Using these results, we

109 *See* U.S. Department of Energy, National Renewable Energy Laboratory, & Pacific Northwest National Laboratory, *National Transmission Planning Study* (Oct. 2024), https://www.energy.gov/gdo/national-transmission-planning-study ("NTP Study").

determined that the buildout of transmission would save on net U.S. consumers $1.83 per MWh, or an average of $18.76 annually, resulting in savings over 20 years of $375.

MIT's study demonstrated the potential for even higher savings from transmission deployment. Researchers at MIT evaluated the value of streamlining the planning and permitting process for new transmission for the national power system under a deep decarbonization scenario. They found that the optimal transmission buildout scenario saves consumers $30 per MWh, or approximately $132 billion in savings annually. This finding translates to about $308 per year in savings on an average annual electric bill.[110]

ACEG's study produced results that aligned with those of the MIT study. The ACEG study also evaluated the optimal buildout of generation and transmission under various emissions reduction scenarios. It found that across all scenarios, transmission deployment resulted in savings in electric bills for consumers. The study estimated that the average electric bill would be decreased from approximately $0.09 per kWh to $0.06 per kWh by 2050, resulting in typical consumer savings of $25 monthly and $300 annually.[111]

Unsurprisingly, these studies generally find higher savings from transmission deployment. National studies are usually conducted to determine the lowest overall power system cost by co-optimizing the buildout of generation and transmission. However, this co-optimization of generation and transmission across the country does not reflect the current barriers to building out power systems. The National Transmission Planning Study does attempt to deploy transmission under constraints more reflective of today's grid, and the benefits to consumers from transmission deployment are much closer to the benefits found in our analysis above of the regional grid operator's benefit-cost analyses.

Benefits of transmission are often higher when evaluated after the fact

After-the-fact evaluations often find that benefits were underestimated in initial planning efforts. Multiple regional studies show that the actual value delivered by transmission investments exceeds projections.

A clear example of this underestimation comes from SPP's evaluation of transmission lines planned in 2012 and 2014. At the time of planning, SPP projected that these investments would yield nearly $12 billion in benefits to consumers over 40 years after accounting for the cost of the projects.[112] However, after the projects were completed, SPP reassessed their value and found that the transmission lines were expected to provide $16.6 billion in net benefits.[113] That updated estimate reflects an increase of more than 38% from the original estimate, resulting in an updated estimate of $3.50 in benefits to consumers for every $1 invested in transmission, substantially higher than initially anticipated.[114]

110 *See* P. Brown, *et al., The Value of Inter-Regional Coordination and Transmission, Joule, Vol. 5, Issue 1,* at 115-134 (Jan. 2021), https://www.cell.com/joule/fulltext/S2542-4351(20)30557-2?_returnURL=https%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS2542435120305572%3Fshowall%3Dtrue.

111 *See* C. Clack, *et al.,* ACEG, *Consumer, Employment, and Environmental Benefits of Electricity Transmission Expansion in the Eastern U.S.* (2020), https://cleanenergygrid.org/wp-content/uploads/2020/10/Consumer-Employment-and-Environmental-Benefits-of-Transmission-Expansion-in-the-Eastern-U.S..pdf.

112 SPP Value of Transmission at 20-24.

113 *Id.* at 5.

114 *Id.*

MISO has produced similar findings. In 2017, MISO reassessed its MVPs, which MISO initially evaluated in 2011 when it planned the lines. The updated analysis projected that the MVP lines would generate between $12 billion and $53 billion in consumer benefits over a 20- to 40-year timeframe after accounting for the cost of the transmission lines.[115] These new estimates of benefits were a 20% increase compared to the original estimate. As a result, consumer benefits rose to $2.20 to $3.40 for every $1 invested in transmission, up from the $1.80 to $3 in benefits for every $1 invested that MISO originally forecasted.[116]

Transmission acts as a hedge against long-term investment risks and future uncertainty. As the U.S. faces significant new load growth driven by data centers and manufacturing, utilities are forced to make decisions as to whether to invest hundreds of millions of dollars to build new power plants to serve new load. Utilities may end up in a situation where they have invested in significant amounts of new generation that have half-century long lives and include significant operational costs.

Based on these analyses by MISO and SPP, we found that initial calculations of benefits in transmission planning studies are often 20–40% higher than initially projected. Applying these numbers to our estimate of $6.3-10.4 billion per year in net consumer savings gives us an expected increase in annual electric bill net savings to $8.7-$14.4 billion for households across the United States.

Transmission insulates consumers from uncertainty

Transmission is critical in protecting consumers from uncertainties, including around the magnitude of future load growth, volatile fuel prices, shifting policy landscapes, technological advances, and extreme weather. A robust and interconnected transmission network offers benefits in various alternative future scenarios.

Transmission acts as a hedge against long-term investment risks and future uncertainty. As the U.S. faces significant new load growth driven by data centers and manufacturing, utilities are forced to make decisions as to whether to invest hundreds of millions of dollars to build new power plants to serve new load. Utilities may end up in a situation where they have invested in significant amounts of new generation that have half-century long lives and include significant operational costs. However, considerable uncertainty remains over how much new demand will materialize and where. The wrong investment can have tremendous impact on the consumers that pay the bills. There is also uncertainty about future fuel prices and generation technology costs. For example, the development of new data centers and surging electricity demand are squeezing the supply of new generation, which has caused the cost of building a new natural gas plant to triple in recent months, rising above $2,000 per kW.[117]

In this context, transmission offers valuable optionality by allowing the power system to adapt

115 MTEP17 at 4-5.

116 *Id.*

117 *See* R. Elliot, N.Y. Times, *Why a Plane-Size Machine Could Foil a Race to Build Gas Power Plants* (May 2025), https://www.nytimes.com/2025/04/08/business/energy-environment/gas-turbines-power-plants.html; *see also* Yahoo Finance, *NextEra Energy Inc (NEE) Q1 2025 Earnings Call Highlights: Strong Growth in Solar Capacity and...* (Apr. 2025), https://finance.yahoo.com/news/nextera-energy-inc-nee-q1-070407561.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAAKVe9iUNfxJcNK6cGeZYBJlNAAqlh74xKg7lwVx9ctgNB5V-8jLaaGmrY6WlNUsLoe9vsxKu5QzD7rEBOtZM-A-A0RtknEb5iyTuGEAHHqdvq7odkffWrD4R1xJZAdhZ27KWQ_x3fpBbudNKtzYX2KSBR5ph9S0yB-LvviUPP37N.

cost-effectively to future changes. If grid planners had proactively planned new transmission expansion on a long-term basis, it would be easier to bring lower cost generation online faster to meet growing demand and leverage load diversity across more interconnected systems. Instead, load growth may force them to rush into service high-cost solutions to meet load growth, leaving consumers to foot the bill.

CONCLUSION

Well-planned, large-scale transmission deployment is one of the most effective tools available to provide savings to consumers while enhancing grid reliability and helping to meet the growing demand for electricity. Across every major U.S. region we analyzed, including MISO, SPP, ERCOT, ISO-NE, and NYISO, as well as in national modeling studies, the consumer benefits of transmission expansion far exceed the costs. These benefits are both immediate once a transmission line is energized and long-lasting, occurring over the entire lifespan of the transmission line. Savings to consumers on electric bills are primarily driven by access to lower-cost energy, but additional savings accrue due to avoided transmission and generation investments and from increased reliability. Yet, despite overwhelming economic justification and growing system needs, transmission buildout has lagged due to planning inefficiencies and persistent misconceptions about cost. Correcting these misconceptions and aligning planning with today's rapidly changing energy landscape is essential to ensuring consumers realize the full savings potential transmission deployment offers.

APPENDIX
Methodology

To estimate consumer savings, we began by collecting regional analyses of transmission's benefits and costs.[118] Some studies report a low and high range for some transmission benefits, which were used to develop the low and high benefit estimates in our analysis. For studies that quantify transmission benefits that do not directly affect consumer's electric rates, such as environmental and public health benefits, those benefits were removed from the calculated ratepayer benefits. We then used total electricity consumption (in MWh) during the study period, either as reported in the benefit-cost analysis or obtained from the region's annual load forecast or FERC Form 714. If the load forecast did not cover the full study period, we extrapolated the remaining years using the region's annual growth rate in the load forecast. We then calculated consumer savings in dollars per MWh by dividing the total benefits by total electricity consumption.

To estimate average savings per consumer at the national and regional levels, we used electricity consumption data from the EIA. We multiplied the dollars per MWh savings by EIA's total annual electricity sales, broken out by customer class and the average annual electricity use per residential ratepayer. For national estimates, we divided EIA's 2023 total annual residential electricity sales by the total number of residential customers in the U.S. to get average national consumption estimates per household.[119] For regional estimates, we performed the same calculation using the 2023 total annual residential sales for each state divided by the total residential customer count in each state and then multiplied the resulting average MWh consumption by the regional dollar per MWh savings.[120]

A full benefit-cost analysis has not yet been conducted for either interregional transmission line included in our study. However, using the Effective Load Carrying Capability (ELCC)[121] calculated for each region served by the transmission line by Astrapé Consulting,[122] multiplied by MISO's 2025/2026 Avg. Net-Cost of New Entry (Avg. Net-CONE),[123] we were able to estimate the economic value of the capacity value the lines provide to each interconnected region. To estimate production cost savings for each interregional transmission line, we relied on an analysis of regional differences in Locational Marginal Prices (LMPs) over a decade from LBNL.[124] While LBNL's analysis is based on LMPs, this should be a close proxy for production cost savings as marginal prices are typically set based on the marginal production cost of the marginal resource in each geographic location. The LBNL analysis also accounts for how those production cost savings experience diminishing marginal returns as transmission expansion

118 The benefit-cost analyses used for the analysis are cited above in the results and discussion section of the report. Although economists recommend that analyses of the benefits of transmission also examine environmental benefits, we excluded benefits that do not directly affect consumer electricity rates, such as carbon emissions reductions. *See, e.g.,* The Benefits of Electric Transmission.

119 EIA-861 Table 6.

120 *Id.*

121 ELCC is essentially the capacity of the transmission line. It is the ability to reliably serve a portion of the overall load during peak demand hours.

122 *See* North Plains Connector ELCC Study; *see also* Three Corners Connector ELCC Study.

123 *See, MISO, MISO Cost of New Entry (CONE) and Net CONE Calculation for Planning Year 2025/2026,* (Sept. 2024), https://cdn.misoenergy.org/20240923%20RASC%20Item%2003%20CONE%20and%20Net%20CONE%20Update649247.pdf.

124 *See* Electric transmission value and its drivers.

reduces marginal production cost differences between regions, and the rate of diminishing marginal returns calculated by LBNL was used in our estimate of production cost savings for each interregional line.[125]

125 For additional discussion on this methodology see pages 13-14 of NERC's Recommended Grid Expansion Would Save Consumers Billions

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Grid Strategies LLC is a power sector consulting firm helping clients understand the opportunities and barriers to integrating clean energy into the electric grid. Drawing on extensive experience in transmission and wholesale markets, Grid Strategies analyzes and helps advance grid integration solutions.

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