REPORT

Electric Transmission Planning: A Primer for State Legislatures

BY ALEX MCWARD

Introduction

The electric transmission grid is a complex network of high-voltage power lines critical to moving large amounts of electricity across long distances to ensure the delivery of adequate and reliable electricity across the country.

The transmission system is primarily made up of transmission lines, transformers and converter stations. Electricity generated at power plants is moved through high-voltage transmission lines until it reaches transformers at utility substations. Substation transformers reduce the voltage before transferring the electricity to the distribution system which delivers the power to homes and businesses.

Most of the country's existing transmission system is in need of major upgrades, while building new transmission capacity is viewed as an increasingly vital step toward achieving decarbonization goals and enhancing electric reliability. New energy sources, increasingly frequent extreme weather events, rising electricity demand and new technologies are testing the aging infrastructure that currently makes up the transmission grid. Around 70% of power transformers and transmission lines are 30 years or older, while their service life is about 50 years.

In addition to the need to replace or upgrade existing infrastructure, the transmission system needs significant expansion. The country's energy system is in a period of transition. President Biden and 30 states have set energy goals that will replace fossil fuel sources with new clean energy resources, while large American companies are increasingly seeking to purchase power from zero-carbon energy resources. Despite a surge of clean energy project proposals in recent years, the transmission system lacks the infrastructure necessary to connect these projects to the grid. Without transmission upgrades and expansions, interconnecting new clean energy projects will become increasingly costly and inefficient, thus severely slowing the decarbonization process. Additionally, expanding transmission infrastructure is critical for improving energy resilience. Grid reliability concerns have grown in recent years as more frequent extreme weather events have made severe blackouts more common. Increased interconnection between regions could expand the diversity of energy resource output across the country and help maintain grid reliability.

In 2022, the U.S. Department of Energy (DOE) commissioned the National Transmission Planning Study to undertake a modeling of the country's transmission needs under different scenarios. The DOE also launched the National Transmission Needs Study the same year to identify historic and expected transmission constraints and congestion, based on an analysis of existing studies. A draft of the Needs Study published in 2023 explained that the U.S. would likely need to increase the amount of new transmission lines throughout the country by 57% by 2035 under a moderate load growth scenario. The study also revealed that transmission needs will shift over time as more clean energy is deployed and regional demand evolves.

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State policymakers can play a vital role in ensuring the necessary policies are in place to enable the reliable operation of the electric grid now and in the future. While transmission projects are mostly proposed and procured by utilities, state policymakers establish the policies and regulations that affect these projects. State legislatures may enact laws with specific processes and guidelines that transmission developers must follow. These laws are typically enforced by state agencies, such as public utility commissions (PUCs). Regulations can also be set at the local, regional or federal level. The Federal Energy Regulatory Commission (FERC) and regional transmission organizations (RTOs) establish rules for transmission planners to follow, and many local governments have specific land use and zoning ordinances that transmission developers must comply with.

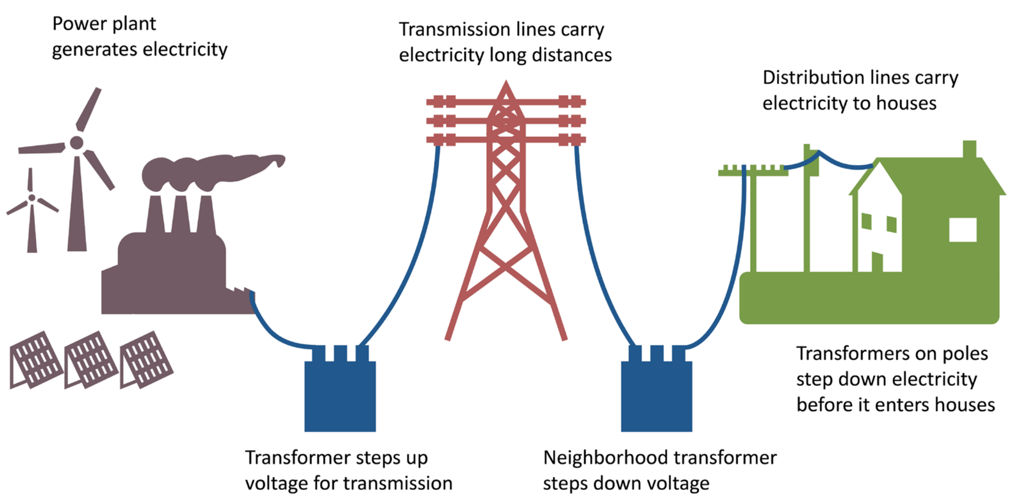
This paper will provide an overview of transmission challenges, planning processes and actors involved, with the goal of enabling state legislators to better understand the current landscape and the options for progress.

Layout of the Transmission System

The country's electric system is made up of over 7,000 power plants, almost 160,000 miles of high-voltage transmission lines and millions of miles of low-voltage distribution lines. The North American power grid is comprised of two large grids—the Eastern and Western Interconnections—and a smaller grid in Texas. The electric utilities within each interconnection are electrically tied together through alternating current lines along with some high-voltage direct current lines. These three interconnections mostly operate independently of each other due to limited electricity transfer capacity. However, there are a few direct current ties between the interconnections that allow for the import and export of small amounts of electricity.

There are 66 balancing authorities operating within the three interconnections. Balancing authorities manage the operation of the electric system by ensuring that power system demand and supply are balanced. In many parts of the country RTOs or independent system operators (ISO) function as balancing authorities. RTOs and ISOs are similar independent bodies that operate the transmission grid for all transmission owners within a certain region. RTOs are responsible for ensuring the power grid can deliver sufficient energy supply across the region. About two-thirds of the country's electric power supply is managed by RTOs, while regions in the Southeast, Southwest and Northwest rely on larger individual utilities to serve as balancing authorities.

Electricity Generation, Transmission, and Distribution



Source: National Energy Education Development Project

Due to the various parties involved, increased collaboration is needed across different states, regions, levels of government and authorities to establish a transmission system planning and policy ecosystem that enables development of the infrastructure necessary to support a modern, clean power grid. Efficient and coordinated transmission planning is crucial for ensuring a reliable grid that enables the energy needs and goals of the country and the states to be met in an affordable and timely manner with the most benefits and fewest impacts.

Transmission Planning Issues

Transmission capacity expansion is necessary to address multiple challenges facing the energy sector. Achieving clean energy goals and enhancing grid reliability both require new transmission lines to increase interconnection between energy resources. The development of new transmission lines often requires interstate collaboration as lines stretch across regions. The involvement of various entities from multiple states with different policies and timelines can make the planning process for new transmission infrastructure complex and resource intensive. Understanding these planning issues is crucial for policymakers to appropriately address the transmission system's needs.

RENEWABLE ENERGY REQUIREMENTS

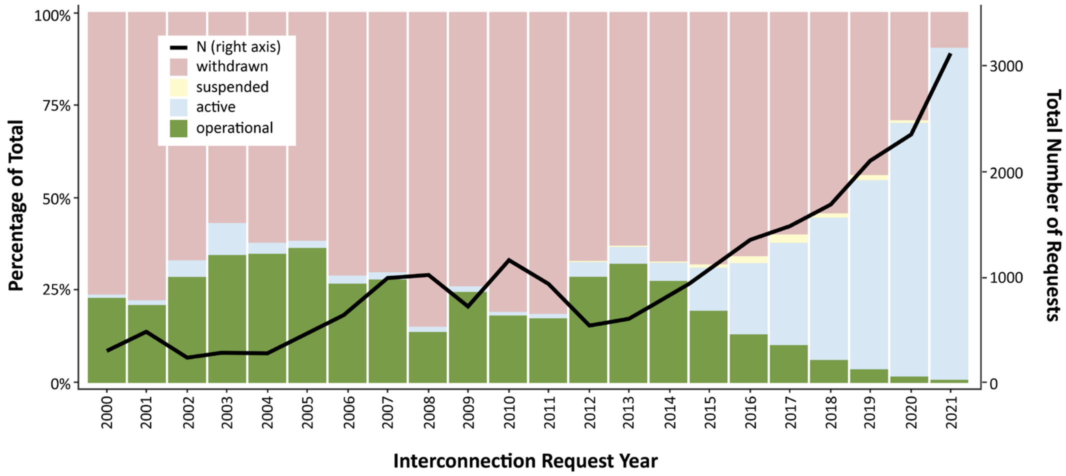
Along with the aging nature of much of the nation's electric generation and transmission infrastructure and the emergence of new technologies, the need for the development of new transmission lines is largely due to both state and national energy goals. Many states have established renewable portfolio standards or clean energy standards requiring a certain amount of utilities' electricity to come from qualifying renewable or emission-free energy sources. Fourteen states have enacted standards requiring 100% of their electricity to come from renewable or emission-free energy sources by a certain date, while an additional 13 states have established lower percentage requirements. In addition to these state requirements, the Biden administration has set the goal of reaching net-zero emissions nationwide by 2050. Currently, just over 20% of electricity generated in the U.S. comes from renewable sources with another 18% from carbon-free nuclear. Therefore, achieving these energy goals will require significant investment in clean and renewable energy projects over the coming decades.

The development of new energy projects to meet these goals will require expansion of transmission infrastructure. Many of the lowest-cost renewable energy sources are not located near existing transmission lines, so new high-voltage lines will be needed to connect power plants with lower voltage transmission and distribution facilities across the country. Furthermore, renewable energy projects are often located in isolated sparsely populated areas, so transmission systems will need to be extended great distances to connect these new energy sources to population centers.

According to the draft National Transmission Needs Study, transmission systems will need to be expanded by 57% by 2030, and existing capacity may need to double or even triple by 2050. The DOE's Office of Policy released a report stating that in 2022 more than 930 gigawatts (GW) of clean and renewable energy projects were waiting in interconnection queues. The interconnection queues continue to grow as new energy projects looking to connect to the grid must undergo impact studies to determine what transmission upgrades are necessary for a project to join the system, and the cost of such upgrades. Completion percentages for projects in interconnection queues have been declining for the past 10 years with completion percentages for renewable projects notably lower than natural gas percentages. Furthermore, wait times for projects in interconnection queues have also increased.

The lower completion percentages and the longer wait times demonstrate both the increase in interconnection requests as well as the need for significant transmission investment. Interconnection delays are not entirely caused by a lack of transmission. A lack of firm deadlines for interconnection studies, the emergence of new technologies and insufficient existing procedures are also preventing new generating facilities from interconnecting to the transmission system. The FERC issued Order 2023 this year to address these interconnection delays. Nonetheless, despite the increase of projects in interconnection queues, the amount of new high-voltage transmission lines has declined over the past 10 years.

Project Interconnection Requests



Source: Office of Energy Efficiency & Renewable Energy

Expanding transmission infrastructure is necessary for connecting new clean and renewable energy projects to the grid. Studies suggest both large-scale, inter-regional development and new high-voltage lines to connect generators to substations or load centers are necessary. Nonetheless, without new investments in the transmission system, interconnection queues will likely continue to grow, project completion rates will decline, reliability challenges will likely increase, and the U.S. will struggle to achieve its clean energy goals.

Offshore wind (OSW) is another technology supported by some states that is driving the need for transmission. With about 80% of the U.S. population living within 200 miles of a coastline, the emergence of offshore wind technologies could bring renewable energy generation closer to consumers in coastal cities. Offshore wind is considered to be the country's next major energy source due to the abundance of potential OSW locations and their proximity to high demand coastal load centers. The Biden Administration currently has the goal to install 30 GW of offshore wind by 2030, and states have established nearly 74 GW of offshore wind procurement targets.

However, despite generation being closer to coastal consumers, OSW will present new development challenges as transmission systems will have to adapt to the new technology and extend into bodies of water. For example, transmission cables will need to be installed offshore connecting marine substations to onshore substations. Cable routes will face new obstacles in key areas of ocean use, such as fisheries. Once onshore, the cables will need to connect to the greater grid system which currently lacks coastal points for interconnection.

Case Study: West Coast Offshore Wind Development

On the West Coast, planning is underway in four locations where development of offshore wind (OSW) projects could occur within the next 10 years. In 2021, California enacted A.B. 525 to develop a strategic plan for offshore wind development. The California Energy Commission has set goals to reach 2,000 to 5,000 megawatts of OSW by 2030, and 25,000 megawatts by 2045.

Despite these goals, California currently lacks much of the necessary infrastructure and technology for offshore wind transmission. Due to the depth of the ocean, OSW projects on the West Coast must rely on floating infrastructure to support turbines and transmission technology. With the readiness of floating technology being relatively low, investments in floating collector systems, substations, converter stations and offshore transmission infrastructure will need to be made to successfully transmit this electricity to the shore. Compared to East Coast wind developments, which benefit from much shallower coastal waters, significant technological advancements are necessary for successful offshore wind transmission on the West Coast.

INTERSTATE TRANSMISSION PLANNING

Despite the need for transmission development, the construction of high-voltage transmission lines has declined in recent decades. Permitting and siting requirements can slow the transmission development process as a mixture of local, state, regional and federal entities are responsible for determining where a project can be built, when it can be constructed and how it will be paid for. The approval process for projects can be lengthy and vary by state. For example, Kansas requires final orders to be issued within 120 days after the application was filed, while South Dakota allows project applications to be reviewed for up to 12 months. Many states also allow timelines for project approval to be extended and some states do not have a set timeline for review.

However, even with state approval timelines, overall project approval timelines can be unpredictable due to various factors, such as local or federal regulations. For example, the TransWest Express Transmission Project stretches from Wyoming to Las Vegas and covers 732 miles. The project received final approval for construction from the Bureau of Land Management in April 2023—a full 18 years after it was first initiated. Once the projects are approved, transmission lines can take up to 10 years to construct.

Siting and permitting issues can become more complicated at a regional level as transmission lines cross state boundaries. Electricity is regularly exported and imported across state lines. This is particularly the case with electricity generated from certain renewable resources as states may lack the geographical features necessary to produce the energy themselves. For example, the Midwest is ideal for wind power due to the region's strong and steady winds. Since areas with adequate conditions for production are limited to specific parts of the country, extensive transmission lines may be needed between states to expand access to renewables. Therefore, the wind power from the Midwest may be transmitted to the East where wind energy is less productive.

Transmission planning at the regional level is conducted within transmission planning regions as established through FERC Order 1000, which encompass both RTO and non-RTO planning regions. RTOs are responsible for determining what improvements are necessary for the grid, with input from utilities and stakeholders including states. Although RTOs play a significant role in transmission planning, individual states are still responsible for approving siting within their boundaries and can also play a role in RTO planning. Regions like the Northwest and Southeast do not have RTOs. Instead, individual utility plans form the basis of the regional transmission plan. While states have the authority to approve transmission infrastructure within their own state boundaries, transmission solutions that arise from planning processes in both RTO and non-RTO regions may extend beyond state lines to address broader needs. A lack of coordination between state siting processes and relevant transmission planners can create challenges for implementing a transmission plan.

Public opposition can further complicate transmission siting. Transmission development often requires the installation of long high-voltage wires supported by large metal towers. While necessary for electric transmission, these structures can be visually unappealing or otherwise impactful to local residents. As a result, communities may disapprove of the siting and construction of nearby transmission projects, thus hindering development plans.

TRANSMISSION RELIABILITY AND RESILIENCE

A robust interstate transmission system is also a crucial component to strengthen electric grid reliability and resilience, as the increased interconnection between regions enables greater flexibility and adaptability to supply and service disruptions. Increasingly frequent extreme weather events in recent years such as heat waves and winter storms have raised concerns about the reliability of the grid. These events have caused electricity supply disruptions across regions, as weather both impacted fuel sources and increased demand for both heat and electricity, forcing generators offline and over-stressing the electric grid.

These disruptions have been exacerbated by an inability to import sufficient power from unaffected regions, causing grid operators to implement rolling blackouts to avoid systemwide failures.

Strengthening the transmission system through interregional interconnection could reduce the impacts of these increasingly common and extreme weather events, while also avoiding the price spikes that occur with constrained generating resources. Increased integration would not only expand access to different sources of electricity but allow regions suffering from reduced energy production due to an extreme weather event to import electricity from unaffected regions. It can also have cost-ameliorating effects during severe weather and under normal conditions due to increased competition.

The increasing reliance on renewable energy furthers the need for a robust and interconnected transmission system. The output of certain sources of renewable energy, such as wind and solar, can vary due to weather conditions. Additionally, extreme weather events can restrict the output of both renewable and fossil fuel resources. Over larger geographic spaces, these resources will balance each other better than over small geographic spaces. Grid flexibility and the ability to quickly and easily move power between regions is considered integral to account for resource variability, thus ensuring an adequate energy supply as the use of renewable energy rises and frequent severe weather events continue.

Case Study: New England Clean Energy Connect

The New England Clean Energy Connect (NECEC) is a proposed transmission line that would deliver 1,200 megawatts of hydropower from Quebec throughout New England. The hydropower in Quebec would be connected to the Clean Energy Corridor in Maine through a Canadian transmission line. The proposed project would be the region's largest source of low-carbon electricity, thus making it a significant step towards achieving the clean energy goals of the states in the region. It would also contribute to electric reliability goals including winter resilience.

However, in November 2021, due to concerns of environmental damage caused by the project, 59% of Maine voters rejected the NECEC through a referendum to ban the construction of transmission lines along the proposed path. As a result, progress on the transmission line was halted. The rejection of the NECEC transmission line demonstrates the challenges facing interstate transmission line planning. Despite the need for additional high voltage transmission lines, public opinion is reluctant to permit development.

The result of the vote led to a lawsuit from NECEC claiming vested rights to build the transmission line. In May 2023 the lawsuit was decided in favor of NECEC developers, and the referendum was overturned, thus allowing construction on the line to resume after being stalled for a year and half.

State Roles in Transmission Planning Projects

Addressing the various issues associated with the modern the electric grid requires the involvement of many government agencies across multiple jurisdictions and a variety of stakeholders. The process of transmission planning typically starts with state legislation that sets energy requirements, such as renewable portfolio standards, that require the development of new transmission infrastructure to accommodate new energy resources.

Most states have enacted legislation or regulations requiring utilities to file integrated resource plans (IRPs) or similar planning documents. IRPs require utilities to review their energy demand and supply to ensure that their customers' long term energy needs will be met in a cost-effective manner. IRPs review a range of energy resource options including energy conservation, energy efficiency, generation and transmission lines. In addition to IRPs, RTOs use models to identify transmission needs to ensure reliable electricity supply.

Once transmission needs are identified through IRPs or RTO models, utilities may propose their desired transmission project, but they must receive a siting permit from various agencies before they can begin construction. Many state legislatures require their public utility commissions to review and approve the siting of proposed transmission projects within the state. Transmission projects must also receive land-use permits from local governments based on the zoning and planning ordinances of the local areas they occupy. Larger transmission projects may also require special federal permits, such as those addressing wildlife protection.

Additionally, the FERC regulates interstate transmission by issuing orders and establishing rules for transmission providers to follow. After siting is approved, certain proposed projects are reviewed by their RTO before they are permitted to connect to their regional transmission grid. Together these entities at the local, state, regional and federal level interact with utilities, contractors, manufacturers, retailers and other stakeholder groups to plan, site and build transmission projects.

STATE LEGISLATURES

States legislatures have significant influence over electricity transmission planning policy. Legislatures establish and fund energy regulatory entities, such as state public utility commissions (PUCs), that are responsible for overseeing and permitting transmission projects. Regulators implement policy based on statutory authority and guidance provided by legislatures. These entities vary across the country as states may designate regulatory authority over transmission projects to PUCs, siting boards, local entities or other state agencies. In addition to establishing these authorities, states may enact laws to support these agencies in achieving state energy goals, including goals related to the transmission grid.

For example, in 2021, Nevada enacted SB 448 requiring electric utilities to develop a plan to build transmission infrastructure to support the state's transition to a clean energy economy. These plans must outline how utilities expect to develop high-voltage transmission lines to increase transmission capacity by at least 800 megawatts by the end of 2028. These infrastructure developments are meant to help increase the reliability and resilience of the state's transmission grid while also expanding transmission access to renewable energy resources. Additionally, the bill requires every transmission provider in the state to join an RTO by 2030 to support the development of regional transmission connections.

State legislatures have also enacted laws specifying who is entitled to build transmission projects. Ten states have enacted right of first refusal (ROFR) laws for transmission development. ROFR offers incumbent utilities the initial opportunity to build transmission projects rather than putting the projects out for competitive solicitation bid among independent transmission developers. States typically implement ROFR laws to help speed up transmission development by avoiding the bidding process. However, ROFR laws are also criticized for limiting competition which may lead to increased costs and construction delays.

In addition to ROFR laws, states may attempt to expedite the siting and permitting processes by requiring by law that all state and local siting and permitting efforts be consolidated into a single process. State legislatures may establish state agencies dedicated to improving transmission access or deployment. Additionally, legislatures may encourage or require state agencies and officials to engage with multi-state, regional, or interregional transmission planning or cost-allocation efforts.

Most state legislatures designate at least one committee in each chamber to be responsible for oversight of state regulatory entities. For example, in Vermont the Energy and Technology Committee is primarily responsible for PUC oversight. These committees typically are the main form of communication between legislatures and regulators, either through committee hearings, reporting from the PUC, or official correspondence between the legislature and PUC. Committees may also have influence over PUCs through budget approvals, commission appointments or reporting requirements.

STATE SITING AUTHORITIES

State legislatures are responsible for designating an entity responsible for authorizing construction and issuing siting permits for transmission projects. In 32 states, PUCs are the entity responsible for approving the siting and construction of transmission facilities. PUCs are broadly responsible for overseeing electric utility service for investor-owned utilities. PUCs generally execute these responsibilities by regulating utility rates and the siting of energy related infrastructure.

Prior to the construction of any transmission facilities, utilities in these 32 states must first apply for approval with the state's PUC. The application includes the utility's proposed route and projected costs for the project. The majority of transmission developments are large-scale projects that compete with other land uses, such as agriculture, forests, parks, historic sites, transportation and housing. PUCs consider these interests by soliciting input from affected parties, including local residents, during the review process. Based on their findings, PUCs may approve or deny a permit for a transmission project. The PUC may also conditionally approve a project requiring certain modifications, such as altering the proposed route.

Legislatures and PUCs are often collaborative in the formation of policies. Legislative committees may reach out to their commission to conduct research studies or help draft legislative language. Oregon O.R.S. § 756.037 specifies that the PUC must provide information, resources and advice when required by the Legislative Assembly. On the other hand, the PUCs may also request statutory changes. Some PUCs, like in Pennsylvania and Vermont, have legislative liaisons who monitor legislative activity relevant to the commission.

State legislatures can also enact laws authorizing the actions of PUCs. For example, North Carolina enacted HB 951 in 2021 authorizing the utilities commission to take all reasonable steps to reduce emissions in the state by 70% by 2030 and achieve carbon neutrality by 2050. The bill also requires the commission to develop a plan with generation, transmission, distribution, storage and efficiency measures necessary for achieving these goals.

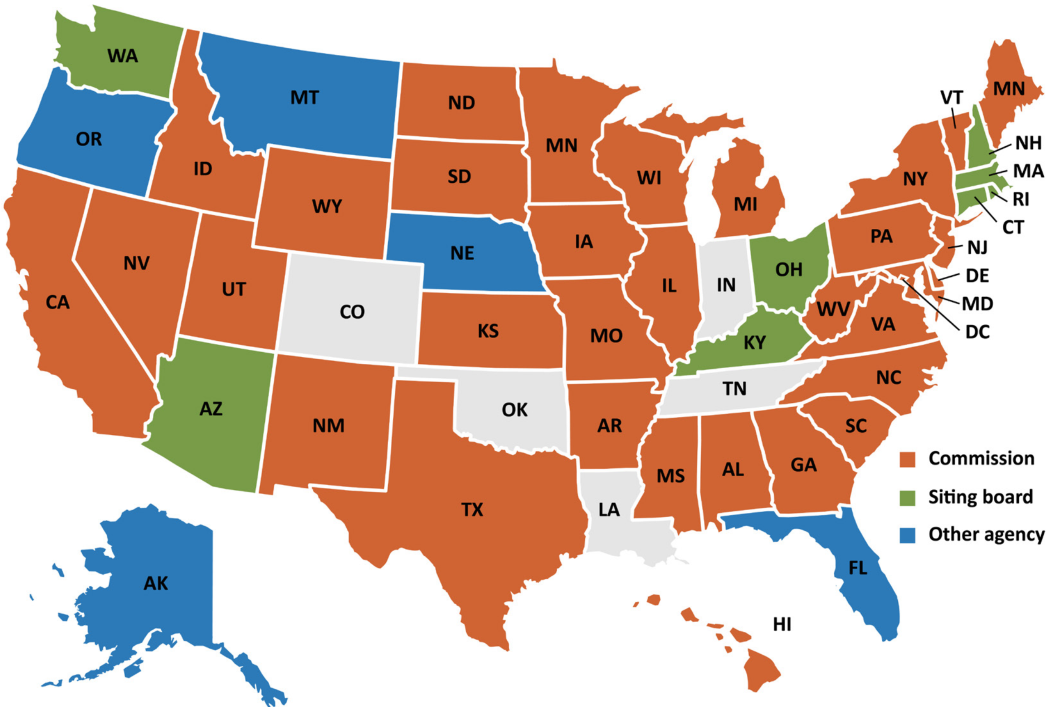
Furthermore, legislatures can encourage commissions or other siting entities to act at an interstate level. Ohio R.C. § 4928.12 requires the commission to hold joint hearings and enter into agreements with agencies of other states to cooperate on regulatory efforts and the enforcement of state laws for transmission entities.

Outside of PUCs, states may incorporate other entities into the transmission planning process. Eight states have designated siting boards responsible for the approval and siting of both transmission lines and generating facilities. Siting boards concentrate the efforts of multiple agencies. While membership of siting boards varies by state, members mostly include directors of other state agencies relevant to the siting process, such as state departments of natural resources or energy. Siting boards may also include legislators or even members of the public. As with PUCs, the composition and actions of siting boards are largely dictated by state legislation. Washington enacted HB 1812 in 2021 to expand the powers of the Energy Facility Site Evaluation Council to facilitate the development of a clean energy system.

Montana, Nebraska, Oregon, Florida and Alaska all designate siting and permitting responsibilities to other state agencies. For example, in Florida the Department of Environmental Protection is primarily responsible for transmission planning and makes a recommendation to the governor, who is responsible for the final decision.

Finally, five states do not have a centralized authority responsible for approving transmission projects. For example, local governments in Colorado are responsible for approving or denying transmission projects within their jurisdiction.

State Designated Transmission Siting Authorities



Source: National Council on Electricity Policy

TRANSMISSION INFRASTRUCTURE AUTHORITIES

As noted earlier, legislatures also can establish other types of state agencies with authority to advance transmission, such as dedicated transmission authorities. Seven state legislatures have established transmission infrastructure authorities to facilitate the development of new transmission systems. These authorities are not responsible for the siting process itself but may be authorized to support state economic, reliability and clean energy goals by establishing preferred siting corridors where transmission lines can be readily located. Examples of siting corridors may be near optimal renewable generation sites, in desired economic development zones, or in areas where transmission can easily connect to neighboring states.

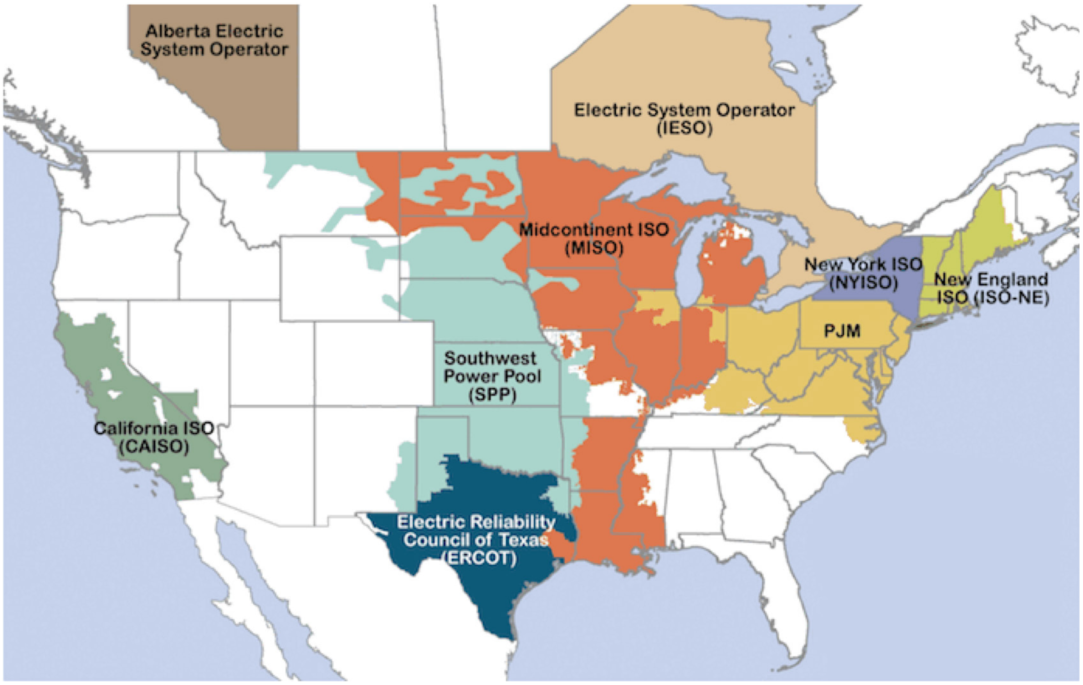
Alternatively, such authorities can be authorized by the state legislature to engage in regional transmission planning processes, issue bonds or use grants and loans to finance transmission projects, enter into lease arrangements or sales contracts, or participate in state siting processes as a third party. Some infrastructure authorities are even authorized to own and operate lines when private investment is not available, and to set rates for the use of facilities.

In 2021, Colorado SB 72 created the Colorado Electric Transmission Authority (CETA). The CETA is responsible for identifying and establishing transmission corridors within the state, but the plans are still subject to siting and permit approval by local governments. The bill requires the public purpose of proposed transmission lines to be evaluated for the system as a whole, so the public use and benefits of the transmission line must be considered for both Colorado and any other states that will be affected by the line. To facilitate this consideration, the CETA is required to participate in regional transmission forums to negotiate and plan interstate transmission corridors with entities outside of the state. The legislation further leaned into the regional benefits of increased transmission capacity by requiring the state's utilities to join an RTO by 2030.

Regional Transmission Organizations

While state entities are responsible for siting of transmission infrastructure within their state, transmission systems often cross state lines to form a regional network. The regional nature of the transmission system has led to the creation of RTOs and ISOs to control and monitor the bulk power grid over a certain area, usually covering multiple states.

Regional Transmission Organizations Map



Source: Federal Energy Regulatory Commission

In 1999, the FERC issued Order 2000 encouraging the formation of RTOs among transmission-owning utilities. The FERC required RTOs to create regional transmission plans and wholesale electricity markets intended to increase competition in power generation. As a result, RTOs formed from existing power pools of generation facilities. Today, around two-thirds of electricity demand is served through RTOs, which act as both grid and market operators, but do not own the generation or transmission. RTOs continue to be governed by FERC rules.

RTOs are responsible for ensuring their transmission systems are reliable and able to deliver sufficient electricity across multiple states. RTO planning processes are heavily dependent on models. Models are run each year to ensure system reliability. If any part of the system fails in the model, the RTO will determine what new transmission lines or upgrades are necessary to prevent this failure. Additionally, if a utility proposes a new transmission project, the RTO will run a model to determine the project's potential impact on the electric grid.

The Electric Reliability Council of Texas (ERCOT) is the RTO for most of the Texas grid. In 2022, ERCOT performed onsite inspections of 22 transmission station facilities to ensure they were properly weatherized for the winter. The inspections were required by new rules from the Public Utility Commission of Texas in response to severe winter weather which left millions of Texas residents without power in February 2021. The lack of sufficient transmission capacity to neighboring grids contributed to the power outages.

State legislatures can enact laws influencing RTOs. However, the extent of this influence varies in part due to the differing compositions of RTOs. Certain RTOs are confined to a specific state, such as ERCOT, the New York ISO (NYISO) and the California ISO (CAISO). In 2022, California enacted

SB 887 directing CAISO to identify the highest priority transmission facilities in need of increased transmission capacity to deliver future renewable energy resources to local areas.

On the other hand, certain states have multiple RTOs operating within them. For example, while Texas is primarily covered by ERCOT, certain areas in the state are serviced by the Southwest Power Pool (SPP) and the Midcontinent ISO (MISO). In 2021, Texas introduced HB 3344 to study the effects of interconnection between MISO and ERCOT in Harris County.

The majority of RTOs cover multiple states. As a result, individual state policies are pulled into the regional landscape. States often convene with RTOs through stakeholder groups. States have also formed regional state committee to coordinate policies with RTOs. Committees are generally made up of PUC members and other state officials appointed by the governor. After collaborating with RTOs in the planning process, states are still responsible for permitting the project within their boundaries.

Despite the growing importance of interregional transmission, RTOs mostly operate independently of each other. However, neighboring RTOs will often establish formal methods for collaboration in transmission planning. PJM Interconnection, NYISO, and ISO New England established the Northeastern ISO/RTO Planning Coordination Protocol. The protocol set guidelines for the exchange of data and information and the coordination of interconnection and transmission service requests between the three RTOs. PJM Interconnection and the MISO signed a Joint Operating Agreement to share data and information to ensure system reliability. Parties from the two RTOs and various stakeholders regularly meet to coordinate system planning. However, despite these formal agreements, collaboration between RTOs has historically been limited.

Federal Role

Although most of the siting and permitting decisions for transmission systems take place at the local and state level, the federal government still plays a role in transmission siting and the transmission planning process. Transmission projects may require permits from certain federal agencies. For example, a project that plans to occupy any federal or protected land, such as U.S. Forest Service land requires a permit from the relevant land administering agency. Projects that cross international borders must receive permits from the DOE. The FERC issues rules to regulate planning procedures and project cost allocation while the DOE operates programs that provide financial and technical assistance to states, utilities and planning entities.

FEDERAL ENERGY REGULATORY COMMISSION

One of the primary actors in transmission planning is the FERC, which regulates the interstate transmission of electricity, natural gas, and oil. Additionally, the commission approves and enforces reliability standards for the bulk power system and oversees RTO transmission planning. The FERC executes these responsibilities by issuing orders and establishing rules to regulate the country's transmission system.

In 2011, FERC issued Order 1000 to revise the transmission planning requirements for transmission providers. First, the order requires transmission providers to participate in a regional transmission planning process which develops a regional transmission plan. The transmission providers must also set standards to identify transmission needs driven by state or federal laws and regulations. Once these transmission needs are identified, they must evaluate solutions to meet those needs. Finally, transmission providers in neighboring transmission planning regions are required to identify the most cost-efficient approaches to their mutual transmission needs.

Order 1000 also created cost allocation reforms for transmission providers requiring regional planning process to have a regional cost allocation method for new transmission infrastructure. For most transmission projects the costs are either allocated to the generating companies that need to connect new power plants to the grid or they are allocated to the regulated utilities that own the transmission. When costs are allocated to utilities the costs may be recovered through rates for customers. The FERC is responsible for approving the rates for interstate transmission lines along with state PUCs.

FERC Order 2003, issued in 2003, set further guidelines for the cost allocation of new or upgraded transmission projects. Under the order, the costs for new projects requiring interconnection within RTOs are allocated to the interconnecting generators. The generators are responsible for the costs of all direct connection facilities required to connect the generator to the transmission grid. The generators must also fund any network upgrades required by the interconnection. While this is the general method of cost allocation for projects, RTOs may propose variations to the process.

In April 2022, the FERC issued a notice of proposed rulemaking that would reform regional transmission planning, while also increasing the role of states in transmission development. The proposal would require transmission providers to conduct long-term scenarios for regional transmission planning and establish transparent criteria for approving proposed transmission facilities. Additionally, providers must collaborate with relevant state entities within the transmission region regarding the cost allocation methods applied to transmission facilities. Requiring state approval for cost allocation prevents utilities from recovering the project's costs from rate payers before the project is operational. The proposal hopes the enhanced role of states will increase transmission development throughout the country.

INFRASTRUCTURE INVESTMENT AND JOBS ACT

The Infrastructure Investment and Jobs Act (IIJA), enacted in 2021, brought significant attention to the country's transmission needs. First, IIJA updated the regulatory framework of muti-state transmission line siting through the implementation of the FERC's backstop siting authority. With backstop siting authority the FERC may intervene over the authority of a single state and issue permits for the construction or upgrade of transmission systems in certain National Interest Electric Transmission Corridors (NIETC) if a state has denied the application of a qualified project or has not acted on the application. NIETCs are areas that meet specific DOE qualifications, such as promoting energy security or enhancing the use of intermittent energy. While no NIETCs have been designated yet, the DOE plans to issue the results of the National Transmission Needs Study, which will inform future NIETC designations by the end of 2023.

The IIJA expanded backstop siting authority so the FERC may still issue the permits for construction if a state denies or holds the application for a transmission construction project for more than a year. In response to state opposition to the backstop siting authority, the FERC initiated the Joint Federal-State Task Force on Electric Transmission for federal and state regulators to policies relevant to planning and paying for transmission.

In addition to strengthening federal backstop siting authority, the IIJA also funded programs under the Building a Better Grid Initiative. The initiative aims to launch the development of new and upgraded transmission lines across the country. As part of this process, the U.S. Department of Energy is conducting the National Transmission Planning Study. The study involves a modeling of the transmission needed to accelerate decarbonization while maintaining grid reliability. The National Renewable Energy Laboratory and the Pacific Northwest National Laboratory are conducting the study. Together, these laboratories are engaging with stakeholders to discuss the large-scale transmission developments that are necessary for achieving clean energy goals. Stakeholders include transmission owners and operators, RTOs, PUCs and state energy offices.

The IIJA also expanded existing policies, such as the State Energy Program (SEP). Established in the 1970s, the SEP supports states through funding and technical assistance in implementing energy efficiency and renewable energy measures. The IIJA granted $500 million to the SEP and modified the requirements for state energy conservation plans to include specific transmission and distribution planning actions. These state actions include support for local governments and tribes, studies on transmission line feasibility, preparation of necessary project design and permits and outreach to relevant stakeholders.

INFLATION REDUCTION ACT

Federal investment in transmission system planning was furthered through the enactment of the Inflation Reduction Act (IRA) in August of 2022. The IRA expands on the Building a Better Grid Initiative with the Transmission Siting and Economic Development Grants Program. The IRA allocated $760 million for the program to help state and local siting authorities with siting and permitting for interstate and offshore transmission lines. Siting agencies may receive grants to be used for purposes such as transmission project studies, identifying alternative siting corridors and facilitating project negotiations. The grants are contingent upon siting agencies making final decisions on transmissions projects within two years of the grant being provided. This support aims to reduce regulatory delays for transmission construction by helping state siting authorities manage the review and approval process for proposed transmission projects. The program also includes grants for state, tribal and local governments for engagement and economic development in communities that are impacted by transmission projects.

The IRA also appropriated $2 billion for a direct loan program for transmission project development known as the Transmission Facility Finance Program. Transmission projects located in a National Interest Electric Transmission Corridor are eligible for the loans. Although there are currently no designated NIETCs, the loan program will continue through September 2030.

Other Trends in Transmission Planning

The transmission system demands more than the expansion of infrastructure to meet renewable energy and reliability demands. New emerging technologies are being deployed on the grid to improve reliability and efficiency without requiring the construction of major infrastructure projects. While these grid modernization initiatives may be beneficial, they will bring significant changes to how energy is transmitted and distributed among consumers. Policymakers will be responsible for navigating these new technologies to ensure an effective approach to grid modernization.

Some of these grid modernization trends can be referred to as nonwires alternatives. Nonwires alternatives are electric investments meant to forego the need to construct new transmission or distribution infrastructure. Such investments are typically more cost-effective, as they avoid or delay the need for costly infrastructure investments. In 2020, Maine enacted HP 855 to create the Nonwires Alternative Coordinator in the Office of the Public Advocate. The coordinator is responsible for identifying nonwires alternatives and comparing their cost-effectiveness to more traditional transmission and distribution investments.

Grid Enhancing Technologies (GETs) are a category of non-wires alternatives which increase grid capacity and flexibility through hardware and software. They include advanced power flow control, dynamic line ratings, and topology optimization. In operations, these technologies can reduce congestion costs and improve economic dispatch, situational awareness and reliability. In planning, they can reduce the time, cost and complexity of integrating new generation and load.

High-performance conductors are another growing category of transmission technology. Most of the current transmission system uses traditional steel-reinforced transmission conductor technology. High-performance conductors consist of advanced conductors and superconductors which can deliver more capacity, are more energy efficient and sag less than traditional steel-reinforced transmission conductors. State regulators typically have a statutory requirement to approve the upfront "least cost alternative," rather than investments that produce cost savings in future years. However, with the passage of HB 729, the Montana Legislature approved cost-effectiveness criteria and an incentive to utilize high-performance conductors for utilities.

Distributed energy resources (DERs) are a growing component of the modern grid. DERs refer to electric generating resources that are located at or near the distribution grid, where electricity is delivered to customers. Rooftop solar, small wind turbines, energy storage systems, electric vehicles and demand-side management programs can all act as distributed energy resources. By connecting directly to the distribution system, these resources can reduce the demand on the bulk power grid, limiting the need for transmission infrastructure investments. However, these resources are often connected to the customer's side of the utility meter, so they are unknown to the utility and difficult to incorporate into system planning.

DERs have also allowed for the development of microgrids. Microgrids are self-contained, miniature electric grids. Microgrids rely on nearby generation sources and grid control equipment that allows them to disconnect from the larger grid. If the larger grid is down, microgrids are able to continue operating in "island mode." Microgrids are often used on college campuses or medical facilities to bolster the resiliency of their electrical system. (For more information on this topic, please refer to NCSL's Integrated Distribution Planning Primer.)

Conclusion

With a significant energy transition on the horizon, an overhaul of the nation's transmission system is required. It is crucial for policymakers to understand the transmission upgrades and developments needed to ensure an effective and efficient energy transition. As state legislatures enact laws authorizing and directing the entities responsible for transmission planning it is important to consider the new challenges and technologies affecting the grid.

While policymakers at both the state and federal level have begun to tackle the country's transmission needs, substantial progress still must be made with policies to address new energy demands, weather risks and new solutions for meeting energy needs over the coming decades. Collaboration between states will be necessary when approaching these challenges to help integrate a resilient and reliable transmission system across the country. Recognizing these needs will allow policymakers to establish the transmission grid necessary for achieving both state and federal energy goals.

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