How are we going to build all that clean energy infrastructure?

Considering Private Enterprise, Public Initiative, and Hybrid Approaches to the Challenge of Electricity Transmission

Published August 2021

NISKANEN CENTER | CATF CLEAN AIR TASK FORCE

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Special thanks to Jay Caspary, Rob Gramlich, Eli Massey, Ari Peskoe, and Alison Silverstein for their thoughtful feedback

Foreword

In April 2021, Clean Air Task Force and the Niskanen Center hosted a half-day workshop with leading academics, industry professionals, and regulators to consider the state of electric transmission and clean energy policy in the U.S. and the need for a fundamentally new approach for building new transmission quickly in light of the need for a net-zero carbon energy system. Following the workshop, we tested our conclusions with the attendees and additional experts to capture the spectrum of issues that transmission and clean energy infrastructure face.

The workshop resulted in a canvas of public policy possibilities, but—importantly—concluded that assembling a set of policies should be secondary to establishing the organizing principles. Policymakers must grapple with the appropriate role of private enterprise and public initiative to create a coherent set of policies that addresses the breadth of new infrastructure needed and ensures a sustained commitment to the effort.

Just a week before the publication of this report, the Senate passed the Infrastructure Investment and Jobs Act. Two of the provisions in the IIJA are captured in this report, both of which weigh on the side of a stronger federal role: the "anchor tenant" funding mechanism and strengthening the federal "backstop" siting authority. The Budget Reconciliation process may include additional policies, such as an investment tax credit, which would weigh on the side of supporting private enterprise.

Electricity transmission development has been languishing for more than a decade without significant policy changes. These incremental changes represent an important recognition by lawmakers of the need for more transmission capacity and the imperative for effective transmission policy to achieve it.

But as we consider the next few decades, the underlying questions must still be answered: what policies can get projects built at the needed scale and speed without replicating the inequitable implementations of past infrastructure expansion, and what are the most appropriate roles for government and the private sector? The 5P framework proposed in this paper is both a scaffold and a call to action, and the specific institutional reform proposals we suggest for consideration are designed to sharpen the discussion. We must incorporate public participation and establish a transparent and consistent development process to improve upon the traditional planning, permitting and paying aspects of infrastructure policy. And we also need to get the job done in just a few decades.

The policies in discussion in Congress are a step forward, but there are many gigawatt-miles to go.

SECTION 1

Executive Summary

Though the technical details vary, a dominant theme in decarbonization studies is that any pathway to a net-zero carbon energy system in the United States will require a staggering build-out of infrastructure for electricity generation and transmission, zero-carbon fuels, and carbon sequestration. Significant action is needed in the next 10 years to establish the trajectory toward completing such an undertaking by 2050.

To date, however, there has been hardly any conversation among policy analysts, let alone high-level policymakers, about how such a massive infrastructure initiative should be undertaken. The matter is especially urgent because we have abundant evidence that our existing system for electricity infrastructure expansion is slow, inefficient, and expensive.

In a spring 2021 workshop, the Niskanen Center and the Clean Air Task Force convened a group of practitioners, advocates, and academics (the Appendix includes a list of attendees and contributors) to consider how the nation can achieve such an unprecedented infrastructure build-out.

Using electricity transmission as a case study, the workshop focused on the following questions:

- How can we achieve the necessary paradigm shift to build at the scale needed?
- More specifically, what are the roles of private enterprise and public initiative in driving the needed infrastructure transformation?

This paper summarizes some key themes and policy ideas from that workshop. It does not represent a consensus of the group but rather starting points for further discussion.

A central framing concept for the workshop, and this paper, is that policy for transmission infrastructure is traditionally structured around the three "Ps": planning, permitting, and paying. One important step forward would be to incorporate two additional Ps in policy

design: participation (to include the perspectives and needs of the full range of stakeholders, especially local communities) and process (to provide a standard framework to spur project development and investment with clear expectations and accountability mechanisms).

There was general recognition that a national climate initiative, such as a carbon tax or clean energy standard, is necessary but not sufficient for removing the barriers to building the interstate transmission that decarbonization will require. There was broad support for the idea that a national transmission plan is needed to establish a clear set of goals and metrics across the many entities involved in moving electricity.

Whether it emphasizes private capital or public spending, any national transmission plan will have to establish enough credibility and buy-in to be sustainable through changing administrations. Policymakers will need to put in hard work to establish the common understanding of costs, benefits, and national priorities on which such a plan must rest. Ensuring the plan's longevity will also require a deliberate policy design to build and empower constituencies who will defend it far into the future.

From this foundation (3+2 "Ps" and a national plan), we describe a range of policy elements, then present two sample policy models for consideration, one emphasizing private enterprise and the other public initiative. While the objectives of the two sample initiatives are consistent, such as addressing conflicts in siting and permitting, they differ in the extent of federal authority that would be invoked.

It is important to note that the models are not strict opposites — they are positioned along a spectrum that runs from the market to the federal government, with state and local government occupying the middle tiers. Elements of the two models could be combined in novel formulations. But outlining two types helps clarify the choices and tradeoffs we face.

The public-initiative model centers around an independent National Transmission Organization (NTO) to facilitate public-private partnerships, centralize siting and permitting, and guide the implementation of the national transmission plan. This would at a minimum require federal legislation to establish authority, provide funding, and alter current permitting practices.

The private-enterprise model proposes that a national transmission plan would lay out the metrics and incentives around which a competitive transmission and generation industry would organize. This solution would build on existing authority at the Federal Energy Regulatory Commission (FERC) but require new rulemaking and likely some congressional action for incentives and additional authority.

The NTO approach risks being cumbersome if it is not well designed, while the private-enterprise approach risks not being able to meet the full scale of national need fast enough. These policy considerations, of course, must be integrated with a calculus about the political feasibility and sustainability of either model. The problem of marshaling political support was beyond the scope of our discussion but must inform future development of the policy framework.

The 5P framework and paradigm contrast may be helpful for discussion of other clean energy infrastructure, though this is also beyond the scope of the workshop.

SECTION 2

Background: The Decarbonization Challenge

Achieving a zero-carbon power grid by midcentury will require replacing much of the nation's current generating capacity with zero-carbon energy and then tripling or quadrupling it to produce the amount of electricity it will take to decarbonize other sectors of the economy with intermittent resources. This expansion must include a great increase in the amount of long-distance transmission, both within and among states.

Such a transformation will require significant changes in the way the power sector is planned, financed, and governed. The scale of the needed change is immense and unprecedented. Decarbonization studies (the Princeton Net Zero American Project,[1] depicted in Figure 1 below, is a typical example) suggest:

- More or less completely replacing the current bulk electricity system, including existing zero-carbon sources at their end of life, by midcentury and increasing total generating capacity from today by a factor of four, from 1,100 GW to 4,000 GW.
- Adding wind and solar at an accelerating rate, ending the 30-year period until 2050 with annual additions five times faster than today, even as the best sites are taken early. The result would be a wind and solar fleet that at peak could produce three times as much electricity as all types of power plants combined can generate today.
- Adding 500-1,000 GW of mostly new, clean capacity that guarantees a steady output, such as nuclear, gas with carbon capture, hydrogen-fueled turbines, and long-duration energy storage, up from 875 GW today.
- In doing so, expanding the total land area required for electric generation (apart from transmission) by a factor of 13, with wind and solar taking up 590,000 square kilometers, an area roughly equal to the size of Connecticut, Illinois, Indiana, Kentucky, Massachusetts, Ohio, Rhode Island, and Tennessee put together.
- Building 110,000 km of new CO_2 pipeline infrastructure, a twelve-fold expansion, and developing hundreds of CO_2 storage sites able to store 1.3 billion tons of CO_2 per year, handling more fluid than U.S. oil production does today.
- More than tripling the capacity of the long-distance U.S. transmission system network, while adding tens of thousands of shorter generation ties to connect wind and solar farms to bulk transmission lines.

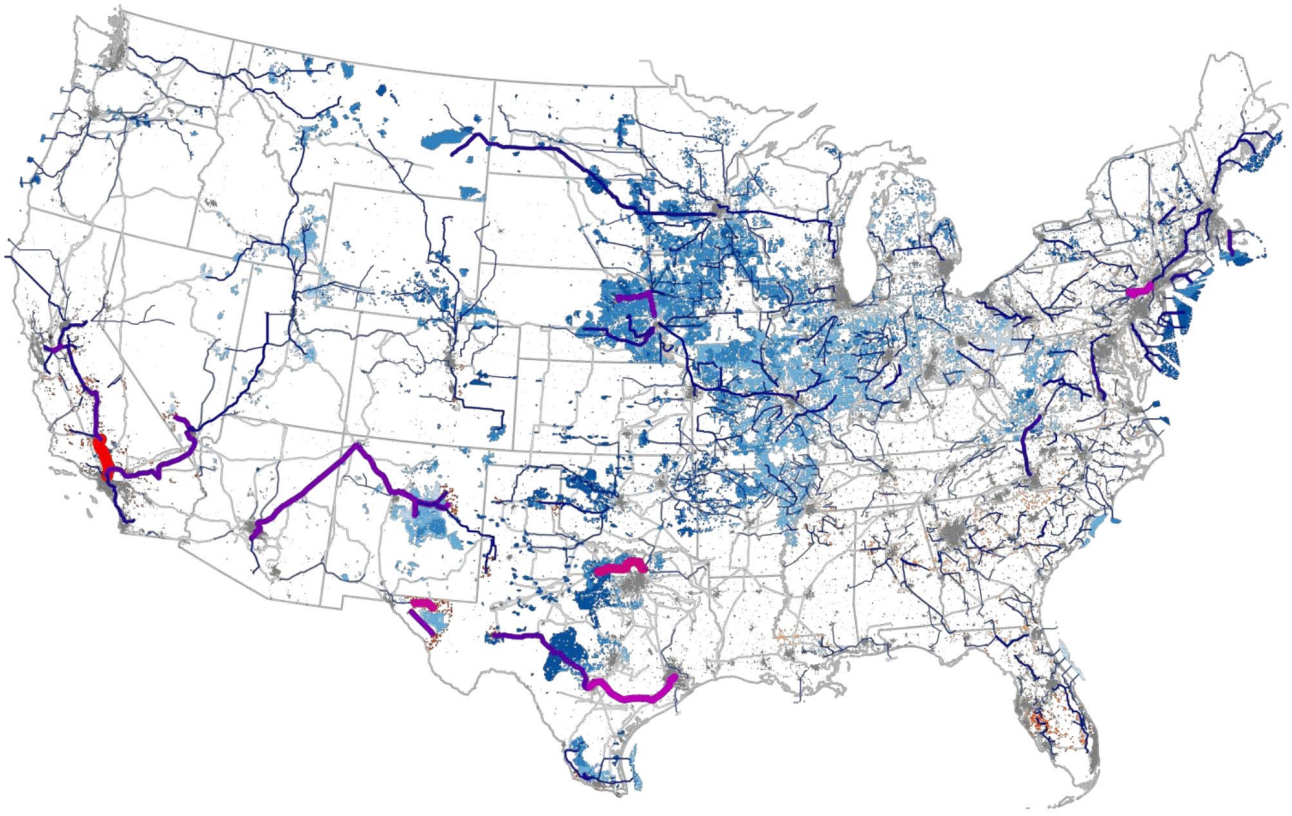
This is a massive industrialization of the U.S. landscape that will take several decades to complete. Clearly, we need to build a lot, and fast — otherwise we will not attain our climate goals. An in-depth discussion about a policy path must first grapple with the significance of this leap and what it implies in terms of governance challenges.

While there is broad consensus across studies on the pace and scale of transformation required, there is no agreement as to the combination of market reforms versus direct regulation and public investments that will lead to timely, cost-effective, and equitable decarbonization.

[1] Eric Larson et al., *Net-Zero America by 2050: Potential Pathways, Infrastructure, and Impacts*. (Princeton University, December 15, 2020)

Figure 1: One example of the nonthermal generation and transmission footprint for a 100% carbon-free electric system in 2050, with siting based on resource availability, land use restrictions, and existing transmission.

Source: Larson, *Net-Zero America*.



Transmission & Generator

2020 transmission capacity: ~320,000 GW-km
2050 transmission capacity: **~1,012,000 GW-km (3.2x)**

Note: Capacity factors at generator sites are reflected in color intensity, with highest CF = darkest color

Note: Transmission expansion is visualized along existing rights-of-way (>160 kV); paths are indicative not definitive.

Transmission Capacity (GW)

- 0.0006
- 0.0006 - 70.5
- 70.5
- 0.0006
- 23.5004
- 47.0002
- 70.5

- PV
- Wind
- Population Density ≤ 100 people per km²
- Population Density > 100 people per km²
- Existing transmission (> 345 kV)

SECTION 3

Why Transmission Is Critical and Difficult

Given its vast geography, the U.S. has access to diverse renewable resources. Solar power is technically and economically feasible in most of the contiguous 48 states; wind power is abundant across the Great Plains and along both coasts; and various pockets of the country are endowed with hydro and geothermal resources.[2] However, to take advantage of these resources, we need a more interconnected transmission grid than the one we have now. Power cannot simply flow one way from remote production areas to load centers; different regions of the country must be connected with two-way lines that can balance source variability, time-of-day considerations, and weather patterns (such as heat waves or cold snaps covering large areas for multiple days).[3] Such resource-sharing will spread the benefits of decarbonization, minimizing the overall costs to consumers.[4]

But the current system of planning and investment produces an electricity infrastructure that expands expensively and inefficiently. A 10-year review of the western U.S. shows little interstate, bulk power transmission has been built compared to what was expected in a 2010 projection of planned projects.[5]

A 2016 report on transmission challenges by the Lawrence Berkeley National Laboratory included five projects with projected completion dates by 2020. Today, in 2021, only one of those projects is complete. The other four have been delayed by both state and federal siting and permitting issues.[6] And yet, transmission capacity in gigawatt-miles (GW-mi) is expanding year over year, and transmission costs borne by consumers are increasing. In the PJM region, wholesale transmission costs have risen 45 percent since 2016 and 122 percent since 2013.[7]

Generation and transmission are one another's limiting factors in the grid. Generation projects may be delayed or face additional costs when there is inadequate supporting transmission to account for the impacts on system flow.[8] Transmission projects, especially interregional bulk transmission, require a business case that new power will be delivered to serve a load. This paper primarily focuses on transmission, in part because its expansion is common to most net-zero analyses (see Figure 2), but also because of the additional complicating factors of multistate projects and complex financing mechanisms that many generation projects do not face.

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[2] National Renewable Energy Laboratory, *Geospatial Data Science Data and Tools*

[3] Aaron Bloom et al, *Transmission Planning for 100% Clean Electricity*, (Energy Systems Integration Group, January 2021); Aaron Bloom et al., *The Value of Increased HVDC Capacity Between Eastern and Western U.S. Grids: The Interconnections Seam Study, NREL/JA-6A20-76580* (National Renewable Energy Laboratory, October 2020); Alexander MacDonald et al., "Future Cost-Competitive Electricity Systems and Their Impact on US CO_2 Emissions," *Nature Climate Change vol 6* (Jan 2016)

[4] Patrick Brown and Audun Botterud, "The Value of Inter-Regional Coordination and Transmission in Decarbonizing the US Electricity System," *Joule* 5, no. 1 (December 2020): 115-134.; Larson, *Net-Zero America*. It should be noted that the amount of transmission required varies exponentially with reliance on renewable energy sources. For example, in the Princeton study (Larson), in a constrained renewable energy availability scenario, where 50% of annual power is provided by wind and solar, and the balance by mostly firm generation such as nuclear and gas with CCS, transmission requirements are 90% higher than today, as compared to 220% higher in the base scenario where wind and solar provide 85% of annual generation.

[5] *10-Year Regional Transmission Plan: 2020 Study Report*, (Western Electricity Coordinating Council, September 2011)

[6] Joseph Eto, *Building Electric Transmission Lines: A Review of Recent Transmission Projects, Energy Analysis and Environmental Impacts Division*, LBNL-1006330 (Lawrence Berkeley National Laboratory, September 2016)

[7] *Consumer Advocates of the PJM States (CAPS) Presentation*, (PJM Annual Meeting, Public Interest Environmental Organization Users Group, May 2021)

[8] Jay Caspary, et al, *Disconnected: The Need for a New Generator Interconnection Policy*, (Americans for a Clean Energy Grid, January 2021)

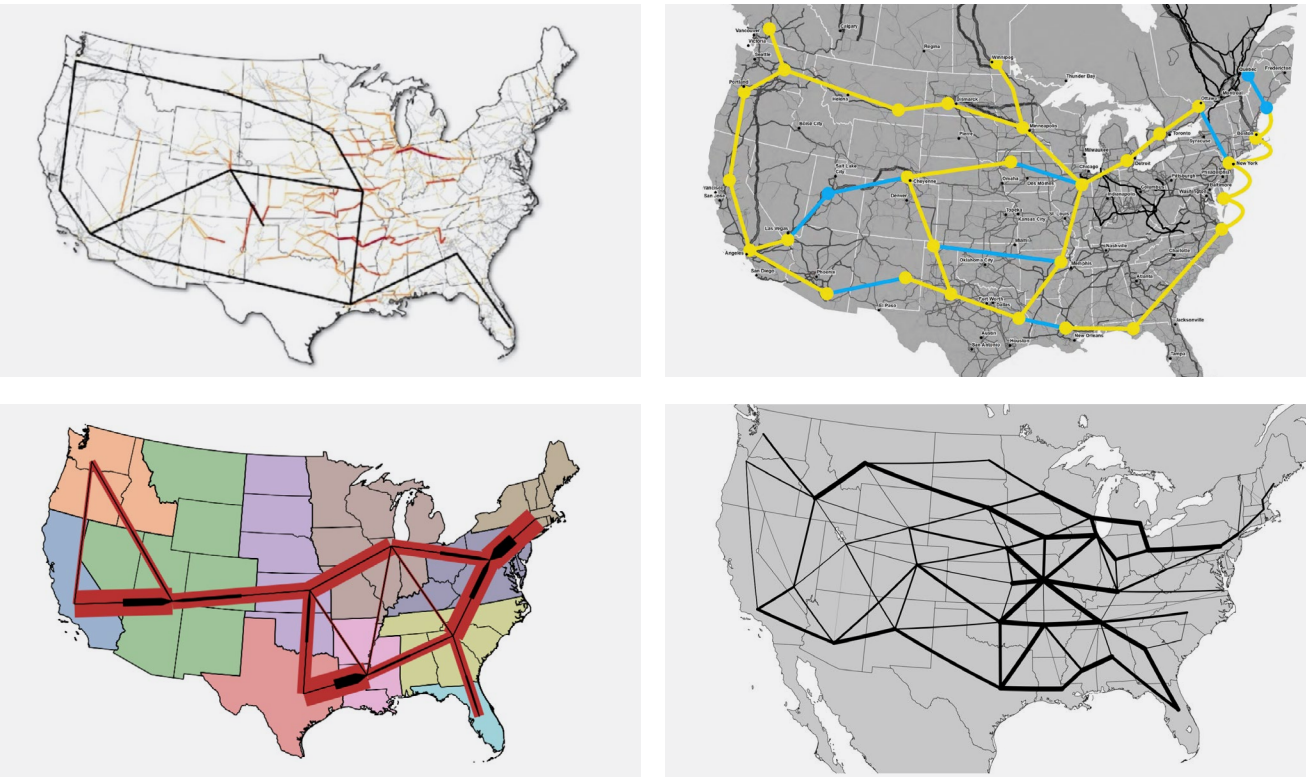
State regulators often have geographically and categorically limited definitions of the benefits that interstate transmission projects must provide to receive approval to be built. Regulators can block a project that does not meet these standards, even if the costs are not going to be borne by customers in their own state. The definition of benefits often includes direct electricity integration — akin to adding local exit ramps for long-distance power lines — which can be particularly burdensome for high-voltage direct current lines due to the cost of converter stations.

The goals of ensuring resilience and incorporating geographically diverse resources are not clearly accounted for in the electricity infrastructure building process. Definitions of need, benefits, and public necessity vary across states and might well be inconsistent with a national perspective. **In the face of such tension, who should have the authority to set the terms and standards, and how should they be enforced to serve the national good?**

To make matters even more complicated, some decarbonization studies additionally find that the lowest-cost approaches to the energy transition have the large interregional lines connected into a continent-spanning grid ("macrogrid"), shown in Figure 2. **Who would build, pay for, and govern this system?**

Making the policy changes and building the coalitions needed to successfully build sufficient generation and transmission is critical for decarbonization. Besides ensuring the reliability of a renewables-based grid, it could serve as a model for other infrastructure, such as the hydrogen-transport and carbon-sequestration build-outs we will need to achieve decarbonization.

Figure 2: Macrogrid concepts from technical and economic studies of decarbonization.[9] Thousands of miles of high-voltage, high-capacity transmission lines could lower consumer costs and speed renewables integration, but the political feasibility is questionable under current policy.



[9] *Aaron Bloom et al., The Value of Increased HVDC Capacity Between Eastern and Western U.S. Grids: The Interconnections Seam Study, NREL/JA-6A20-76580 (National Renewable Energy Laboratory, October 2020); Aaron Bloom et al., Transmission Planning for 100% Clean Electricity, (Energy Systems Integration Group, January 2021); Patrick Brown and Audun Botterud, "The Value of Inter-Regional Coordination and Transmission in Decarbonizing the US Electricity System," Joule 5, no. 1 (December 2020): 115-134; Christopher Clack et al., Weather-Informed Energy Systems: for Design, Operations and Markets (Planning Version) (Vibrant Clean Energy, August 2020)*

SECTION 4

Transmission Development: Key Elements and Challenges

It is often said that transmission is enabled by three Ps: planning, permitting, and paying. Below, we describe these traditional terms and introduce two more: participation and process.

The traditional three Ps: planning, permitting, paying

Planning. "Planning" is a broad term that encompasses various levels of market and government action. Under the current U.S. system, that responsibility is split between federal, state, and local governments or, some would say, less charitably, Balkanized. Utilities, regional transmission organizations, independent system operators, and regional planning entities each establish and run their own planning processes. The Federal Regulatory Energy Commission (FERC) established planning requirements, but each process is designed separately by the planning entity. Planning starts with demand forecasts reflecting expected growth and considers where new transmission lines must be built or existing lines must be upgraded to provide reliable and affordable electric service. Looking forward, planning is likely to become a more contested space for a few reasons.

First, demand growth has been modest for more than a decade, but many expect a step-change increase in transmission capacity requirements with decarbonization. The tension between generation and transmission capacity expansion make such step-changes difficult to plan for across a system.[10]

Second, in the case of lines built and operated through such a planning process, the interregional lines that will best serve decarbonization must participate in the planning processes in each region they traverse. Though interregional planning is required by FERC, to date this process has not resulted in any interregional lines.

Third, lines that are financed by private developers ("merchant lines") do not have to proceed through the regional planning process but still must be connected into the system of an incumbent utility for their power to reach users. These lines are subject to the backed up and inefficient interconnection process of getting plugged into the grid before they can operate. The interconnection of externally developed lines often requires changes to the system into which they connect, which imposes additional costs on the merchant developers and can conflict with the existing plans of regional transmission organizations.[11] In general, under the status quo, planning is still a very siloed and fragmented process at all levels.

Permitting. In many states, all transmission projects must be approved at the state or local level and receive a "certificate of public good" permitting construction.[12] Related but sometimes separate is the siting review and approval process, in which the particular path of the line and impacted land are examined to determine whether environmental and social impacts are consistent with regulatory standards. This process may occur at the state or county level. Finally, the federal government requires a review under the National Environmental Policy Act (NEPA) for any project that involves federal financing or traverses federal land or that could impact habitats

[10] See, for example, Futures 1,2,3 in MISO's 2021 Long-Range Transmission Plan Roadmap

[11] Jeffrey Tomich, "Midwest Transmission Morass: A 100% Clean Power Warning?" *E&E EnergyWire*, (March 21, 2021)

[12] Liza Reed et al., "Expanding Transmission Capacity: Examples of Regulatory Paths for Five Alternative Strategies," *The Electricity Journal* 33, no. 6, (July 2020)

[13] Eto, *Building Electric Transmission Lines*

and historic sites protected by the Endangered Species Act and National Historic Preservation Act, respectively. Some states also require environmental reviews (e.g., California) or historical site reviews (e.g., Ohio).[13] Any one of these processes can add procedural hurdles or prompt a cancellation of a transmission line if one state or locality does not support it or if coalitions object.[14]

Complicating matters, identification of "need" in the permitting process can be different from the identification of need in the utility planning realm, with the former focusing on economic need and benefits to the state and the latter focusing on the function of the overall electricity system. Ultimately, a state regulator's determination of need is the final word and can terminate a project.[15] The potential for delays from permitting or planning creates timing uncertainties for transmission lines, which in itself can prevent them from moving forward.

Paying. Transmission lines built by an incumbent public utility may be financed directly by increasing retail rates and receive a guaranteed rate of return from regulators. Lines developed in the traditional utility planning process (i.e., nonmerchant lines) that bring benefits to multiple utilities ideally share the costs across all beneficiaries commensurate with the benefits received. There are some criteria established by FERC for specifying how this allocation should be determined, but they are not sufficient to provide a clear and universal formula or even an adequate definition of who counts as a beneficiary.[16] Interregional lines often fail to get off the ground due to uncertain financing or incongruous cost allocation formulas.

Merchant lines, which have no incumbent public utility sponsor, can provide a multitude of benefits, but their rates of return typically depend on partnering with generation providers to sell the power.[17] Guaranteeing income often requires signing long-term power purchase agreements, and it can be difficult to line up investors with such long time horizons.

Expanding the transmission framework: participation and process

Participation is usually considered part of permitting, but we argue that a framework for tackling the overall scale of change needed, and how a community defines its needs within that transformation, should view inclusive and equitable community participation as a separate, critical element in development. Questions of participation and process are closely related. The interjurisdictional nature of transmission makes development particularly complex and therefore opaque, but **there is currently no federal standard or common state framework for getting a project from conception to implementation.**

Participation. Local community input is increasingly critical to infrastructure development on private lands subject to state and local land-use regulation, on public lands where it has implications for neighboring landowners and community users, and on sovereign tribal nations and tribal footprints. This issue has grown more salient thanks to increased understanding of the decades-old environmental justice movement, fresh skepticism of eminent domain, controversies over federal land management in the West, and the growth of social media. The absence of community support can be fatal, particularly when incumbent electric generators and other stakeholders opposed to a proposed project align themselves with local communities that are opposed.

Community attitudes are shaped by perceptions of project impacts on land, culture, landscape, aesthetics, and wildlife; noise, health, and safety; and economic factors such as landowner compensation, employment, tax revenues, and property values. Constructive project development efforts often involve early and continuous community engagement. Inclusive, "smart from the start," sustained interaction should educate, build trust, and incorporate local input and community compensation such as impact mitigation, sharing of project revenues, direct investment in community infrastructure (e.g., parks and schools), or provision of

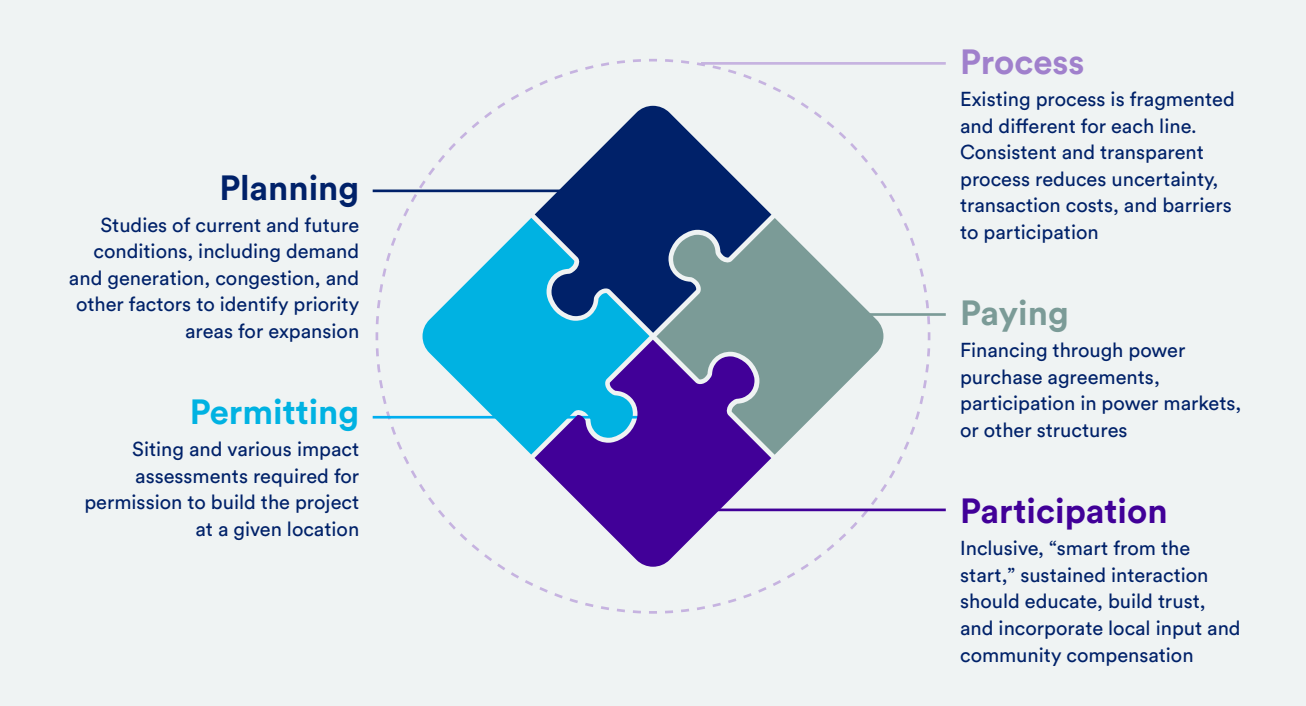
[14] Liza Reed, *Transmission Stalled: Siting Challenges for Interregional Transmission,* (Niskanen Center, April 2021)

[15] Ibid

[16] Federal Energy Regulatory Commission, Order No. 1000 - Transmission Planning and Cost Allocation

[17] Stephen Smith, Clean Line: A TVA Failure of Clean Energy and Environmental Leadership, (cleanenergy.org, January 8, 2018)

Figure 3: Putting the 5 Ps together. Planning, participation, permitting, and paying are all pieces; process defines how these pieces fit together in a cohesive framework that enables project development and completion.



home-value insurance. These efforts may be encouraged by promoting and rewarding corporate best practices and establishing standards for community benefits and engagement, compensation, just and equitable transitions, and environmental justice.

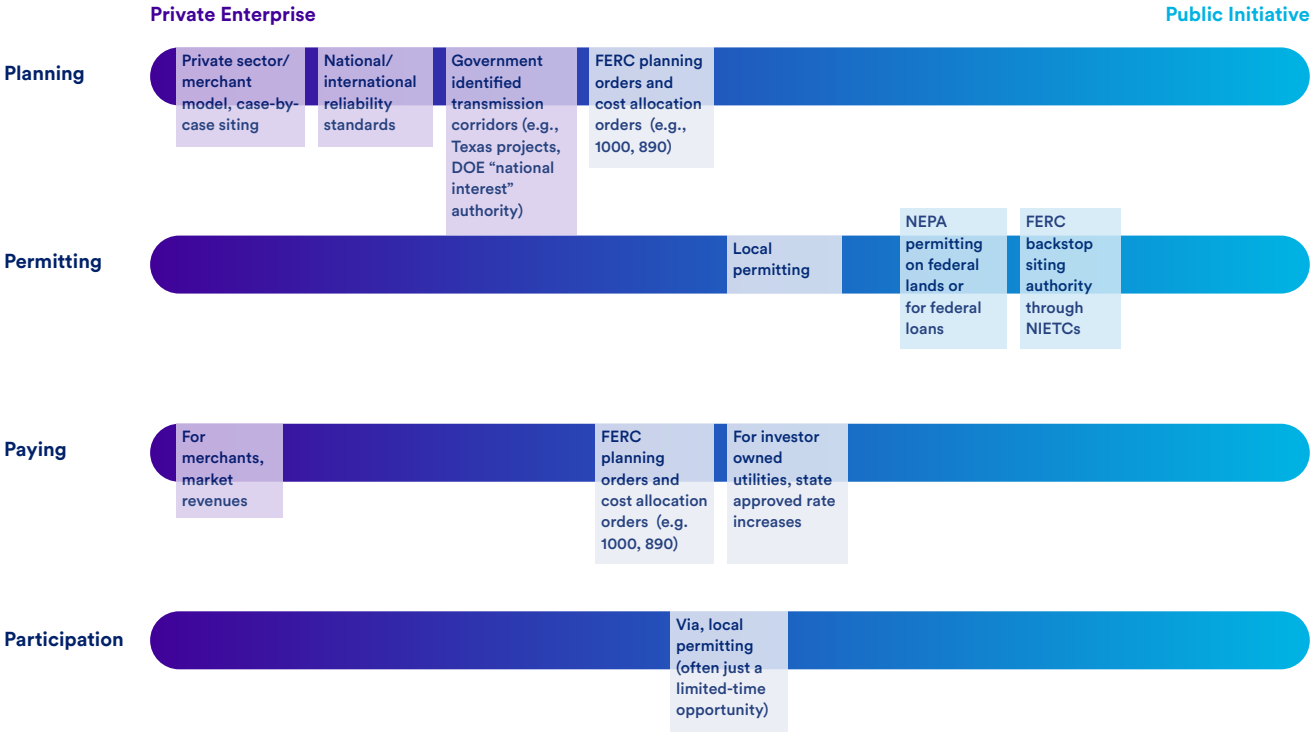
Process. Interstate transmission projects lack standardized and transparent development processes. In many locations, renewable energy projects have been the subject of guidelines for technical and regulatory considerations and implementation, but transmission is without such guideposts, particularly for private developers. A commitment to process would undergird planning, paying, permitting, and participation and would focus on how they interact for successful completion of lines. A comprehensive study of successful and delayed projects could identify issues that might require standardization. A federal agency, for example, could study and perhaps even standardize a process, socializing or requiring best practices and knowledge sharing with stakeholders.

These five facets are interrelated (see Figure 3), and rarely does a project suffer from just one delay. Massive amounts of carbon-free generation — whether renewables, hybrid systems with energy storage, nuclear, or thermal with carbon capture — are likely to face similar barriers as transmission. Renewable energy projects already are facing some of these barriers in many regions.

Laying out the components of infrastructure planning is not the same as prescribing their contents, however. If we agree that the 5 "Ps" are a useful framework, we still need to decide on a broader set of principles that should inform each of them. Tackling the decarbonization challenge may require us to rethink those principles fundamentally — applying a paradigm shift rather than a series of small changes to existing policies. The workshop compared approaches that rely on incentives for private development with those that emphasize public initiatives.

The balance of this paper catalogs some options (existing and conceptual). The existing policies are captured in Figure 4 on the next page, followed by Figure 5, which captures the breadth of ideas discussed. Both figures place the policies along a private enterprise to public initiative gradient for comparison.

Figure 4: Current transmission elements are a mix of private and public



SECTION 5

Exploring the Private Enterprise Approach

Examples and challenges

Clean Line Energy Partners may be the most well-known merchant transmission project model of the last decade due to Russell Gold's book *Superpower*, though the company did not complete the several projects it proposed. SOO Green (a proposed 349-mile, 2,100-megawatt, high-voltage direct current [HVDC] transmission line from Mason City, Iowa, to the Chicago, Illinois, area that will run underground along an existing railroad) is the latest merchant line to receive significant attention in the transmission world. Both of these proposed lines were backed by private investors expecting a return on their investment. A third, hybrid example is the set of three lines intended to bring Canadian hydropower to Northeast electric markets. These include the failed Northern Pass project in New Hampshire;[18] the New England Clean Energy Connect project in Maine, approved by state regulators but as of this writing still challenged by a state referendum and lawsuits;[19] and the currently proposed Champlain Hudson Power Express project in New York. All three are private development initiatives, with the transmission investments paid for through Massachusetts and New York programs for decarbonizing the power systems in those states.

The Clean Line proposals traversed multiple states with some new rights-of-way. They struggled with permitting lines, particularly in the states they merely passed through, and also faced challenges acquiring power contracts. The New England Clean Energy Connect line faced multiple challenges along its route, although it had legislatively approved financing. The SOO Green line may avoid some of these hurdles because it will use existing rights-of-way, specifically railroads, to bury HVDC, bypassing many permitting requirements. The initial line does not include pass-through states and instead connects Iowa wind to neighboring Illinois load. This may not typify the situation facing most bulk transmission, though some macrogrid designers propose a system of two-state links, which increases costs but may find more success politically. The SOO Green line has run into as much as three years of delay due to the PJM interconnection queue, however, a planning issue.[20]

Private investment is not limited to merchant lines: Most states get at least some of their electric service from investor-owned utilities (IOUs). Some of these utilities are vertically integrated, meaning they own generation and transmission and are typically regulated by a state commission, which may approve projects (e.g., siting) and approve rate increases for the utility to recover costs and receive a return on investment. Because of their limited geographic footprints (as well as exemptions in FERC orders, and in some states, laws that further protect their interests), IOUs are often reluctant, if not outright opposed, to developing interregional transmission, which would bring competitively priced power.[21]

Maintaining growth in transmission development to effectively decarbonize requires costs to fall fast enough to make up for increasing project difficulty. On the one

[18] Julia Gheorghiu, "New Hampshire Supreme Court Strikes Down Appeal for Northern Pass Transmission Permit" *UtilityDive,* (July 22, 2019).

[19] Bruce Mohl, "Throwing up Roadblocks to Quebec Hydroelectricity," *Commonwealth Magazine,* (April 2021)

[20] See SooGreen's recent complaint filed at FERC: https://elibrary.ferc.gov/eLibrary/filelist?document_id=14966067&optimized=false

[21] Ari Peskoe, "To Catalyze Transmission Development, end the Utility Protection Racket," *Utility Dive*, (February 2021), and Ari Peskoe, "Is the Utility Transmission Syndicate Forever?" *Energy Law Journal*, 42, no. 1 (2021):1-66 both provide a detailed history of the state and utility relationship.

hand, technology costs fall as more units are developed. On the other hand, the highest-efficiency and lowest-risk sites will be developed first. Policies that focus on unlocking private investment must consider not only the project costs but how to create a process that is repeatable and can increase efficiency even amidst a variety of business and regulatory models.

Potential solutions within the private enterprise framework

A number of incremental reforms could facilitate transmission build-out in a private investment framework:

Investment tax credits facilitated the expansion of wind and solar generation capacity, which has helped bring down the cost of both of those resources. Transmission has been proposed as a technology that could benefit from a tax credit to incentivize more investment. Investment tax credits (ITCs) may be useful for merchant developers, though some investor-owned utilities claim they do not need tax credits for transmission lines as they can raise ample capital if permitting is likely.

Permitting reforms at the state or federal level could provide exceptions for infrastructure projects that meet certain requirements. For example, natural gas pipelines enjoy significantly streamlined permitting compared to electric transmission, which helped the natural gas industry respond quickly to the opportunity presented by hydraulic fracturing. On the other hand, recent gas pipelines have faced significant environmental opposition, and several notable projects have recently died. Exceptions for transmission could be given for using existing rights-of-way, avoidance of environmental impacts, incorporation of a sufficient community engagement plan, etc.

Other incentives could be created for **reuse and expansion of existing transmission corridors**, brownfield and Superfund sites, as well as construction adjacent to highways, railways, and pipelines.

Project developers could also be encouraged to implement **best-practice inclusive community engagement processes** on a more widespread and consistent basis by broadly socializing these concepts and creating a voluntary system of project-development certification and public recognition.

Even more dramatically, transmission could be facilitated through a **consent-based siting** paradigm in which project proponents are legally required to achieve the approval of host jurisdictions without coercive backstop support and to offer sufficient incentives to obtain that consent. A more extreme version of this paradigm would be to entirely flip the traditional model, restructuring the design of electricity infrastructure projects to **create a demand within communities** by providing sufficient benefits that they choose to compete for hosting opportunities. These partnerships could become a standard industry practice, bringing economic growth to struggling regions, increasing land values, and using agreements with other utilities to provide broadband internet and other valued community services.

Federal and state governments could support the development of **regional transmission-anchored economic development clusters** through financial incentives and administrative capacity. Neighboring states could collaborate and create public-private partnerships unique to the region, playing to their generation strengths (e.g., wind in the Upper Plains, gas with carbon capture and sequestration in the Marcellus and Gulf regions, and solar in the Southwest, potentially including local development of generation-component manufacturing). To a certain extent, regional transmission organizations serve this role but only for member public utilities and not for broader multi-sector partnerships with an economic development focus.

SECTION 6

Exploring the Public Initiative Approach

A government-driven paradigm for transmission expansion would address growth through varying degrees of command and control. While it would have the same objectives as the private enterprise framework, the two approaches look quite different in practice.

Examples of past state and federal intervention

Planning. The Department of Energy and FERC are the most likely agencies to implement a transmission mandate. Under the Obama administration, the Department of Energy led a regional planning effort funded by the American Recovery and Reinvestment Act (ARRA). It coordinated multiple workshops to establish training criteria for regulators and other planning participants and identify regionally beneficial transmission lines. FERC has established rules and validated North American Electric Reliability Council standards requiring regional transmission planning processes and reliability metrics that must be met for transmission systems. Due to the related challenges in permitting and paying, however, these planning processes do not result in large interregional trunk lines. They can provide excellent venues for diverse stakeholder participation, which could be used as a learning tool for future efforts.

Permitting. There have been many attempts at establishing a stronger federal role in transmission siting. The 2005 Energy Policy Act (EPAct) established mechanisms through which DOE and FERC could act to build more transmission. The DOE was authorized to identify national interest electric transmission corridors (NIETCs). This designation would give FERC backstop siting authority for any transmission line proposed in these corridors that faced opposition at the state level. All attempts at exercising this authority have failed in court. Initial NIETC designations were too broad, and state and local jurisdictions objected. Even when narrowed in geographic scope, the language of the law, as interpreted by the U.S. Court of Appeals for the Fourth Circuit, grants FERC siting authority only in the case of a state's delay, not a state's rejection, so the backstop siting has limited applicability for projects in its current form.

Partnerships and coordination. The same EPAct of 2005 provided a mandate to the DOE, through Power Market Administrations (PMAs), to partner with developers to build transmission lines in the designated national interest corridors in the South and West for the purpose of moving hydropower produced with federally owned resources. This partnership authority would allow the federal government to both finance and site transmission lines. PMAs have significant lending authority to offer transmission developers. Each has its own footprint, budget model, and approach to coordinating these loans. The EPAct also instructed the Department of the Interior and DOE to coordinate to streamline development of these transmission lines, which did lead to identification of barriers and collaboration but few completed lines to date.

Cost allocation. FERC has issued a series of orders over the past 15 years establishing regional partnerships, planning expectations, and financial frameworks, ostensibly to increase transmission development. The toothless requirements of interregional planning and the underdeveloped details of cost allocation, as well as the specific exemption of local reliability projects from competitive bidding, have undercut the intended outcome of those orders. The carve out for local reliability projects allows utilities to upgrade their lines at the expense of the consumer, without also providing access to low-cost regional resources.

These previous attempts at federal mandates resulted in limited expansion of transmission. A government initiative to develop transmission and generation would likely need to be much more ambitious to be effective, while also carefully designed to survive challenges in court. These initiatives could be federally implemented solutions, federal requirements on each of the states, or state-driven mandates.

Potential solutions in the public initiative framework

The federal government could lead **development and/or ownership of key infrastructure**. Through expansive use of federal lands, federal rights-of-way (e.g., highways), federal lending authority, and ultimately eminent domain authority, an **independent National Transmission Authority Organization** ("NTO") could own the system, contract for private development, and allocate costs, perhaps by levying uniform fees ("postage-stamp rates") across all electricity users or all bulk power markets. Poland's and China's power grids are fully owned by state companies, and the French and Swedish grids are owned partially by the national government through mixed private-public companies. If enough transmission and generation are built through these mechanisms, it could disrupt existing silos in planning and unlock more partnerships and investment from private sources.

Federal procurement of electricity from carbon-free sources is being discussed to support generation development. Some transmission developers advocate for federal procurement of transmission capacity as well, which could serve as a financial stabilizing mechanism for a project and could sunset as local offtake is contracted.

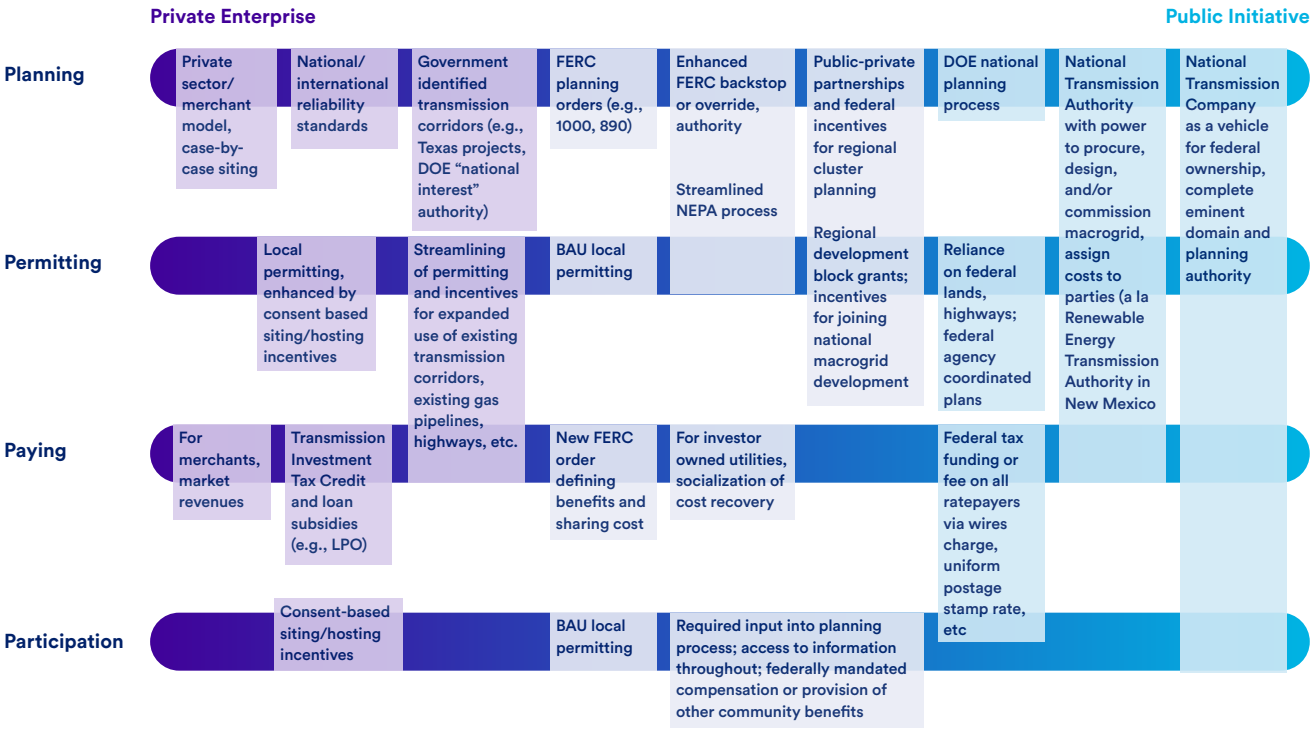
Federal incentives could compel action through mechanisms such as **regional development bank investments or state block grants for connecting to a macrogrid.** This is similar in some ways to incentive-driven "consent based" siting as applied in the Finnish and Swedish nuclear waste context. However, the ability of the federal government to compel sufficient state cooperation toward a national goal is less certain than it was when the interstate highway system was built, and examples from the Obama administration in health care show that states may well reject these funds for political reasons, endangering the whole system.

Override authority at the state or federal level, such as expanded backstop siting authority at FERC, in theory encourages local action but also prevents project cancellation based on a single veto. New proposed regulations in New York would allow the state to streamline renewable energy project siting by, in effect, serving as the primary permitting authority, with local jurisdictions reduced to providing input in a limited time frame.

Presumptive minimum project mitigation and compensation standards could be established by the federal government or by state governments to share the benefits of transmission development more equitably with host communities. This could go a long way toward achieving the goal identified earlier of creating affirmative demand from local communities to host new clean energy infrastructure projects because they would be seen as net contributors, not detractors, to the local communities. Further, if such standards were applied on a uniform basis across competing transmission proposals, they would help counteract any perverse incentives for competing project developers to cut corners on community participation, which should extend throughout a project development and building cycle.

Hybrids. Hybrid applications of private and public approaches have been successful regionally. In 2009, MISO kicked off the multi-value projects, or MVPs. One of the driving factors was states' renewable energy mandates. The participating public utilities agreed on a cost allocation that shared all of the projects' expenses among all of the members. Similarly, in 2005, the Texas legislature tasked ERCOT to establish transmission to support regions that the state labeled competitive renewable energy zones (CREZ). This state mandate was established to grow the renewable energy business, which was booming in Texas. New Mexico is pioneering a new idea that may be a scalable model with the Renewable Energy Transmission Authority (RETA), which was established to facilitate public-private partnerships for renewable energy transmission and storage development in the state. These approaches, as of now, do not address interstate projects.

Figure 5: Example elements of transmission development paradigms



SECTION 7

Summary of Workshop Themes and Outcomes

Appendix 2 captures the details of the workshop discussion, and Figure 5 displays the policy ideas across the private-to-public spectrum. Here we highlight some major themes. First, private enterprise and public authority are deeply intertwined, particularly with respect to major infrastructure. Innovators and investors will demand clear and consistent market definitions from the government to commit resources adequate to the challenge. Meanwhile, the government cannot on its own produce the decentralized experimentation and innovation that a deep market can provide and relies on financial markets to the extent it engages in capital spending. But just how the relationship should be structured remains open for debate. A different level of public initiative versus free enterprise may be appropriate across each of the 5Ps.

Second, the 5Ps should be considered together to form policy solutions that will approach the scale of action necessary. FERC issued a series of orders requiring various levels of planning collaboration, but without solutions for the other Ps, this has not resulted in completed large interstate projects. Below we begin this work by presenting two proposals that span the 5Ps, one weighted toward private enterprise and the other weighted toward public initiative, specifically federal authority.

Third, however the government's role is structured, there was consensus that it must become far less fragmented. Permitting stands out as a central barrier to clean-energy infrastructure, and the overlapping authorities and conflicting incentives of local, state, and federal officials will have to be reconciled or consolidated in order to make progress. These may be addressable without an expansive federal role, but it would require an interstate commitment to a framework of rules and a spirit of cooperation.

The discussion in Appendix 2 highlights three areas where authority has shifted that could benefit from rebalancing: siting of generation, oversight of local utilities, and mechanisms for interregional transmission. Briefly, utility incentives are not always aligned with consumer and national needs, and state regulators can be caught in the middle; private investment in renewable energy generation has met public pushback in the form of state and county siting limitations, which may be a cautionary tale for transmission to learn from; and interstate and interregional transmission is now critical for clean energy goals and thus needs updated rules of engagement.

Potential ways forward

Two key themes: planning and standardized participation protocols

The **two key themes** that emerged were the imperative for a national electric infrastructure plan (in addition to national decarbonization policy) and the interest in further developing a model for "participation" that is meaningful and actionable at scale.

1. A national plan for building the zero-carbon electricity sector seems to be an imperative.
This challenge has been noted by previous papers and identified as an opportunity in decarbonization studies, but the function and form of such a plan is still undefined. At a minimum, this plan would be a transmission plan, based on a set of objectives and data agreed upon by stakeholders, including decarbonization goals but also likely definitions of benefits and costs that can be mutually agreed upon. The result would be both a plan that identifies and prioritizes transmission connections and a process for iteration as infrastructure is built.

Some asked, in response to studies that propose a macrogrid: do evolving technology and unpredictable markets suggest an incremental "mesh" build-out that may be more regional and flexible in technical design, not a macrogrid as currently envisioned?

Others have countered that a macrogrid can provide additional national energy security benefits beyond the consumer cost benefits already identified. A national plan would establish the key criteria for evaluation of these alternatives. Though the question needs further investigation, the discussion indicated that an updated FERC rule on cost allocation and RTO planning would not be enough to achieve the scale and speed needed. On the other hand, a study from DOE that incorporates social, political, and regulatory issues along with technical questions may be unwieldy and untimely, if it's even achievable. Previously funded regional DOE planning processes were successful on paper but resulted in few completed projects. A retrospective on that effort and an establishment of recurring processes over the coming decades is important. The governance of RTOs, the role of states in permitting but not planning, and the open question of the appropriate role of federalism in pursuing a national priority must also be considered.

The paradigm of implementing a public or private approach may end up defining the form of a national plan and the extent to which it defines values versus established timelines and goals. The credibility of any plan to sustain through changing administrations requires some steps to be taken in advance of overarching policy to establish the common understanding of metrics.

2. Participation historically has been done on a state-by-state and individual project basis but may need standards or improved development processes for effective infrastructure growth. Policies that help build support from local host communities and reduce conflicts are needed to speed project development and increase the chances proposals will be approved. But community participation and support is, by definition, a local issue, with great variation across geographies and not often amenable to narrow one-size-fits-all solutions. This suggests the importance of policies that build community and developer engagement capabilities, provide strong incentives to resolve conflict, and allow stakeholders the flexibility to reach agreement. There are two main elements of participation — engagement between communities and developers, and sharing of project benefits.

Engagement. Best practices often include early and sustained engagement between communities and developers for mutual education and trust building, with diverse community stakeholders, including officials, other community leaders, and disadvantaged groups; incorporation of meaningful input into project development plans; and the use of structured conflict resolution processes when needed to resolve issues.

For private developers, this could include socialization of best practices with case studies describing past successes and failures and incentives for better engagement (for example, voluntary systems of project development certification and public recognition of success). For government projects, this could include requirements to adopt some form of best practices and identification of an authority to determine best practices. A best practice might include funding for communities to support project engagement through attendance, facilitation and technical expertise.

Benefit sharing. Benefit sharing can take many forms, including direct compensation (fixed monetary payments, sharing of ongoing project economic value; funding new community services such as broadband, local economic development initiatives); environmental impact mitigation (re-routing, land set asides, habitat protections); and private contracting between developers and opponents (through home value insurance or liability insurance). Better engagement processes may lead to outcomes where communities receive a more acceptable share of project benefits or where the mix of project benefits received is better matched with the community's priorities. Establishing specific presumptive minimum project sharing or mitigation requirements may further support this. One estimate from the workshop was that projects historically have committed less than 2% of overall costs to community benefits.

These elements of participation should be considered for incorporation in any approach — for example, the need for engagement does not necessarily require siting and permitting to remain at a local or state level; a federal siting and eminent domain approach to a national grid plan could also effectively engage local communities.

[25] Morgan O'Hanlon, "Texas House panel weighs anti-renewable energy bills fueled by winter storm," *Dallas News* (9 April 2021).

Two sample policy proposals

1. Public initiative: National Transmission Authority
Some participants suggested that national planning should go further and create a National Transmission Authority (NTA) that would marshal federal funding and direct development of transmission, with full eminent domain authority — as is currently the case with the power marketing agencies such as WAPA or the New Mexico State Renewable Energy Transmission Authority. Under this approach:

Planning, as previously noted, would be central, and the authority would additionally manage the implementation of the plan and feedback and data for iterations. The mandate for planning could extend to generation as well, either from the central authority or as technical assistance to localities.

Permitting would be a federal authority for these lines. This may already be an established authority through Section 1222 of EPAct of 2005, though it may need to be amended to grant that authority to a national agency in lieu of existing power-market administrators (which together do not cover the contiguous U.S.).

Planning and permitting within the same federal agency could effectively utilize existing rights-of-way, including establishing proper incentives for maximizing existing electricity corridors, brownfields, and already disturbed land such as rail and highways. Any development led by an NTO would likely require review under NEPA. Timely and sustained development would likely require legislative action on NEPA process, timelines, and requirements for transmission.

Paying must address financing the authority itself and determining a mechanism to pay for transmission costs. User fees for generators interconnecting the lines and utilities off-taking from the federal lines could pay for the system.

Participation, as described above, would be a mandated aspect of all public-private partnerships.

Process becomes, in many ways, the mission of the national transmission authority to establish and evolve as needed.

Some critical questions for this policy approach identified by participants include:

- Can this approach build fast?
- Can it build efficiently?
- How would this authority interact with DOE and FERC to provide robust redundancy of effort without the bloat of repetition and conflicting authority?
- How would it be funded through different administrations?
- How would it answer objections and lawsuits from states?
- Can this be legislatively managed to scale up but then also scale down as transmission requirements shift from development to stewardship and maintenance?

2. Private enterprise: realigning incentives and clarifying processes to catalyze private development
Could a national plan that identifies priorities and benefits, funding, and other regulatory streamlining for transmission and generation speed the necessary development through private enterprise? This national plan could delegate certain implementation or details to the RTOs, who would then follow the rules and cost allocation as established by FERC.

Planning, as described above, would be national but with a less prescriptive hand. Location, design, and technology of lines, as well as financial structures and generation contracts, would be left to utilities, states, and regional organizations as happens currently. A new cost allocation formulation from FERC would be necessary.

Permitting in a decentralized fashion still presents a potential problem for transmission and generation, particularly for non-incumbent actors and interstate lines. The Federal Power Act could be revised to have transmission fall under federal authority for lines within the national transmission plan, similar to the Natural Gas Act. The federal government could streamline NEPA regulations, open up federal lands to projects, and facilitate permitting on mine lands, brownfields, and federal transportation ROWs and utility ROWs. Such changes would be more likely to sustain through multiple administrations if facilitated through legislation.

Paying would be managed by cost allocation rules and federal investment in the form of tax credits and even partnership on key lines and technologies identified as needing additional market support (e.g., spanning many states or using the newest electronics for power flow or high-voltage direct current). Under this distributed approach, the correct incentives for both private developers and investor owned utilities to

develop interregional lines is crucial. Changes to the current business model and incentive structure should be carefully considered. Policies could identify areas where differential incentives (such as different returns on equity) would be effective, across projects but also across financial structures of transmission developers.

Participation, as described above, would almost certainly still need to be legislatively enforced.

Process would require special attention, through a study and possibly legislation, to provide the necessary transparency and consistency for all stakeholders and prevent the fragmentation and siloed approach from continuing to stymie development.

Some critical questions for this policy approach identified by participants include:

- Can this build enough — as the "best" locations are built, what additional incentives will be needed to complete a national plan?
- How can equity be included and addressed?
- Does the level of federal intervention in private enterprise increase over time, and is that a reasonable basis for policy or does it risk leaving too many communities and states without support?
- Has FERC demonstrated a track record for clear and decisive action that would move these many issues forward fast enough?

SECTION 8

Conclusion

The workshop and subsequent discussions underscored that transmission has been siloed from a policy perspective.

Transmission infrastructure is the backbone of our electricity system, and significant expansion is necessary in any pathway to a decarbonized economy. Expanding transmission capacity can create a market for the generation expansion that is also required, but there is no authority to mandate the construction of interstate and interregional transmission. Establishing an inclusive and transparent process for transmission development, including addressing planning, participation, permitting, and paying, is crucial for meeting a zero-carbon energy goal. The details of such a process will depend on the paradigm under which it is organized: one of public initiative, private enterprise, or a combination.

We offer this analysis of transmission issues and opportunities to spur discussion on the 5P framework and sample policy proposals. We included some questions throughout to demonstrate how this work could continue, within our organizations and others.

Many of the ideas presented in this paper have been presented in other forums, but we found the public- or private-paradigm approach was a valuable tool for guiding discussions at a higher level, to take into account the scale and scope of changes needed and address how the ideas may or may not gel into a cohesive approach.

The lessons from this workshop and the 5P framework may be applicable to other categories of energy infrastructure — for hydrogen or carbon sequestration, for example — that will need to be built to achieve decarbonization.

The discussion presupposed a national decarbonization initiative — a clean energy standard or a carbon tax — as a necessary foundation for any aggressive build-out of low-carbon infrastructure. It also put to the side questions of political viability to encourage a broad ranging discussion of possibilities. As we discuss and develop policy proposals, though, the questions of political viability and public opinion must come to the fore to build coalitions for implementation.

APPENDIX I

Attendees and Contributors

Inclusion on this list indicates participation in the workshop or follow-up discussion in preparation of this report but does not indicate an endorsement of the report nor attribution for any statements within.

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APPENDIX II

Workshop Discussion Details

The following are key takeaways from the workshop discussion:

Existing planning mandates are limited in their scope, and transmission projects place state and federal authorities in tension: Independence Energy was a two-state transmission line, connecting Maryland and Pennsylvania, planned through the PJM planning system (following FERC and RTO procedures). Despite this, the line was rejected by Pennsylvania regulators, who argued that it would raise costs without accruing benefits to Pennsylvanians while lowering costs for Marylanders. The planned interstate line is now a single-state line, and the system benefits are not fully realized. The details of this project intersect with many issues with transmission (lack of) process, but it is raised in particular here to illustrate that planning is necessary but not sufficient.

Some attendees suggested that the macrogrid would need central planning and centralized process preemption (i.e., federal intervention) if projects stall or regulations conflict but that the primary authority should remain at the state/local level. This could be achieved in theory through incentivizing regional partnerships and state participation. Recent political fissures between states and the federal government regarding federal incentives for transit and health care suggest this may not result in national adoption. Transmission examples such as the Independence line show that state regulators may have narrow decision criteria that a federal incentive would not alter, making the resort to preemption the rule rather than the exception. Yet there is also concern that federal intervention is subject to more litigation and delay. States could be consulted in a federal process through a consultative board of state regulators or be given a window of time in which to express concerns.

Utility incentives are not aligned with consumer and national needs: Some participants observed that policymakers and consumers have driven renewable energy adoption: in rural co-ops through popular votes and in public utilities through state and local policies for renewable energy adoption and increased consumer choice. But deployment rates of clean energy have been relatively low compared to the expected need. While local opposition can still stop projects, so can suboptimal regulation.

Others noted that there is no differential incentive to take on more difficult, interregional projects because incumbent utilities enjoy the same rate of return on any transmission investment. Vertically integrated utilities that also own generation eschew interregional lines that may grant entry to new competitors. Even in places with competitive power markets, incumbent generators are often those opposing interregional transmission carrying clean energy from competitors.

Further, in some states, the incumbent utilities benefit from right-of-first-refusal laws. These laws allow utilities to build projects even if the regional transmission planning process identifies a proposal from a competitor to build the line at a lower cost.

Some participants discussed that FERC regulations also can create differential incentives for building local transmission projects. FERC's decision to exempt local reliability projects from competitive bidding altogether further incentivizes utilities to favor lower-voltage, intrastate transmission projects over interstate trunks. That focus on short-haul transmission to the exclusion of broader concerns helps explain why some areas have seen transmission expenses rise as much as 40 percent without gaining any connections to geographically diverse sources.

Booming markets for generation often meet government siting barriers: A key takeaway from most decarbonization studies is that the build-out of electricity infrastructure must start immediately and speed up. Though costs may fall with production and experience, opportunities for building out may become harder to find — the best sites for generation from a technical and regulatory standpoint get used first, making the politics and economics tighter in the future.

The "best and easiest" sites are defined based on the availability of the resource, local financial incentives, and the likelihood of approval and acceptance (a factor that privileges less dense areas). The Department of

Energy and various industry groups provide guidance on determining site suitability based on these factors. State and local rules and incentives can create clusters for development but are often followed by backlash.

One example presented at the workshop: wind developed quickly in Iowa due to landowner interest but was followed by a string of local ordinances for setback minimums that limit the usability of remaining land for wind turbines. Ohio has seen modest wind development in comparison to Iowa, but local setbacks have already become barriers for additional development. In recent months, members of the Texas legislature, a body that had supported wind and transmission development a decade ago, used the February cold snap as a reason to propose additional costs and regulations limiting future renewable development.

Interstate and interregional transmission need rules of engagement: The FERC guidance on how the cost of transmission lines should be divided among multiple utilities is too general, resulting in an underdefined market. There is not a consensus formula for identifying beneficiaries, especially for projects with diffuse benefits throughout a region, such as large transmission lines. In MISO's case, the MVPs were built prior to the FERC Order 1000 establishing the overly broad cost allocation rules. The member utilities came to an agreement on cost allocation, and the projects were all approved together in order to come to this agreement. The unique conditions that enabled that utility agreement, which included state-driven renewable energy mandates, are unlikely to recur, especially as state policies and clean energy approaches have fragmented.

Community participation is critical for widespread adoption and project success: There are a variety of formats to ensure diverse public participation. For some new projects, communities ask for financial assistance for a new fire station or library or park. There are many possible types of benefits, and cash payment does not necessarily address coalition concerns, landowner versus community differences, and equity. Participation must address local concerns with mitigation, compensation, and a trustworthy, inclusive, consistent development process throughout a project.

Successful top-down infrastructure development has benefited from expansive authority: Bonneville Power Association and the Tennessee Valley Authority had federal mandates and plenty of financial backing when they were first established to facilitate the integration and sale of hydropower from federal dams into the electricity system. These missions could be revisited but may need legislation to expand their focus to address transmission more broadly. TVA notably declined to sign a power purchase agreement with CleanLine for renewable energy, stating that it would lock the agency into high costs for its customers. Existing federal energy authorities do not cover the entire contiguous U.S. though, so interregional collaboration will be limited unless a new authority is established.

Recent attempts at federal authority or regional action have been met with many years of litigation, such as the DOE's efforts to establish National Interest Electricity Transmission Corridors within which FERC would have backstop siting authority. Legislation granting broader federal authority in transmission might be necessary to achieve decarbonization but may be followed by years of litigation with the states if not carefully scoped (and even then may still face challenges).

State and federal agency funding and partnerships can catalyze change: New Mexico's Renewable Energy Transmission Authority was established with a legislative mandate to create public-private partnerships, offer tax breaks and local compensation, and exercise eminent domain. RETA uses a transparent development process to engage stakeholders that is seeing some success but took nearly a decade to get off the ground due to legislative changes and limited funding.

CleanLine Energy Partners participated in a public-private partnership with the U.S. DOE that provided financial support and federal siting authority through a provision in Section 1222 of the EPAct of 2005. This partnership was revoked when the administration changed in 2016. Though this dissolution followed a series of setbacks for the project, the political risks of executive branch solutions are salient.

[22] Morgan O'Hanlon, "Texas House Panel Weighs Anti Renewable Energy Bills Fueled by Winter Storm" *Dallas News, (9 April 2021)*

[23] In contrast, in the 1960s, TVA pursued transmission expansion. See: FERC South Central Task Force, *Power Pooling in the South Central Region*, (February 1981). TVA and South Central Electric Companies built 500kV and 345kV lines to share resources across the two regions, one with higher winter demand and one with higher summer demand.