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Is Transmission Expansion for Decarbonization Compatible with Generation Competition?

Timothy J. Brennan

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About the Author

Timothy J. Brennan is a senior fellow at Resources for the Future and a professor of public policy and economics at the University of Maryland, Baltimore County (UMBC). He has published over 135 articles and book chapters, principally on antitrust and regulatory economics, including the electricity, telecommunications, postal, oil pipeline, and other infrastructure sectors. He also has a strong interest in the nexus between economics and philosophy, which he has applied to questions such as the ethics of discount rates and the role of consumer error in designing energy policy.

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Abstract

Decarbonization of the electricity sector, and expanding it to facilitate decarbonization of transportation, heating, and other energy applications primarily using fossil fuels, is an important step in mitigating climate change. A widely advocated step in that direction is long-term planning to massively expand the transmission system to deliver electricity generated by wind and solar units that are far away from population centers. The transmission system has seen substantial investment in recent years, with few examples of failure to construct new lines, but future climate imperatives may justify moving away from the process of adding incremental capacity in response to specific requests. However, the planning process may sacrifice much of the benefits of competition that electricity policy has striven to achieve over the past three decades. These benefits are not only those from independent output and capacity responses to market prices but also dynamic benefits from technological innovation and market information acquired over time. Reconciling the benefits of competition with central planning has long been necessary in the electricity sector. I propose options for preserving some of the benefits of competition, if long-term transmission planning remains an imperative.

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1. Introduction and Summary

Reducing and eventually coming close to eliminating carbon dioxide emissions is important if not imperative in limiting future harms from global warming. Two related items top the list of ideas for doing so and decarbonizing the economy. The first is substituting electricity generated by non-emitting renewable sources for that from burning fossil fuels—coal, natural gas, oil—that leads to carbon dioxide emissions. The second is to substitute this "clean" electricity for uses of fossil fuels that do not yet substantially involve electricity. This includes transportation (substituting electric vehicles for those powered by internal gasoline or diesel combustion engines) and home heating (substituting electric heat pumps and water heaters for furnaces and heaters using natural gas or propane).

If implemented to meet emission reduction goals for 2030 or 2035, this will require a rapid and vast expansion of renewable power generators' capacity. Hydroelectric power, although clean and renewable, cannot readily be expanded and, because of the environmental and land use harms from dams, may be contracted, so this expansion will come from solar power generators and wind power, both on land and offshore. Unlike fossil fuel generation, which can be located near population centers that are often near gas pipelines and railroads and ports that can deliver coal, wind and solar generators have to be built where the wind blows and the sun shines.

This leads to a second step—an equally rapid and vast expansion of the capacity of electricity transmission lines to bring this electricity from these envisioned solar and wind generators to where people use it both as they have done and will do to provide power to cars and heating for homes. This is well known by electricity researchers and environmental advocacy groups (Joskow 2021; Brattle Group and Grid Strategies 2021; ESIG 2021). Regulators are aware of this as well; the Federal Energy Regulatory Commission (FERC) has opened a proceeding to consider policies to foster transmission expansion and convened a joint panel with state regulators to examine this issue.[1]

A central theme in much of this assessment is that the current methods for expanding transmission are inadequate, with three main concerns. The first is that expansion relies on response to incremental requests on a generator-by-generator basis, a process arguably too slow to meet decarbonization imperatives. Second, building lines between wind and solar generation sites and where people live is likely to cross

1 Federal Energy Regulatory Commission (FERC), Joint Federal-State Task Force on Electric Transmission, Docket No.AD21-15-000. Order Establishing Task Force and Soliciting Nominations (issued June 17, 2021). Among other issues is how to integrate wind and solar power, which are notoriously intermittent—wind may die down or the sun may go behind clouds—into a grid designed for reliable fossil fuel sources. This intermittency is countered by the use of readily dispatched natural-gas-powered generation. Future solutions may include storage (MIT Energy Initiative 2022) or external management of customer electricity use to match it to the amount generated at any given time (Brennan 2020).

multiple states and involve multiple transmission operator jurisdictions, complicating expansion. A third is that incumbent generators have too great an influence over transmission supply and thus would delay or impede requests for connections to renewable power that typically may come from relatively new entrants into the generation sector.

To address these shortcomings, regulators and some decarbonization advocates have proposed replacing the incremental, requests-based method for expanding transmission with large-scale planning that would define how much new transmission we need and where it would go. This planning would involve, by necessity, current and expected future generators, as the lines would be designed to transport the electricity they can supply. After briefly reviewing evidence suggesting that transmission investment need not have been systemically underprovided, Section 2 discusses these proposals and how they rely on a different vision of the future that would render past methods for planning and constructing transmission largely insufficient.

The question examined here is whether this kind of planning is consistent with competition in generation, the main theme (see Section 3). Two factors apply, only one of which may be readily appreciated. The direct effect is that largescale stakeholder planning involves bringing generation companies together that might nominally compete but, as part of that process, need to share their future capacity plans and supply expectations. In most contexts, this would be an antitrust violation.

The indirect, less-appreciated effect involves the long-term information acquisition. The benefits of competition are not just having firms bid against each other by cutting prices to attract customers and make sales. In addition, the information on present and expected future costs need not be gathered, put into a form where it can be made available to the planner, and delivered timely and accurately. That information can remain with the suppliers that bear those costs, with the information mediated in markets, through competition that sets prices equal to the cost of the last unit supplied. Leaving supply and purchase decisions with the suppliers that have the cost information and buyers that reap the benefits also will mean that those decisions will be designed to maximize the benefits to those actors, without having to be concerned with whether and how the motives of and incentives facing the planner will reflect those benefits.

Both of these reasons—getting cost-based pricing and efficiently using information held by electricity and transmission suppliers—justify the extensive effort made by legislators and regulators over the last three decades, if not longer, to bring competition to the sector, primarily in wholesale bulk power generation markets, including regulations to improve the incentives of transmission entities—independent system operators (ISOs) and regional transmission organizations (RTOs)—to expand capacity in response to new generators.[2] Proposals to substitute collective planning for

2 FERC, Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, Docket Nos. RM95-8-000 and RM94-7-001, Order No. 888, Final Rule (issued April 24, 1996) ("Order 888"); Federal Energy Regulatory Commission, Regional Transmission Organizations, Docket No. RM99-2-000; Order No. 2000, Final Rule (issued December 20, 1999) ("Order 2000").

the case-by-case request approach for adding transmission capacity run counter to that effort, not because they might induce anticompetitive conduct—antitrust laws can address that—but because they sacri-fice the benefits that competition brings. Such substitution may be worthwhile if the decentralized process for expanding capacity is insufficient to meet decarbonization imperatives. But sacrificing that decentralized information advantage of markets is not without cost.

The choice is not necessarily either central planning or market competition. Before summarizing how those potential costs might influence those charged with transmission planning, it is important to remember that tension between competition and management of electricity markets is not new (Brennan et al. 1996; NAS 2021, p. 109). Section 4 summarizes this history, with at least three important contexts. First, although generation can be competitive, transmission and distribution remain prone to monopoly. Second, because supply needs to equal demand on virtually a minute-by-minute basis, a central entity—an independent system operator in states that use them or a vertically integrated utility in states that retain them—remains in place to call upon generators to increase or reduce supplies at the last minute to ensure that supplies exactly meet demand. Finally, because inability of a supplier to meet customer demands means that everyone on the grid may suffer a blackout, the reliability of the electricity system is, in economic terms, a “public good” for the local or regional grid as a whole. Whether the centralized management needed to regulate monopolies, maintain load balances, and ensure reliability can be reconciled with decentralized competition has been perhaps the fundamental question of electricity policy, even before the calls for long-term transmission planning to facilitate decarbonization.

Moreover, once potential costs of limiting competition are recognized, they may be mitigated within transmission planning policy, as detailed in Section 5. To the extent possible, long-term planning should be designed to retain flexibility to vary plans as market conditions warrant. Included in preserving independent flexibility in these plans is to recognize that innovation incentives may be attenuated, possibly implying that public research funding may be needed to compensate.

The longer the planning horizon, the more likely mistakes are. Technological improvements in some types of generators may mean that lines built to serve one type are no longer used and thus sit empty. Greater adoption of appliances and equipment that use less electricity to provide equivalent levels of service may mean that transmission facilities envisioned to connect users to large amounts of wind and solar power are underused. Compounding this potential for error is the possibility if not likelihood that lines will be built to serve interests other than efficient decarbonization, such as responding to the preferences of legislators for having lines constructed in their districts. Finally, ensuring effective buy-in from all affected parties may entail effective carbon pricing, so the relative benefits of decarbonization can be balanced against allocation of the costs of transmission expansion.

Section 6 offers a brief concluding summary.

2. The Argument for More Transmission

2.1. That Was Then...

Walter Heller, chairman of the Council of Economic Advisers in the 1960s, once observed that "an economist is someone who, when he finds something works in practice, wonders if it works in theory." Although this may seem like a jocular criticism, the inverse is not: if something does not work in practice, why does it not work in theory? That step is necessary to understand the cause of the failure, the appropriate remedy, and, most fundamentally, whether a failure has occurred at all.

This question applies to transmission. As noted, concerns that it will be inadequate are widespread (NAS 2021; Brattle and Grid Strategies 2021; ESIG 2021). Recently, FERC convened a joint task force comprising federal and state regulators to address the need for more transmission.[3] In July 2021, FERC issued an advance notice of proposed rulemaking "on the need for more holistic transmission planning," followed by a notice in April, 2022).[4] This board and the advance notice were put in place about a decade after FERC adopted Order 1000 to address perceived inadequacies in transmission investment.[5]

Although this need seems obvious to proponents of policy to promote transmission, the predicate to the policy question before us is why transmission investment will be inefficient, in the sense that a line with net benefits would not be built. The "works in theory" part is that lines presumably would be built if the benefits of adding a line or expanding the capacity of current lines exceed the costs of doing so. If they are not being built, the "works in practice" part, something must stand in the way. If added lines with net benefits nevertheless would not be built, it is important to know why, so one knows how to design policies to correct that failure. Perhaps the failure involves the ability of those that benefit from more transmission from coming together to compensate for the building costs. Perhaps it is on not the market side but the policy side, where government action is a barrier.

3 See *supra* n. 1.

4 FERC, Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection, Docket No. RM21-17-000, Advance Notice of Proposed Rulemaking (issued July 15, 2021) ("FERC ANOPR"); Federal Energy Regulatory Commission, Building for the Future Through Electric Regional Transmission Planning and Cost Allocation and Generator Interconnection, Docket No. RM21-17-000, Notice of Proposed Rulemaking (issued April 21, 2022) ("FERC NOPR").

5 FERC, Transmission Planning and Cost Allocation by Transmission Owning and Operating Public Utilities, Docket No. RM10-23-000; Order No. 1000, Final Rule (issued July 21, 2011) ("Order 1000").

A first step in understanding the need for transmission policies and how to design them is to see if the record supports claims that something prevented building otherwise beneficial lines. That record is not compelling. Changes in the level of transmission could appear low relative to prior overbuilding, encouraged by rate of return regulation (Brennan 2006). Observers noted some years ago an increased frequency in transmission line relief requests. Some took this as a potential sign that the lines were inadequate back then. However, that record alone is also consistent with transmission having been overbuilt. The optimal investment in transmission presumably will have some positive amount of congestion incidents; the prior level may have been too low.

A better place to look may be the record used by FERC to justify its Order 1000, its most recent major foray into transmission investment policy. FERC found that "the narrow focus of current planning requirements and shortcomings of current cost allocation practices create an environment that fails to promote the more efficient and cost-effective development of new transmission facilities" (Order 1000, paragraph 55), a claim much like the arguments made today for proactive national transmission planning.

Order 1000 focused on three broad categories of improvements:

- requiring regional transmission planning, including sharing information among transmission facility owners;
- such planning should include "relevant Public Policy Requirements" beyond reliability, cost, and congestion, included in state laws and regulations generally unspecified, but including renewable portfolio standards and "fair consideration of lines proposed by nonincumbents" (Order 1000, paragraphs 2, 111, 81, 47);
- rules to allocate costs up to 80 percent of transparently measured benefits (to ensure that costs of projects with net benefits are covered), with no costs borne by those outside of a region unless they volunteer, but allowing cost allocation to differ based on the justification for the new line (e.g., "reliability, congestion relief, or Public Policy Requirements") (Order 1000, paragraph 685).

Unfortunately, FERC did not provide much of a record of failure. In particular, it included no examples of lines for which the expected benefit (at the time construction would have been approved) exceeded the expected cost but were not built. It gave no examples of lines thwarted by failures of planning or information sharing, or inability to allocate costs on the basis of benefits, either economic or created by "Public Policy Requirements." FERC summarized its rationale by saying "the remedy we adopt is jusified sufficiently by the 'theoretical threat' identified herein, even without 'record evidence of abuse'" (Order 1000, paragraph 53). It asserted that this substantial additional investment was evidence that it needed to change the processes by which transmission investments were planned and approved (Order 1000, paragraphs 42–53).

More recent evidence at least superficially does not indicate a systematic failure to invest in transmission. A 2020 Department of Energy (DOE) study of transmission congestion reported that transmission investment in the part of the continental

United States under FERC jurisdiction (roughly, everything but Texas) was about six times greater in 2018 than 20 years earlier.[6] It is difficult to prove a negative, but the evidence from these reports is far from conclusive that transmission has seen too little investment so far, in any systematic way—that is, failed to "work in practice."

Finally, in recent decades, we have not needed much transmission. Based on U.S. Energy Information Administration data, the annual quantity of electricity generated by US utilities—that is, leaving out self-generation from residential solar, for example—grew at a rate of just under half a percent per year from 2001 through 2021. A slow growth rate would tend to camouflage any problems in getting substantial amounts of new transmis-sion built. This much transmission investment in the last few years is likely because of the growth of wind power and decline in coal-fired generation, with wind farms being in different places than the coal units.

2.2. ... But This is Now?

The operative term is "so far." That record does not imply that concerns motivating the formation of the federal-state board and the observations of policy commentators lack justification. In important and relevant ways, the future may not be like the past.

A first, highlighted in Taylor and Van Doren (2004), Brennan (2006), National Academies of Sciences, Engineering, and Medicine (2021), and Hesamzadeh et al. (2021), is that the functional separation of transmission from generation makes it harder to coordinate expansion of both. With vertical integration of both, the decision to expand them can be evaluated and matched when the expected benefits exceed the costs. When separated, that coordination has to be handled across the managerial boundary between the generators and the independent RTO. The independence of the RTO from the generators is by design, to mitigate incentives transmission owners have to favor affiliated generators and thus inhibit competition among generators (Brennan, Palmer, and Martinez 2002).

With little demand growth, this added coordination may not have been consequential. However, for reasons of both economics and policy, the demand for transmission is likely to vastly increase. As noted by Joskow (2021), Brattle and Grid Strategies (2021), ESIG (2021), and FERC, among others, the first reason is the switch to reduce if not largely eliminate fossil fuel emissions from electricity generation. This will largely entail substituting wind and utility-scale solar-powered generation for units relying on the carbon-dioxide-producing burning of coal and natural gas. Even apart from decarbonization policy, the falling costs of wind and solar power are dictating extensive substitution as well.

This scale of construction of new wind and solar generators entails expanding the transmission grid because of the different locations of renewable generators and fossil fuel powered units. Natural gas generators will be located near gas pipelines. As natural

6 Calculated from the nominal dollars of 1996–2018 transmission investment reported in Figure ES-1 of DOE (2020).

gas is delivered to many areas as a fuel for home heating, these generators may be near the consumers of the electricity they produce. Coal plants need to be near railroad lines or ports that can deliver coal; these two may be near the consumers of electricity.

Renewable generation is quite different. Wind farms need to be located where the wind reliably blows. Solar plants need to be located where the sun shines. For these reasons, wind farms and solar plants are not likely to be near population centers where electricity users reside. Moreover, both use quite a bit of land, which will be more expensive in populated areas. Even if substituting renewable for fossil fuel generation is megawatt-hour for megawatt-hour, more transmission will be needed simply to maintain the capacity to deliver current quantities of electricity.[7]

Decarbonization, however, is not limited to a megawatt-for-megawatt substitution. It will also entail substituting renewably generated electricity for fossil fuel based energy uses largely outside the electricity system. The most prominent example is replacing gasoline- and diesel-powered internal combustion engines with electric motors in cars and trucks. Other substitutions include replacing gas hot water heaters and home furnaces with electric units. For this electrification to be free of carbon dioxide emissions, these new uses will have to be powered by a greatly expanded supply of wind and solar generation, which requires greatly expanding the grid as well (ESIG 2021).

2.3. What Needs to Change?

My distillation of the arguments for transforming the transmission investment process to facilitate decarbonization is that three related features of the Order 1000 approval environment should change.

To begin, the focus needs to be national rather than regional (NAS 2021, p. 116). The Order 1000 process is defined within regions covered by the current set of regional transmission operators. However, not every region contains areas with plentiful wind supply or sunshine. Moreover, regions that can produce quantities of wind and solar electricity to meet decarbonization goals are not near many major population centers. To get renewable electricity from where it can be generated to where it would be used, for both currently electrified services and expanded new ones in transportation and heating, lines that cross regional boundaries are needed. The cooperation and information sharing Order 1000 requires within regions would have to extend across regions.

This expands the cost allocation problem in two ways. First, with more regions involved, approvals will be necessary from more states and landowners. In principle, if the benefits of a new line exceed the costs, these could be compensated for any losses they bear from new lines crossing their territory. However, each party could attempt to claim added harm and fewer benefits and thus demand extra compensation. This

7 This may be why transmission has expanded considerably despite little growth in electricity deliveries.

attempt to "hold up" additional investment, especially as more parties are involved, can impede negotiations that could get new lines built. For this reason, "cost allocation" is likely to involve cost assignment and, potentially, benefits payments that do not match what parties would have asserted are acceptable. National transmission will likely come with more mandates.

If allocated costs are supposed to be no greater than net benefit, the benefit calculation becomes important. With more regions involved, the benefits of the added lines may not be apparent. Instead of the benefits from using the electricity itself, or getting it at a lower price because of avoiding costly line congestion, other benefits may rise in importance. These include reliability and resilience.[8] As both of these involve low-probability grid failures, the benefits can be speculative. But an instance of failure, however large, does not itself justify an investment to avoid it without an estimate of its likelihood.

Decarbonization itself could and should be a benefit from these added lines. It makes national transmission planning appealing and national cost allocation necessary. However, as discussed at the end of Section 5, its benefits are not monetized without a carbon price. Electricity generated from wind and solar may become sufficiently attractive in these benefit calculations only if the alternative is more expensive because of the carbon dioxide emitted from natural gas and coal units. Whether that higher price comes about from a carbon tax, cap and trade program, renewable energy credit requirement or something else and is based on expected future economic damages from climate change (Rennert et al. 2021) or sustainability-based limits on current emissions (Stern and Stiglitz 2021) are not issues to settle here. However, absent something to make fossil fuels more expensive, renewable generation will be less economically beneficial, making it more difficult to allocate costs so as to avoid making anyone worse off from having the new lines.[9]

The last issue, and the one of most interest here, is the call for long-term national planning. Advocates of new transmission have cited failures of "participant funding"—that is, having the system grow incrementally in response to a call from generators or load-serving entities for the addition to serve a specific need, where those asking for the new transmission pay for it. Limitations of "participant funding" were already expressed in Order 1000's requirements for regional planning and cost allocation. However, with added benefits at hand, including those from decarbonization itself, the potential net benefits may justify the magnitude of proposals for national transmission planning and investment.

8 I do not address whether these two terms are synonyms, one is a subset of the other, or they are different. I speculate on potential differences in Brennan (2021), but that is outside the scope of this paper.

9 The breadth of decarbonization benefits and their absence from electricity generation markets, along with the probabilistic nature of benefits from added reliability and resilience, could make "benefits" sufficiently vague and broad to avoid cost allocation altogether and have new transmission funded by the taxpayers. Some have analogized this degree of expansion to the government-funded Interstate Highway System.

A comment from the US Chamber of Commerce on FERC's ANOPR[10] highlights the issue:

> The ANOPR, on the other hand, asks the question as to whether the transmission planning and generator interconnection processes should be reformed so that such planning incorporates the needs of "anticipated future generation." This concept reflects a new expectation of the interstate transmission planning process essentially a "build it and they will come" paradigm. While a more holistic approach to transmission planning and generator interconnection is not objectionable on its face, it does represent a departure from the longtime "used and useful" justification for the recovery of transmission infrastructure in utility rates. Thus, the Commission's critique and evaluation of existing transmission planning processes should acknowledge that the predictive development of potentially necessary transmission is a new objective not previously sought by FERC from regional planning processes.[11]

It is this "new expectation," which raises tensions with competition, to which we turn.

10 https://www.globalenergyinstitute.org/sites/default/files/2021-10/Chamber%20Comments%20on%20FERC%20Transmission%20ANOPR.pdf, in response to FERC ANOPR, *supra* n. 4.

11 https://www.globalenergyinstitute.org/sites/default/files/2021-10/Chamber%20Comments%20on%20FERC%20Transmission%20ANOPR.pdf, in response to FERC ANOPR, at 3, footnotes omitted.

3. Conflicts with Competition

Collective planning may be private. Antitrust laws in the United States and around the world ban agreements among competitors to fix prices, allocate buyers among themselves, and otherwise subvert competition.[12] Although much in antitrust is controversial, with the goals of antitrust under review in the US antitrust enforcement agencies, little debate has occurred over the decades regarding prosecuting competitor agreements regarding price, output, and who gets to sell to whom.

Collective planning may also be public, where the government becomes involved in deciding who should produce how much, and at what price. The degree of transmission planning envisioned by many as necessary to decarbonize the US economy invites a substitution of private and public collective planning for independent, competitive decisionmaking. This level of planning is inconsistent with the decades-long effort to expand the scope of competition in the electricity sector. The push to expand the use of carbon-free, renewable generation methods, coupled with increasingly using electricity to substitute for fossil fuels in transportation, may imply that incremental methods for expanding transmission capacity that have worked in the past will not work in the future. However, in many ways still underappreciated benefits of private information in conveying the ben-efits of competition, and how proposals to substitute large-scale non-incremental transmission planning, may be based on inadequate appreciation of the benefits of disaggregated decisionmaking.

It is useful to distinguish two types of competition. The first, "static" competition, refers to the ongoing efforts of individual firms to attract buyers from their rivals by charging lower prices and improving the quality and service of their products. The widely accepted aversion to firms colluding on price reflects this concern. The second, "dynamic" competition, refers to the longer-term aspirations of sellers to come up with new and improved goods and services, including marketing their offerings. The core concern with dynamic competition is fundamentally the rate of innovation in that particular sector.[13]

12 As with all generalizations, this has exceptions. With court oversight to varying degrees, one can have research joint ventures and standard-setting organizations. More broadly, the "rule of reason" doctrine in this part of anti-trust can excuse an anticompetitive agreement if, basically, it is the least anticompetitive solution to an otherwise insoluble problem. An example is that, again with some court oversight, music copyright holders can provide collective licenses to all of their music, to facilitate public performances, notably broadcasts. Finally, under the Noerr-Pennington doctrine in US antitrust law (FTC 2006), competitors can come together collectively petition the government for laws and regulations. Under the state action doctrine, collective behavior affirmatively ex-pressed and actively supervised by state or federal governments remains legal.

13 Whether a trade-off exists between static and dynamic competition, for example, or, with all else equal, markets with one or few major competitors (less static competition) have a greater rate of innovation (more dynamic competition) than markets with lots of smaller participants, or static and dynamic competition are complements, remains a hotly debated topic (Brennan, 2007).

3.1. Static Competition: The (Probably Nonsmoking) Smoke-Filled Room

The electricity sector exemplifies the standard view that opposite of competition is monopoly. The wires portions of the sector, transmission and distribution, generally do not lend themselves to competition and thus remain regulated. However, the generation and retailing portions are potentially competitive, with multiple suppliers bidding against each other to sell electricity and attract customers. For over 25 years, a primary objective of national energy policy has been to promote competition among generators, primarily by instituting means to inhibit their control of access to transmission lines necessary to compete.

The collective planning model for future transmission envisioned in recent proposals is in tension with this view. To put it bluntly, in other settings, sellers sharing future capacity and output plans would likely be an antitrust violation. Absent a specific exemption from Congress, generators would run the risk of antitrust liability. A statement from current enforcers that, in the interest of climate policy, they would not bring a case provides no assurance that future administrations or private parties will not file a case.[14]

As noted, generators participating in a transmission planning process may get legal protection. If the process is instituted as one in which generators advise a state or federal regulator, they may be protected by antitrust exemptions for petitioning the government. If their participation is mandatory, that protection may be stronger, as those state or federal regulatory requirements would preclude the kind of competition the antitrust laws are designed to protect. However, a court can issue this protection only after a case has been filed, so participants remain at some risk—because the benefits of ongoing competition on price are at risk.

3.2. Dynamic Competition: How Do We Know the Future?

However, competition has another conception and hence another source of tension with long-term transmission planning. It provides a means to reward entrepreneurs for finding and acting on private information to discover new markets, reduce costs, and deploy innovative technologies. In that conception, the opposite of competition is not monopoly; monopolists can also be so rewarded. Rather, the opposite is collective planning, which attenuates or removes the ability and incentive to exploit private information to pursue new technologies and market opportunities.

14 The Trump administration's threat to file an antitrust suit against auto companies that cooperated with California regulators on car emissions controls, although it did not go anywhere, might not provide much comfort to generators that share their plans with transmission providers to plan the electricity market of the future (Davenport, 2020).

This does not mean planning is always bad. That is what firms do, internally, because markets need time and low transaction costs to work. The concern that vertical separation of generator ownership from transmission control, to facilitate competition in generation, could inhibit transmission planning exemplifies the potential benefits of coordination under a common authority.

However, the scope of the long-term transmission planning suggests that dynamic competition may be inhibited for a long term, with potential costs that ought not to be ignored.[15] As the passage from the Chamber of Commerce filing says, the current system allows for ongoing novelty, as someone who finds technological or marketing improvements that make a new line beneficial can petition to have it constructed. This incremental process has the virtue of allowing lines to adapt to developments in the sector. These can include differential rates of technological change that increase the relative advantages of solar generation, wind generation, carbon capture and storage, and energy efficiency have over each other.[16] Climate itself may change relevant costs, such as fire-related risks associated with the locations of some transmission lines that may be proposed. These developments can also include carbon mitigation or adaptation policies that make previously unprofitable lines profitable. The "holistic," "proactive," anticipatory nature of the process may set in concrete this process and preclude the evolution that may and, to some extent, hopefully will be likely as we learn more about how to best undertake massive decarbonization of the US economy.

The hallmark of what may be sacrificed with this proposed long-term transmission planning is "flexibility." Hu et al. (2015), in advocating an "open access" approach to grid policy, observed, "The goal is not to dictate particular designs of operation of the grid, but rather to future-proof the grid with the flexibility, resilience, and scalability to meet future needs." Of course, transmission planning should not be based on the past; the future is likely to be quite different. The concern is how much we know now about what the future will be and how much we lock in one vision of it through long-term transmission planning.

Lessons from other sectors may be instructive. Bauer and Bohlin (2022) noted principles that should apply to policy and regulation of 5G wireless networks:

- Market design should create conditions that allow entrepreneurial experimentation across phases of innovation;
- Policy and regulation should allow differentiation while providing safeguards against discrimination;
- Policy ought to facilitate institutional diversity (e.g., open standards in addition to standard essential patents and proprietary technology); and

15 Winston (1993) provided a useful description of the importance of the dynamic benefits of competition beyond relatively short-term improvements in pricing and production.

16 This is why it is not enough to know now the likely locations of future wind and solar generation, as one or the other may become less valuable over the length of the planning period.

- Policy needs to create a dynamic learning system to avoid locking the system into a low performance trajectory.[17]

Openness and nondiscrimination are important but not new; they have been defining features of policy and regulation toward transmission since at least FERC Order 888 in 1996. Long-term planning potentially threatens the possibility of experimentation, differentiation, institutional diversity, and dynamic learning that dynamic competition provides.

17 This list is from a presentation of Bauer and Bohlin (2022) by Johannes Bauer at a webinar from the Florence School of Regulation, Apr. 27, 2022. https://fsr.eui.eu/event/innovation-in-5g-technology/.

4. We Have Been Here Before

The possibility of substituting long-term planning for initiative-based transmission expansion is not the first time tension has occurred between competition and the operation of the electricity system. For most of its history, competition did not exist at any major level within the production and delivery sectors. Whether such tensions have been resolved, and how, may provide lessons for preserving some of the benefits of competition within centralized long-term planning of the transmission grid.

4.1. The Electricity Sector Has Never Been Entirely Competitive

Although generation can be competitive, transmission and distribution remain prone to monopoly. For local distribution, the costs of duplicating the wires, poles, and conduits means that it is unlikely that multiple suppliers will be competing with each other. Transmission lines from a specific region of generators share this characteristic, but perhaps more important is "loop flow": power produced at one location and used in another flows across all lines in between, combining even separately owned lines into a single grid.

Much of the effort to introduce wholesale generation competition into the electricity grid has been to ensure nondiscriminatory access of all generators to transmission networks (Orders 888, 2000).[18] The instrument for this has been to separate ownership of generation from control of transmission through the institution of ISOs as part of RTOs. In principle, this separation limits the ability of monopoly transmission operators to discriminate in favor of some generators, particularly affiliated incumbent generators, over others, particularly new entrants, often using relatively new renewable technologies.

Whether these have worked and how well is a matter of some contention that I do not address here.[19] Openness and technological neutrality are important regulatory principles. To the extent those principles can be followed, regulated transmission (and distribution) sectors can remain compatible with competitive generation (and retailing) sectors. This compatibility, however, has been maintained largely through avoiding long-term coordination with transmission grids and all the generators that they can or might serve.

18 See FERC orders at *supra* n. 2.

19 For a relevant example of disputes regarding the willingness of RTOs to accept interconnections, see Howland's (2022) report of the controversy regarding PJM's alleged unreasonable refusal to interconnect with the proposed Soo Green transmission line.

4.2. Can Markets Move Fast Enough to Keep the Lights On?

A feature unique to electricity is that supply needs to equal demand virtually minute by minute. Excess demand leads to outages; excess supply leads to burnout of the lines. For other commodities, differences between supply and demand are relatively small, such as the inconvenience of having to return to a store if shelves are empty or to put unsold goods into inventory or, if they will not keep, throw them away. The general absence of real-time retail electricity prices that reflect net supply situations does not help (Faruqui 2009).

As a result, a central entity—an independent system operator in competitive generation markets or a vertically integrated utility in states that retain them—remains in place to call upon generators to supply electricity, or reduce supplies, at the last minute to ensure that supplies exactly meet demand. Part of this may be to manage capacity markets to ensure that generation is available to keep loads balanced during unexpected unit failures or spikes in demand.[20] These central entities also procure the ancillary services necessary to maintain system voltage and frequency and may become more important as the grid relies more on wind- and solar-powered generation with outputs that vary minute by minute with variation in wind speed or cloud cover (Brennan 2021). This procurement of last-minute power, capacity, and ancillary services has generally been compatible with overall competition in generation, although by their nature, these services have been either very short term or, for capacity markets, involved planning over relatively short time horizons.

4.3. Reliability as a Public Good

A feature of electricity networks is that the inability of a supplier to respond to the demands of its customers means that everyone on the grid may suffer a blackout. At some cost, some individuals may be able to procure reliability for themselves by purchasing generators, solar panels, or batteries, but these options are not likely to be economically available for all. As a consequence, the reliability of the electricity system is, in economic terms, a “public good” for the local or regional grid as a whole. This attribute has been recognized for decades, with US standards set by the North American Electric Reliability Corporation, formed in 1968 and overseen by FERC.[21]

The optimal level of reliability cannot be determined simply by individual decisions to purchase more reliable electricity (other than going off the grid to generate it). Along with the regulation of remaining monopoly transmission and distribution and the need to manage supplies to meet loads by the minute, ensuring reliability requires continuing centralized management of the grid. Whether that can be reconciled with decentralized competition has been perhaps the fundamental question of electricity policy, even before the calls for long-term transmission planning to facilitate decarbonization (Brennan et al. 1996).

20 The necessity of having capacity markets on top of markets for the energy that such capacity supplies remains a matter of considerable debate.

21 NERC Operating Manual August 2016, https://www.nerc.com/comm/OC/Operating%20Manual%20DL/Operating_Manual_20160809.pdf; https://www.nerc.com/pa/Stand/Pages/default.aspx.

5. Policy Implications

The central point is to recognize the potential costs in lost static and dynamic competition when implementing long-term anticipatory transmission planning. It is not that such planning should not take place. As noted and widely recognized by those in the climate policy community, imperatives to decarbonize electricity generation and the economy as a whole will likely entail extensive new, interregional transmission investment. Recognizing these costs, however, suggests some policy responses that may be helpful.

Antitrust immunity. A first concern is that the joint participation of competing generators in this process inhibits static competition on price and perhaps other dimensions, such as reliability. One impediment to coordination between generation and transmission may be antitrust policies that discourage competitors' information sharing and output commitments. Without such sharing, it is more likely that lines may be incorrectly sited, sized, and designed. If legal uncertainty associated with participation in collective planning and information sharing is significant, explicit statutory immunity may be warranted.

Innovation support. With regard to dynamic competition, the risk posed by long-term anticipatory planning is that the loss of opportunities to profit from independent entrepreneurial initiatives reduces incentives to innovate. A potential mitigation policy would be to increase public funding of research and development in non-emitting generation, carbon capture and storage, improved batteries, and other technologies to make up for any reduction in potential profits brought about by central planning of the bulk power system.

Limit the planning horizon. FERC's currently proposed time horizon for transmission planning is 20 years (NOPR, paragraph 10). The longer the time horizon, the more information that might accrue after plans are put in place may be lost. FERC should be sensitive to the trade-off between potential gains from longer-term planning and the costs of forgoing learning in the interim. To reduce these costs, FERC should consider reducing the planning horizon, including allowing review of original plans and implementation of revised plans over shorter periods.[22] One can think of reducing the duration of planning as capturing some of the "option value" of waiting to make otherwise irreversible commitments.

Allow independent variation. The case for long-term transmission planning is based in part on the premise that the "participant funding" model, by which generators request new capacity for which they are willing to pay, is insufficient to meet the need for extensive decarbonization. The choice perhaps should not be to have either planning or participant funding but instead to use both. It may be that FERC could oversee a broad national plan to expand the transmission grid but may be able to retain a process by which generators that perceive new market opportunities remain able to

22 If plans can be completely revised every three years, for example, then the planning horizon is essentially three years, not 20.

exploit them by requesting lines outside the long-term planning process. Generators that perceive such opportunities may not want to cooperate in long-term planning and forgo the competitive advantage they perceive that remaining independent would provide. Whether and how to construct the long-term planning process will have to consider this possibility and perhaps require universal participation and the risk of forgoing the competitive benefits such independent action provides.

Accept inevitable error. Long-term planning that does not allow for using private information as it may develop over time means that mistakes are likely. Technological change in electricity generation, for example, may mean that lines planned at one time turn out to be used much less than envisioned, especially lines constructed out to genera-tor locations that are not part of any loops that would carry electricity between other locations. Everyone involved should expect such errors and be prepared to justify their costs, borne inevitably by ratepayers (or taxpayers, if lines are constructed with public funds), by the overall net benefits of collective planning.[23]

Explicit carbon pricing. The last and likely hardest policy to implement, but one that may be even more necessary for long-term transmission planning, is explicit carbon pricing. An obvious reason is that the demand for renewable generation, and thus the lines planned to serve it, depends on the fossil fuel alternatives, be they natural gas generators or internal combustion-powered automobiles, becoming expensive. Decarbonization may drive new transmission, but until climate mitigation policy becomes much firmer, it introduces policy risks that may keep new lines from being built that would be profitable were the country committed to reducing carbon emissions.

A less obvious but potentially important reason has to do with engendering cooperation across all parties affected by the planned expansion of the transmission system. Sufficiently wide public acceptance of an expansion will require that costs allocated to a particular state or area are sufficiently below the benefits transmission brings to that state. Building new transmission may require negotiations with multiple states and landowners that can impede construction of otherwise desirable lines.[24]

Among these benefits that would either go to the state directly or be the source of benefits elsewhere that could be transferred to the state are those from decarbonization. If such benefits are measured by the avoided discounted future global costs of climate change—the "social cost of carbon"—they will include benefits that do not accrue now to the residents of states along a transmission route. Consequently, a line may sometimes be beneficial when associated global carbon reduction benefits are included but the benefits to residents of those states do not exceed the costs to residents of other states for whom a new line is seen as an environmental detriment. This possibility would preclude a bargain in which those who view the line as costly can

23 To the extent that planned new transmission is viewed as a public good rather than a private benefit to renewable generators and those who use electricity from them, taxpayers may be involved in the funding.

24 Joskow (2021) provides examples of successful and unsuccessful interstate bargains.

be compensated solely out of the benefits that accrue to residents who would benefit from increased access to renewable power.

This problem would be mitigated or avoided if the benefits of decarbonization are reflected in a price that energy buyers have to pay for fossil fuel based alternatives.[25] This need not be a tax or emissions permit price. It could be a renewable energy credit that fossil fuel producers or electricity users have to pay to buy or sell carbon-emitting energy sources. The relative merits of different means for imposing a price on carbon is beyond the scope of this paper. The core point is that renewable energy sources need to be able to charge a price reflecting their competitive advantage over fossil fuel generators that have to pay this carbon cost, in order to have appropriate incentives to build and thus be willing to pay for lines and compensate those who do not want them.[26]

25 The problem might also be mitigated by using tax dollars to compensate those bearing the costs of the lines but not reaping benefits commensurate with the monetary value of carbon mitigation determined by public policy.

26 In assessing the policy implications of these failures, it is important to keep in mind that NIMBY objections reflect real costs; they may be exaggerated because objectors might have disproportionate political clout, but that does not necessarily imply that the costs are trivial or nonexistent. Using the gains from new transmission to new renewable generation to cover those costs may be required to accomplish the goals of a long-term planning process.

6. Conclusion

The importance of rapid decarbonization of electricity generation, in conjunction with the rapid expansion of the capacity to generate electricity to substantially reduce green-house gas emissions in transportation and heating, may warrant large-scale rapid expansion of the grid. The benefits of decarbonization may well justify replacing the current system, depending largely on incremental expansions at the request of particular generators to long-term collective planning in anticipation of future transmission needs. Policy makers charged with that planning should recognize the trade-off between those benefits and the potential loss of static competition on price and quantity and dynamic competition from entrepreneurial investment and innovation as technologies and market opportunities evolve over time.

Tensions between competition and operation of the electricity grid are nothing new. Separation of control of regulated monopoly grids from ownership of generation was an important step to try to promote competition between incumbent generators and new entrants. Central grid operators have proven necessary to procure ancillary services, last-minute energy, and, arguably, capacity to ensure that supply remains balanced with demand. Supply reliability largely remains a public good subject to sector-wide standards.

Policy makers engaged in long-term transmission planning may have several methods for mitigating some of the potential effects from reduced static and dynamic competition. Antitrust immunity may be necessary to assure competitors that they can participate in the planning process. Innovation support may help replace effort that might otherwise have been supplied by independent entrepreneurs. Reducing the time horizon of transmission plans may allow all participants to take advantage of new learning on the relative costs and benefits of market opportunities and technologies for carbon mitigation. If possible, keeping the proverbial door open to independent participant-funded requests for new transmission may preserve opportunities for new competitive efforts. Planners also need to recognize the inevitability of mistakes and be prepared for public resistance to paying for lines that end up underused. Last, and likely most difficult, some form of carbon pricing may be necessary to ensure that the net benefits of planned lines can be positive for generators, users, and the states and regions through which those lines would run.

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