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Expanding the U.S. Electric Transmission and Distribution Grid to Meet Deep Decarbonization Goals

by Alexandra B. Klass

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Summary

This Article, excerpted from Michael B. Gerrard & John Dernbach, eds., *Legal Pathways to Deep Decarbonization in the United States* (forthcoming in 2018 from ELI), addresses the critical role of the electric transmission and distribution grid in achieving deep decarbonization, and discusses the primary federal and state laws that govern expanding the grid. Although significant legal and political barriers exist to creating the new transmission necessary to meet deep decarbonization goals, there are public law and nonpublic law tools available to surmount these barriers. Moreover, technology developments in energy storage, demand response, distributed energy resources, and the smart grid can both improve the existing grid and reduce the extent of grid expansion required for deep decarbonization.

I. Introduction

This Article discusses the role of the electric transmission and distribution grid in achieving deep decarbonization. It begins with an introduction to the electric grid itself and the primary actors that maintain the grid. It then discusses in general terms the additional electricity transmission, distribution, and energy storage needs to accomplish the goals of deep decarbonization in the United States. In doing so, it draws on materials in the *US 2050: Pathways to Deep Decarbonization in the United States* reports published in November 2015,[1] as well as additional reports prepared by the U.S. Department of Energy (DOE) and other experts that have evaluated ways to decarbonize the U.S. economy and modernize the electric grid. The Article then moves to a discussion of the primary federal and state laws that govern electricity transmission and distribution and the effect of those current laws on deep decarbonization efforts. Finally, it ends with a discussion of potential new public and private law approaches to achieving deep decarbonization goals relevant to the electric transmission grid.

II. The Electric Transmission Grid

The U.S. electric transmission grid is a complex network of electricity generation, transmission, and distribution that delivers nearly 4,000 terawatt hours of electric energy generated from about 7,000 operational power plants in the United States over 642,000 miles of high-voltage transmission lines and 6.3 million miles of low-voltage distribution lines to nearly 160 million residential, commercial, and industrial customers.[2] The electricity generation component of the grid consists of generating plants powered by coal, natural gas, oil, nuclear energy, hydropower, wind, solar, and other renewable energy resources. As of 2016, fossil fuel plants (coal, oil, natural gas) made up approximately 64% of total U.S. generation, nuclear energy provided 20%, hydropower was 6%, and other renewable energy resources such as wind, solar, and geothermal energy contributed nearly 8% of the total.[3]

1. James H. Williams et al., US 2050 Report: Pathways to Deep Decarbonization in the United States (2015) [hereinafter US 2050 Report].
2. *See* U.S. Dep't of Energy, Quadrennial Energy Review: Energy Transmission, Storage, and Distribution Infrastructure 3-4 (2015) [hereinafter QER Report]. *See also* U.S. Energy Info. Admin., *Frequently Asked Questions—How Many Power Plants Are There in the United States?*, https://www.eia.gov/tools/faqs/faq.cfm?id=65&t=2 (last updated Dec. 1, 2016); U.S. Energy Info. Admin., *Table 4.1: Count of Electric Power Industry Power Plants, by Sector, by Predominant Energy Sources Within Plant, 2005 Through 2015*, http://www.eia.gov/electricity/annual/html/epa_04_01.html (last visited June 29, 2017).
3. U.S. Energy Info. Admin., *Frequently Asked Questions—What Is U.S. Electricity Generation by Energy Source?*, https://www.eia.gov/tools/faqs/faq.php?id=427&t=3 (last updated Apr. 18, 2017).

The high-voltage transmission system carries this energy from power plants to electric substations near load centers (i.e., population or industrial centers) where the voltage is "stepped down" so it can be transferred to the more numerous low-voltage distribution lines that supply power to homes, businesses, and industrial facilities. The vast majority of high-voltage transmission lines are alternating current (AC)—facilitating easy voltage conversion—although some are direct current (DC), which has higher per-mile efficiency and the ability to transfer power between the three U.S. electric interconnections.[4]

Large investor-owned utilities, along with municipal utilities, rural electric cooperatives, and federal power authorities (such as Tennessee Valley Authority and Bonneville Power Administration), often own and manage both electric generation facilities (i.e., power plants) and transmission and distribution facilities.[5] Investor-owned utilities, also known as "electric utilities," are regulated by state public utilities commissions (PUCs) with regard to price and other aspects of service in exchange for receiving a state-granted monopoly to provide electricity service within a given city or other geographic footprint.

In recent years, however, other private companies known as "independent power producers" have begun to own and manage a significant percentage of generation plants. Unlike electric utilities, independent power producers do not have retail customers, but simply produce power for resale. Likewise, "independent transmission companies" and "merchant transmission line companies" have begun to participate in markets to provide long-distance transmission service to electricity generators and distributors.[6]

Managing the reliability and security of the electric grid is a herculean task. At the present time, energy storage options for electricity are limited, which means that there must be enough, but not too much, electricity flowing through the grid at every moment, maintained at an appropriate voltage, that can be dispatched to customers on demand. If these conditions are not met, blackouts or brownouts can occur and the grid does not serve its function of providing safe and reliable electricity.[7]

Following the Energy Policy Act of 2005 (EPAct 2005), the Federal Energy Regulatory Commission (FERC)[8] designated the nonprofit North American Electric Reliability Corp. (NERC) as the entity responsible for overseeing grid reliability and security for the United States.[9] NERC establishes minimum standards for operating the bulk transmission system, sets contingencies that grid owners/operators must meet to ensure system reliability, and otherwise engages in planning and monitoring activities.[10] NERC delegates many of its reliability responsibilities to "regional entities" (REs) that propose reliability standards to NERC and, ultimately, to FERC for approval.[11] These reliability standards consist of rules governing power plant operators and transmission line operators designed to protect infrastructure, maintain adequate power supply, and prevent cyber attacks and other security breaches.[12] FERC and NERC have enforcement authority and can impose penalties on utilities and other grid participants for noncompliance.

Electricity markets consist of wholesale markets—where utility and non-utility generators sell power to utilities and other electricity providers for resale—and retail markets—where utility and non-utility electricity providers sell power to residential, commercial, and industrial end-users. FERC regulates wholesale electricity markets under the Federal Power Act,[13] and states, through PUCs, regulate retail

4. The U.S. electric grid consists of three interconnections—or power networks—that operate independently from each other with limited transfer of power between the interconnections. These interconnections are the Eastern Interconnection, the Western Interconnection, and the Electric Reliability Council of Texas (ERCOT), which covers most of the state of Texas. Within each interconnection, power flows freely and "helps maintain the reliability of the power system by providing multiple routes for power to flow and by allowing generators to supply electricity to many load centers. This redundancy helps prevent transmission line or power plant failures from causing interruptions in service." *See* Sara Hoff, *U.S. Electric System Is Made Up of Interconnections and Balancing Authorities*, U.S. Energy Info. Admin., July 20, 2016, https://www.eia.gov/todayinenergy/detail.php?id=27152.
5. With regard to electricity generation, investor-owned utilities provide 38.7% of total U.S. generation, non-utility generators provide nearly 39.9%, publicly owned (i.e., municipal) utilities 10%, federal power agencies 6.4%, and electric cooperatives 5%. *See* American Public Power Ass'n, 2015-2016 Annual Directory & Statistical Report 28, *available at* http://www.publicpower.org/files/PDFs/USElectricUtilityIndustryStatistics.pdf.
6. Merchant transmission line companies do not own generation assets and do not sell electricity at retail to customers. Instead, they are simply in business to build and operate the transmission lines and obtain revenue solely through the contracts they make with generators and purchasers of energy through the lines. Because these contracts are for the transmission of electric energy in interstate commerce, the Federal Energy Regulatory Commission (FERC) regulates the contract rates under the Federal Power Act. Independent transmission line companies generally operate the same way except that in some states, they are able to obtain status as a transmission-only public utility and obtain rate recovery from retail customers under state law. *See, e.g.*, Alexandra B. Klass & Jim Rossi, *Revitalizing Dormant Commerce Clause Review for Interstate Coordination*, 100 Minn. L. Rev. 129, 150 (2015); Alexandra B. Klass, *The Electric Grid at a Crossroads: A Regional Approach to Siting Transmission Lines*, 48 U.C. Davis L. Rev. 1895, 1925-26 & n.160 (2015).
7. Yuri V. Marakov et al., Pacific Northwest National Laboratory, Analysis Methodology for Balancing Authority Cooperation in High Penetration of Variable Generation 1.1 (2010) (PNNL-19229), *available at* http://www.pnl.gov/main/publications/external/technical_reports/pnnl-19229.pdf.
8. FERC has congressional authority under the Federal Power Act to regulate a wide range of energy resources and industries, including wholesale electricity sales and interstate transmission of electricity. FERC is an independent regulatory agency with five commissioners appointed by the president with the advice and consent of the U.S. Senate. Each commissioner serves a five-year term, and no more than three commissioners may belong to the same political party. *See* Fed. Energy Reg. Comm'n, *What FERC Does*, http://www.ferc.gov/about/ferc-does.asp (last updated May 24, 2016); Fed. Energy Reg. Comm'n, *Commission Members*, http://www.ferc.gov/about/com-mem.asp (last updated Feb. 3, 2017).
9. NERC, History of NERC (2013), http://www.nerc.com/AboutNERC/Documents/History%20AUG13.pdf.
10. NERC, *About NERC*, http://www.nerc.com/AboutNERC/Pages/default.aspx (last visited June 29, 2017).
11. NERC, *Key Players*, http://www.nerc.com/AboutNERC/keyplayers/Pages/default.aspx (last visited June 29, 2017); Hari M. Osofsky & Hannah J. Wiseman, *Hybrid Energy Governance*, 2014 U. Ill. L. Rev. 1, 36, 41-44 (2014).
12. NERC, *United States Mandatory Standards Subject to Enforcement*, http://www.nerc.com/pa/stand/Pages/ReliabilityStandardsUnitedStates.aspx?jurisdiction=United%20States (last visited June 29, 2017).
13. Under the Federal Power Act, FERC has jurisdiction to regulate wholesale sales of electric energy in interstate commerce and the transmission of electric energy in interstate commerce. 16 U.S.C. §824(a) (1935).

electricity markets under state law. About half of the states are "traditionally regulated," meaning that they grant monopoly service territories to designated electric utilities that are "vertically integrated," meaning that the utilities own generation assets, transmission and distribution infrastructure, and sell electricity and transmission services to retail customers. In exchange for this grant of monopoly power, state PUCs review and approve the utilities' rates (i.e., prices) charged to customers to ensure they are nondiscriminatory and are just and reasonable while at the same time allowing the utilities to earn a return on capital investments and recover their operating costs.

The other half of the states are "restructured," meaning that they have established competitive markets for electricity generation and, in some states, allow multiple power providers to compete to sell electricity to retail customers. In those states, the utilities generally retain monopoly power and obtain a return on investments from customers only with regard to transmission and distribution services and not with regard to electricity generation.

In approximately half of the country, nonprofit organizations called regional transmission organizations (RTOs) and independent system operators (ISOs) manage the transmission grid on behalf of their members—consisting of electric utilities and other entities owning transmission assets, independent power producers, developers, and customer groups—and also oversee wholesale electricity markets within their territories.[14] In the remainder of the United States, primarily in the Southeast and intermountain West, there are no RTOs and ISOs and, in those jurisdictions, electric utilities buy and sell transmission access as well as wholesale electricity through bilateral transactions that FERC approves to ensure such transactions are nondiscriminatory and just and reasonable under the Federal Power Act.

III. Transmission Needs for Deep Decarbonization

A. *Deep Decarbonization Reports*

The executive summary for *Pathways to Deep Decarbonization in the United States* asserts:

> [M]eeting the 2050 target [i.e., reducing U.S. greenhouse gas (GHG) emissions 80% below 1990 levels by 2050] requires almost fully decarbonizing electricity supply and switching a large share of end uses [most notably the passenger transportation sector] from direct combustion of fossil fuels to electricity (e.g., electric vehicles), or fuels produced from electricity. . . .[15]

The report provides four different deep decarbonization scenarios to reach the 2050 target: (1) High Renewables; (2) High Nuclear; (3) High Carbon Capture and Sequestration (CCS); and (4) Mixed, all of which were so named "according to the different principal form of primary energy used in electricity generation."[16] The report authors state that the GHG reduction target is technically feasible using existing commercial or near-commercial technologies, even assuming present-day energy consumption trends, and is expected to have an incremental cost to the energy system of approximately 1% of the gross domestic product with a wide uncertainty range.[17] The report goes on to describe the nature of the changes to the electricity sector that would be required:

> [E]lectricity generation would need to approximately double (an increase of 60-110% across scenarios) by 2050 while its carbon intensity is reduced to 3-10% of its current level. Concretely, this would require the deployment of roughly 2,500 gigawatts (GW) of wind and solar generation (30 times present capacity) in a high renewables scenario, 700 GW of fossil generation with CCS (nearly the present capacity of non-CCS fossil generation) in a high CCS scenario, or more than 400 GW of nuclear (4 times present capacity) in a high nuclear scenario.[18]

Thus, the report assumes a doubling of U.S. electricity generation with a massive transition away from fossil fuel-fired generation without CCS (66% of total generation in 2015) and a significant increase in the use of nuclear generation, renewables generation, fossil fuel with CCS, or all three.[19] Because all four scenarios require doubling existing electricity generation, all four scenarios require an increase in electric transmission capacity to transport these new sources of generation to end-users, with the largest increase associated with the High Renewables Scenario.[20] It is important to stress at the outset that all the scenarios in the *Pathways to Deep Decarbonization* reports assume that virtually all passenger vehicle transportation would be electric vehicles (EVs) in order to sharply reduce the GHG emissions associated with the current passenger fleet of gasoline and diesel vehicles. Since only a very small percentage of U.S. passenger vehicles today are EVs, the electricity generation and transmission infrastructure needs required for such a conversion are massive, especially if done in conjunction with grid decarbonization.[21]

14. Fed. Energy Reg. Comm'n, *Regional Transmission Organizations (RTO)/Independent System Operators (ISO)* (showing RTO/ISO map), http://www.ferc.gov/industries/electric/indus-act/rto.asp (last visited June 29, 2017).
15. US 2050 Report, *supra* note 1, Executive Summary, at vii. This would require a reduction of U.S. petroleum consumption by 76-91% by 2050 across all electricity generation scenarios. *Id.*
16. *Id.* at v.
17. *Id.* at v-vii.
18. *Id.* at xiii.
19. US 2050 Report, *supra* note 1, at 70-71
20. *See, e.g.*, *id.* at 47; Judy W. Chang & Johannes P. Pfeifeinberger, Brattle Group, Well-Planned Electric Transmission Saves Customer Costs: Improved Transmission Planning Is Key to the Transition to a Carbon-Constrained Future (2016) (discussing significant, regional electric transmission needs required to support a low-carbon electricity future).
21. Although researchers at Pacific Northwest National Laboratory found that the grid had sufficient spare capacity to convert nearly all passenger vehicles to EVs if vehicle charging is managed properly, that assumed continuing to use the existing mix of electric energy resources, including current levels of fossil fuel use. *See* Michael Kinter-Meyer et al., Pacific Northwest

Those transmission needs are even more significant in the High Renewables Scenario. This is because, as discussed in more detail below, renewable energy resources are not dispersed evenly throughout the United States and, using current technologies (as assumed in the report), renewable energy resources can only be transported via electric transmission lines to end-users.[22] For instance, the significant onshore utility-scale wind resources in the United States are concentrated in the Midwest and Plains states and are thus far from major population centers on the coasts. The same is true for utility-scale solar energy (concentrated in the desert Southwest) and major hydropower resources. This stands in contrast to coal, oil, natural gas, and nuclear fuel, which can be transported by truck, pipeline, or train to power plants built near population centers with existing distribution lines to carry the energy generated at those plants to homes and businesses. Moreover, the High Renewables Scenario requires a significant amount of "energy storage," also discussed in more detail below, to address the fact that the wind does not always blow and the sun does not always shine, and thus that energy must somehow be "stored" for later use.[23]

The report concludes that under all four scenarios, average electricity rates increase modestly as compared to the reference case (from approximately $.0.17 per kilowatt hour to $0.19-.23 per kilowatt hour, with the top of that range associated only with the High CCS Scenario) and that the cost of transmission also increases only modestly, except in the High Renewables Scenario.[24] But these "costs" reflect only the actual cost to build the necessary transmission, if all approvals go quickly and smoothly. They do not include the costs associated with any delays, lawsuits, or investment uncertainty that accompanies those delays and lawsuits, as well as other legal and financial barriers to building the necessary transmission infrastructure. These potential barriers, many of which are legal, political, and socioeconomic, are the topic of much of the rest of this Article, and the Article highlights the extent to which existing laws and regulations place limitations on meeting the 2050 goal and potential means of overcoming some of those limitations.

B. Other Sources of Information on Deep Decarbonization, Transmission Needs, and Resource Balancing

Other experts, most notably DOE, have prepared reports analyzing the need for additional transmission expansion and investment to ensure the continuing viability of the grid as well as to transform it to accommodate decarbonization of the electricity sector. As an initial matter, after decades of decline in investment in the transmission grid, utilities and other grid operators have increased spending on grid expansion dramatically since 2010, with investor-owned utilities spending a record high $20.1 billion in investment in 2015, as compared with $10.2 billion in 2010.[25] These investments include new line construction as well as non-line investments such as station equipment, towers, and "smart grid" investments for both the transmission and distribution grid, such as "smart meters." These investments also include automated systems to detect faults, measure grid activity, and communicate information more efficiently and on a two-way or multi-way basis that involves generation, transmission, and distribution operators, and end-users.[26]

According to DOE, these developments, particularly the expansion of long-distance transmission lines, are necessary to connect high-quality renewable energy resources in remote parts of the country to the grid. DOE concluded that, even assuming significant investments in renewable "distributed resources" that do not require long-distance transmission, such as rooftop photovoltaic (PV) solar, additional transmission capacity is still needed to decarbonize the electric grid.[27] DOE, the nation's electric utilities, and other experts continue to evaluate how to transform the current electric grid, which developed from a patchwork of technologies that came together beginning in the 1960s, into the type of modern grid needed to meet 21st century deep decarbonization, reliability, and cybersecurity needs.[28]

As a result of these needs, in 2015, DOE undertook the significant "Grid Modernization Initiative" with a vision to achieve, among other goals, 80% clean electricity by 2035; create new energy products and services and reduce barriers to new technologies; and mitigate the risks to the grid of extreme weather, cyber threats, physical attacks, natu-

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National Laboratory, Impacts Assessment of Plug-In Hybrid Vehicles on Electric Utilities and Regional U.S. Power Grids, Part 1: Technical Analysis (2007); Michael Kinter-Meyer et al., Pacific Northwest National Laboratory, Impacts Assessment of Plug-In Hybrid Vehicles on Electric Utilities and Regional U.S. Power Grids, Part 2: Economic Analysis (2007).

22. The US 2050 Report authors include both onshore renewable energy resources as well as shallow offshore wind energy resources in their assumptions regarding the potential for significantly greater use of renewable energy resources in the electric transmission grid. Although offshore wind resources currently face regulatory and technical difficulties, they have the potential for reducing the amount of overland electric transmission lines needed to deliver abundant, high-value wind resources to population centers because nearly half of the U.S. population lives in or near coastal cities. *See* U.S. Dep't of Energy, Office of Energy Efficiency & Renewable Energy, *Offshore Wind Research and Development*, http://energy.gov/eere/wind/offshore-wind-research-and-development (last visited June 29, 2017); Daniel Cusick, *N.C. Rakes in $9M From Offshore Lease Sale*, ClimateWire, Mar. 17, 2017; Daniel Cusick, *Offshore Wind Is Almost a Go, but Challenges Remain*, ClimateWire, May 31, 2016.

23. *See* US 2050 Report, *supra* note 1, at 15 (discussing energy storage needs) and 37 (discussing the fact that wind, solar, and nuclear energy are "non-dispatchable" (i.e., cannot be switched on and off on demand) and thus "present challenges for balancing electricity supply and demand").

24. *Id.* at 47.

25. *See* Edison Elec. Inst., Transmission Projects: At a Glance v (2016) (bar graph showing yearly investments). *See also* QER Report, *supra* note 2, at 3-6 to 3-7 (describing dramatic increase in transmission-related investments and projects with $5.8 billion spent in 2001 compared with $16.9 billion spent in 2013).

26. *See* QER Report, *supra* note 2, at 3-6 to 3-7, 3-13 to 3-15; Lincoln L. Davies et al., Energy Law and Policy 710-12 (2015) (discussing smart grid technologies).

27. QER Report, *supra* note 2, at 3-8 to 3-9.

28. *See* John Fialka, *Modernizing the Grid: "A Tugboat Trying to Turn a Big Ocean Liner,"* ClimateWire, July 6, 2016.

ral disasters, and aging infrastructure.[29] In January 2016, DOE announced it would provide up to $220 million in grants for multiple projects and initiatives to achieve these and other grid-related goals through partnerships among the national laboratories, state and local governments, and industry and nonprofit actors.[30] It is important to note, however, that the Trump Administration has indicated that it may cut back substantially on a number of energy-related grants and, thus, these investments are far more uncertain as of the beginning of 2017.

A 2012 study conducted by DOE and the National Renewable Energy Laboratory entitled the "Renewable Electricity Futures Study" explored the potential for significantly increasing the use of renewable energy in the U.S. electricity grid, with particular focus on decarbonizing the grid through use of 80% renewables, with 50% of that derived from wind and solar energy. The study concluded that existing technologies make such percentages feasible in terms of U.S. electricity generation, but that such a shift would require extensive new transmission expansion, particularly in the Midwest and Southwest regions of the country, in order to access high-quality wind and solar resources in those regions and deliver them to population centers.[31] Nevertheless, the executive summary of the report concludes its section on transmission as follows:

> Significant institutional obstacles, including constraints in siting new transmission lines, cost allocation concerns with transmission projects, and coordination between multiple governing entities, currently inhibit transmission expansion. The mechanisms to overcome these obstacles were not explored in the study, but the analysis demonstrates that additional long-distance transmission capacity can be an important characteristic of high renewable electricity futures.[32]

Later sections of this Article discuss these "significant institutional obstacles" as well as potential public and private law approaches that could help overcome them.

IV. Technologies Available and Under Development for Deep Decarbonization

This section highlights the transmission-related challenges associated with meeting the 2050 deep decarbonization goals and the potential ways to overcome those challenges. It focuses particularly on existing and potential technologies that can both improve existing electricity transmission and distribution systems and also reduce the need for new transmission in the first place.

There are numerous technologies available and under development to achieve deep decarbonization goals that relate to electricity transmission, distribution, and storage. With regard to long-distance transmission, many of the smart grid developments described in the DOE grid modernization reports noted in Section III can make electricity transmission more efficient and effective, thus making the integration of significant renewable energy into the grid (as well as coal with CCS and nuclear) more efficient. These include:

- Enhanced sensing systems, such as advanced synchrophasors that keep the grid running both under normal conditions and in extreme weather conditions through refined grid measurement technology
- Improved communication infrastructure, grid-level energy management systems (EMS) with fast and automated control mechanisms to allow the grid to be operated more reliably with lower reserve margins, reducing the need for additional power generation to keep the grid in balance
- AC/DC power flow controllers and converters that adjust power flow at a more detailed and granular level
- Improved management of metadata through power transmission analysis software and other data technologies[33]

Moreover, advances in wind forecasting have already allowed greater penetration of wind energy in some regions of the country, particularly the Midwest, by better anticipating when wind resources are available and thus allowing those energy resources to "bid in" to regional wholesale electricity markets and reduce intermittency/variability concerns associated with integrating increasing percentages of renewable generation resources in the grid.[34]

29. *See* U.S. Dep't of Energy, Grid Modernization Initiative (2015); U.S. Dep't of Energy, Grid Modernization Multi-Year Program Plan (2015).
30. *DOE Announces $220 Million in Grid Modernization Funding*, U.S. Dep't of Energy, Jan. 14, 2016, http://energy.gov/articles/doe-announces-220-million-grid-modernization-funding. DOE also evaluated electric transmission needs in Wind Vision: A New Era for Wind Power in the United States (2015). The report considered 10% wind penetration by 2020, 20% by 2030, and 35% by 2050. The study concluded that new transmission capacity would be 2.7 times greater in 2030 and 4.2 times greater in 2050 than the respective baseline scenarios (with wind held constant at 2013 levels of 61 gigawatts), with transmission expansion concentrated in the Midwest and south central regions of the United States. *Id.* at xliv.
31. Trieu Mai et al., Nat'l Renewable Energy Lab., Renewable Electricity Futures Study: Executive Summary 25-26 (2012) [hereinafter Renewable Electricity Futures Study: Executive Summary]; Michael Milligan et al., Nat'l Renewable Energy Lab., Renewable Electricity Futures Study: Bulk Electric Power Systems: Operations and Transmission Planning (2012).
32. Renewable Electricity Futures Study: Executive Summary, *supra* note 31, at 26. *See also* Joseph H. Eto, Building Electric Transmission Lines: A Review of Recent Transmission Projects 23 (2016) (recognizing difficulties of building multistate transmission projects).
33. U.S. Dep't of Energy, Grid Modernization Initiative, *supra* note 29; QER Report, *supra* note 2, at 3-2, 3-14; U.S. Dep't of Energy, Grid Modernization Multi-Year Program Plan, *supra* note 29, at 12-13; Davies et al., *supra* note 26, at 711-12.
34. *See, e.g.*, Midcontinent Independent System Operator (MISO), *Wind Integration*, https://www.misoenergy.org/WhatWeDo/StrategicInitiatives/Pages/WindIntegration.aspx (last visited June 29, 2017); Kristian Ruud, *First Person—Grid Operator: Riding Midwest Winds*, EPRI J. 1 (Nov./Dec. 2015); Kris Ruud, Wind Forecast Integration at MISO, http://www.ieee-pes.org/presentations/td2014/td2014p-000699.pdf; Dale Osborn et al., Great Plains Institute, *Transmission & Wind: Lessons From the Midwest* (2013), http://www.betterenergy.org/transmission-wind-lessons.

Another existing technology for long-distance transmission that could be significantly expanded to meet deep decarbonization goals is high-voltage direct current (HVDC) transmission lines to transport utility-scale wind and solar energy long distances from generation sites to load centers. The existing U.S. electric grid was built using high-voltage AC transmission lines, which means that the voltage and the current on those lines oscillate in a wave-like pattern. AC lines were initially favored in the late 19th century when electric utilities first constructed the grid because the technology did not exist to efficiently convert the high voltages traveling on DC lines to the lower voltage necessary for use in homes and businesses.[35] Today, however, as conversion technology has developed, HVDC lines are seen as having a significant advantage in moving large amounts of power long distances, because their increased efficiency over distances of several hundred miles means lower "line losses" during the transmission process.[36]

Although few such lines currently exist in the United States, Clean Line Energy Partners, a merchant transmission line company, has proposed five different multistate HVDC lines to bring significant amounts of wind energy generated in the Midwest and Plains states to population centers throughout the United States.[37] Although Clean Line has faced significant regulatory barriers with these projects that are discussed in later sections of this Article, most experts agree that the greater use of HVDC lines would significantly enhance the electric grid. This is because such lines would allow the increased use of renewable energy resources in the U.S. grid, connecting the best wind and solar resource areas with load centers with fewer power losses, and also because such lines would allow the transfer of power between the three U.S. interconnections.[38]

As for the electric distribution system, many of the smart grid initiatives for the transmission system regarding sensors, data management, and two-way communications can also transform the distribution system, allowing two-way communications between grid operators, utilities, and consumers. Moreover, these improvements will allow increased integration of distributed generation (DG) in the form of rooftop PV solar. This, in turn, can facilitate greater use of this source of renewable energy, and reduce the need for continued reliance on fossil fuels to meet the deep decarbonization goals of doubling electricity demand and shifting away from oil in the transportation sector. Additional technologies critical to distribution system improvements are

- "smart meters," and advanced power electronics and devices, which enable buildings, large building loads, appliances, and EV charging systems to regulate energy more effectively and provide capacity energy and ancillary services to the grid; and
- enhanced sensors and visualization techniques for distribution systems and buildings to allow buildings to communicate with grid control systems to offer grid services and support buildings.[39]

Likewise, better use of "energy consumption data" for commercial, industrial, and residential buildings will allow all of these smart grid developments to make buildings more efficient, reduce the need for additional generation resources, and rely more heavily on DG resources.[40]

Last, developments in energy storage technologies have the potential to transform the long-distance transmission and distribution grid. Energy storage, which currently consists of large- and small-scale batteries, pumped storage hydropower, compressed air flywheels, and thermal energy, allows electricity from renewable energy resources such as wind and solar to be generated at times of peak sun and wind and then stored for later use.[41] It also allows grid operators and utilities to reduce peak electricity demand (and thus the need for additional non-renewable baseload generation resources) and also reduce the need for new transmission lines. Finally, it reduces the need for grid operators to "curtail" renewable energy resources, particularly wind, because excess energy can be stored for later use and does not risk overloading the grid.[42] Thus, energy storage has the potential to reduce the current limitations of these "variable" energy resources and allow them to be more fully integrated into the grid.

According to DOE, new battery technologies such as "next generation aqueous electrolytes (aqueous soluble organics, hybrid flow, low cost transition metal systems); metal-organic electrolytes, non-aqueous electrolytes, novel membranes, and systems development can lead to improved performance and cost reductions."[43] DOE also states that "[f]urther advances in sodium based batteries, modified lithium-systems, and multivalent redox couples are needed to bring these promising technologies to a higher readiness level" and that advances in flywheel technologies can "improve the efficiency and lower the cost of next generation flywheel storage systems."[44]

35. *See, e.g.*, Klass, *The Electric Grid at a Crossroads*, *supra* note 6, at 1910-11, 1927-28.
36. *Id.* at 1928; Clean Line Energy Partners, *How HVDC Works*, http://www.cleanlineenergy.com/technology/hvdc/how (last visited June 29, 2017); Fact Sheet, Siemens, High-Voltage Direct Current Transmission (HVDC) Status May 2014, *available at* http://www.siemens.com/press/pool/de/feature/2013/energy/2013-08-x-win/factsheet-hvdc-e.pdf.
37. *See* Clean Line Energy Partners, *Projects*, http://www.cleanlineenergy.com/projects (last visited June 29, 2017).
38. *See, e.g.*, *The Cheapest Way to Scale Up Wind and Solar Energy? High-Tech Power Lines*, Conversation, Jan. 27, 2016; David Roberts, *This New Transmission Line Will Help Unleash Wind Energy in the Great Plains. One Down, Dozens to Go*, Vox, Mar. 29, 2016, http://www.vox.com/2016/3/29/11322600/plains-eastern-transmission-line.
39. U.S. Dep't of Energy, Grid Modernization Multi-Year Program Plan, *supra* note 29, at 17-20.
40. *See, e.g.*, Alexandra B. Klass & Elizabeth J. Wilson, *Remaking Energy: The Critical Role of Energy Consumption Data*, 104 Cal. L. Rev. 1095 (2016).
41. *See* Amy L. Stein, *Reconsidering Regulatory Uncertainty: Making a Case for Energy Storage*, 41 Fla. St. U. L. Rev. 697, 705-09 (2014) (discussing types of energy storage technologies).
42. *Id.*
43. U.S. Dep't of Energy, Grid Modernization Multi-Year Program Plan, *supra* note 29, at 20.
44. *Id.*

Developments in commercial-scale energy storage technologies, particularly lithium-ion batteries, which are furthest along in utility-scale development, illustrate the potential for energy storage at both the transmission and distribution levels. In 2014, Texas' largest transmission and distribution utility—Oncor—proposed a multibillion-dollar investment in utility-scale batteries beginning in 2018 to allow it to store Texas' ample wind energy, which generally has its peak generation at night, when electricity demand is low, for later use during higher periods of demand during the day.[45] The utility also began pilot projects to couple battery use with solar PV and other on-site generating sources to use batteries at the generation and distribution levels. Although Oncor has faced regulatory hurdles in connection with this initiative, which are described in later sections of this Article, the fact that the proposal exists displays the potential that new battery technologies have for realizing deep decarbonization goals based on a High Renewables Scenario.

Moreover, the EV maker Tesla Motors now sells two forms of electric battery storage for stationary use using lithium-ion batteries. The first, the Powerwall, is designed for homeowners with PV rooftop solar panels, and the second, the Powerpack, is larger and is designed for commercial and utility customers to store larger amounts of grid-scale and industrial power.[46] Finally, after the Aliso Canyon major natural gas storage leak in 2015 in southern California, California regulators directed electric utilities to initially replace the facility with battery storage rather than new gas resources. By early 2017, the utilities, working with Tesla, Samsung, and other companies, completed three lithium-ion energy storage projects, resulting in 70 megawatts of energy now serving the southern California electric grid by absorbing solar and other energy when it is produced and then providing power to the grid at a later time.[47] These and other storage technology developments may play a central role in meeting deep decarbonization goals, although concerns remain about the timing, economics, and scale-up of the necessary technologies.[48]

Beyond their use for energy storage in the transmission grid, improved batteries are the key to developing the future U.S. fleet of EVs that will be needed to transition the transportation sector away from gasoline- and diesel-powered vehicles necessary to meet the goals set forth in the *Pathways to Deep Decarbonization* report.

It is also worth noting that there are potential developments in renewable energy generation technologies that can significantly impact the need for new transmission to meet deep decarbonization goals. Although the deep decarbonization reports rely upon present or near-future electricity generation technologies, DOE has analyzed the impact of building significantly taller wind turbines (standing 110-140 meters tall, up to one-and-one-half times the height of the Statue of Liberty), which allows access to better wind resources higher above the ground, thus creating new opportunities for wind generation throughout the country.[49] According to DOE, such turbines would allow for wind energy potential in an additional 700,000 square miles, approximately one-fifth of U.S. land area. Increasing the footprint of strong wind energy potential in the United States would reduce the need for long-distance transmission lines to bring existing wind energy resources from the middle of the country to population centers on the coasts.

Moreover, there are several U.S. offshore wind projects under development that could significantly increase the amount of available wind energy in the grid. Although offshore wind development has faced technical and regulatory difficulties in the United States to date, it has the potential to integrate large amounts of renewable energy into the grid without the need for overland electric transmission lines subject to multiple state permitting authorities. This is because nearly 40% of the U.S. population lives in cities on the coasts and that percentage is increasing.[50] Notably, since 2016, the declining cost of offshore wind along with new state initiatives to promote it on the East Coast makes it more likely that offshore wind will play a much greater role in future renewable energy generation in the United States.[51]

In sum, there are existing and potential technologies that can both improve existing electricity transmission and distribution systems and also reduce the need for new transmission in the first place. The reason this section focuses heavily on reducing the need for new transmission is because it can be costly and, more importantly, there are significant legal and socioeconomic barriers to building new electric transmission infrastructure separate and apart from cost and technology.[52] Thus, reducing the need for new transmission lines to accompany increased GHG-free electricity generation is a critical component of meeting deep decarbonization goals. The remainder of this Article addresses these existing barriers to new transmission and ways to remove or surmount them.

45. James Osborne, *Oncor Proposes Giant Leap for Grid, Batteries*, Dallas Morning News, Nov. 8, 2014; Robert Fares, *Three Reasons Oncor's Energy Storage Proposal Is a Game Changer*, Sci. Am., Nov. 18, 2014; Brattle Group, The Value of Distributed Electricity Storage in Texas (2014) (discussing feasibility of large-scale batteries for electric transmission and distribution).
46. *See* Anne Mulkern, *Tesla Says It Will Double Capacity of Home Battery*, EnergyWire, June 10, 2015.
47. *See, e.g.*, Julia Pyper, *Tesla, Greensmith, AES Deploy Aliso Canyon Battery Storage in Record Time*, Greentech Media, Jan. 31, 2017; Diane Cardwell & Clifford Krauss, *A Big Test for Big Batteries*, N.Y. Times, Jan. 14, 2017.
48. *See, e.g.*, John Fialka, *Will the World's Largest Storage Battery Be America's Energy Cure?*, ClimateWire, July 7, 2016.
49. *Unlocking Our Nation's Wind Potential*, U.S. Dep't of Energy, May 19, 2015, http://energy.gov/eere/articles/unlocking-our-nation-s-wind-potential.
50. *See* Nat'l Oceanic and Atmospheric Admin., *What Percentage of the Population Lives Near the Coast?*, http://oceanservice.noaa.gov/facts/population.html (last visited June 29, 2017). *See also supra* note 22 and accompanying text (discussing need for long-distance transmission lines to transport utility-scale wind and solar energy from sparsely populated parts of the country where it can be generated to population centers).
51. *See, e.g.*, Saqib Rahim, *BOEM Sees No Sign of Deterrence From White House*, EnergyWire, Apr. 21, 2017; Cusick, *supra* note 22.
52. For a discussion of the costs associated with building the transmission infrastructure necessary to connect remote renewable energy resources with population centers, see University of Texas at Austin Energy Institute, Estimation of Transmission Costs for New Generation (2016).

V. Laws Applicable to Transmission Expansion for Deep Decarbonization

Experts generally agree that additional long-distance transmission is needed to bring utility-scale wind and solar energy from the regions of the country where those resources are plentiful to population centers often many states away.[53] But present-day laws governing the approval of interstate electric transmission lines (often referred to as the "siting process") and the use of eminent domain authority to obtain the easements over land necessary for such lines, in many cases make actually constructing those lines quite difficult.

First, the fact that states are primarily responsible for siting and eminent domain for interstate transmission lines often severely limits the ability of utilities, merchant transmission lines, and others to obtain approval to construct lines needed to integrate new electricity generation into the grid to meet deep decarbonization goals. As summarized in a report by the Bipartisan Policy Center in 2013 discussing this issue:

> Siting new transmission lines is often a prolonged, expensive, and contentious undertaking. . . . In recent decades, . . . the evolution of interstate and regional electricity markets has increasingly necessitated long-line, interstate transmission projects. Further, the extent of [variable energy resource] integration that will be required by existing state renewable portfolio requirements, and the reality that many renewable resources are located at a distance from load, will likely create a greater need for new long-line transmission in some regions.
>
> . . . Under the current siting regime, the developer of a multistate transmission line must obtain requisite approvals from state and local authorities along the full length of the line. . . . For their part, individual state authorities may be bound by state statutes to accept or reject the project on the basis of their in-state transmission needs, or the in-state benefits that the project offers. In these cases, states may not be empowered to consider the regional benefits of a proposed project. Thus, a project that transmits power generated in one state, passes through a second state, and serves load in a third state could have difficulty winning approval from regulators in the second state. In some states, regulators might even be required by law to reject a project that does not serve load within the state's boundaries, even in cases where the project delivers broader benefits to the region at large that the state would share in over time.[54]

Second, these problems are exacerbated by the fact that many state laws do not allow—or are not clear whether they allow—merchant transmission lines and other non-utility transmission owners to obtain siting permits and exercise eminent domain authority. In other states, "right of first refusal" laws give utilities the first option of building transmission lines in the state, thus limiting the potential for new market actors who might seek to build lines in the state that would not only benefit the local utility's customers, but also would serve regional or national needs and/or meet clean energy goals.[55] Although FERC Order 1000 and RTO regional planning efforts have helped put more emphasis on multistate transmission goals, RTOs do not exist throughout the country and all the regional planning in the world cannot overcome state siting procedures that focus narrowly on in-state need. Because of the regional nature of renewable energy resources (valuable wind in the Midwest and Plains states and utility-scale solar in the Southwest), even if a state wishes to generate or use more renewable energy resources, it generally must import those resources from, or export those resources to, neighboring states that may not share the same goals and may not approve the necessary transmission lines.[56] The potential for every interstate electric transmission line to have to obtain multiple state approvals, using multiple standards, with risk of multiple legal challenges creates uncertainty and delay, and reduces the necessary investment in new interstate transmission lines to meet deep decarbonization goals.

It is important to note that for many other types of infrastructure projects that cross state lines, the U.S. Congress has granted federal agencies the power to approve such projects, allowing for a federal authority to weigh the national benefits of such projects against any costs or harms to individual state or local interests. For instance, in the late 1930s, Congress granted the Federal Power Commission (now FERC) the right to approve and grant eminent domain authority to natural gas pipeline companies proposing to construct interstate natural gas pipelines and associated infrastructure. Likewise, after World War II, Congress granted the U.S. Department of Transportation the authority to plan, approve, and build the Interstate Highway System. But with regard to interstate electric transmission lines, Congress has declined to transfer siting

53. *See* Klass, *The Electric Grid at a Crossroads*, *supra* note 6, at 1922-24 & n.147 (citing and describing studies); Chang & Pfeifenberger, *supra* note 20 (discussing the need for a significant increase in multistate, regional electric transmission planning and construction to meet the future needs of a carbon-constrained electric grid, reduce electricity costs, and replace aging infrastructure).

54. Bipartisan Policy Center, Capitalizing on the Evolving Power Sector: Policies for a Modern and Reliable U.S. Electric Grid 28-29 (2013); James J. Hoecker & Douglas W. Smith, *Regulatory Federalism and Development of Electric Transmission: A Brewing Storm?*, 35 Energy L.J. 82, 86-88 (2014) (discussing state siting barriers to interstate transmission projects); Klass, *The Electric Grid at a Crossroads*, *supra* note 6, at 1924-25. *See also* Richard Martin, *Getting Cheap Wind Power Where It's Needed Shouldn't Be This Hard*, MIT Tech. Rev., Apr. 25, 2016.

55. For reasons why utilities might not have sufficient incentives to build such lines, see Brian Eckhouse & Joe Ryan, *Tapping the Power of the Great Plains to Light Faraway Cities*, 28 Env't Rep. (BNA) A-10 (Feb. 11, 2016) (discussing why utilities "don't have much motivation to build long lines that extend beyond their service areas").

56. Texas is the primary exception to this rule because unlike the other continental U.S. states, it has its own electricity grid—ERCOT—and contains both significant in-state renewable and non-renewable energy resources as well as major population centers within its borders. Other states must cooperate with neighboring states to either import or export electricity resources and market actors must coordinate among multiple state regulators to build any necessary transmission lines for import and export of generation.

and eminent domain authority from the states to FERC, DOE, or another federal agency.[57]

There are many historical reasons why siting and eminent domain authority for interstate electric transmission lines has remained at the state level. These include the fact that the grid was developed by local electric utility actors and was regulated exclusively at the state level from its inception until Congress enacted the Federal Power Act in 1935. Even in the 1930s, although Congress granted FERC's predecessor authority to regulate wholesale sales of electric energy in interstate commerce and the transmission of electric energy in interstate commerce, states did not in general object to the construction of interstate transmission lines. States understood that those lines benefitted their residents through greater access to low-cost electricity. By contrast, at that same point in the 1930s, states like Georgia were blocking interstate natural gas pipelines from the Gulf Coast to northeastern cities on grounds that the pipelines did not benefit their states. This led to natural gas shortages and industry layoffs in northeastern cities, prompting Congress to enact the Natural Gas Act of 1938 and transfer siting approval and, a few years later, eminent domain authority to the Federal Power Commission.[58]

Certainly, the creation of RTOs and ISOs, coupled with major FERC orders like Order 888 in 1996 and Order 1000 in 2011, went a long way toward establishing an open access U.S. transmission grid and requiring utility transmission providers to engage in joint planning processes to identify regional transmission needs and evaluate proposed solutions to those needs.[59] Nevertheless, states now often object to interstate electric transmission lines, particularly DC lines, for many of the same reasons they objected to interstate national gas pipelines in the 1930s. Congress is nonetheless more hesitant to take authority for land use matters, like energy facility siting, away from states than it was during the New Deal in the 1930s. Thus, although Congress has taken some actions to authorize FERC and DOE to exercise siting authority in a few instances, federal agency power in this area is quite limited, as explained in more detail below.

A. State Siting and Eminent Domain Authority for Electric Transmission Lines

In general, states grant to their PUC or similar state agency the authority to review and approve both interstate and intrastate electric transmission lines to be built within the state based on a showing that there is a "need" for the line and that any environmental impacts associated with the line can be addressed.[60] A favorable decision for the company proposing to build the line results in the state agency issuing an approval called a certificate of need, a certificate of public convenience and necessity, or similar designation. Such approval generally grants the company the power of eminent domain to obtain the easements necessary to build the line if voluntary negotiations with landowners fail.[61] For lines that cross several states, the operator must seek certificates in multiple states and often be subject to differing legal standards.[62]

Utilities have always built intrastate and interstate transmission lines to meet the needs of their local customers by connecting power plants to load centers. But with the growth of renewable energy in recent years—particularly wind energy—utilities, merchant transmission line companies, and others have attempted to build an increasing number of multistate lines to bring those renewable energy resources to population centers. There is significant uncertainty under many states' laws regarding whether their PUC or similar state agency should approve interstate transmission lines that create national clean energy benefits but have more limited state and local benefits.[63] Many state laws also either prohibit merchant transmission lines and other non-utility electricity providers from seeking siting permits or are unclear on this point, leading to investment uncertainty and delays.[64]

Several states have enacted laws in recent years to facilitate significant transmission expansion projects to integrate more renewable energy into the electric grid. These include the competitive renewable energy zone (CREZ) projects in Texas,[65] the Renewable Energy Transmission Initiative (RETI) in California,[66] and Michigan's Wind Energy Resource Zone process,[67] all of which are designed to better connect renewable energy resources to the grid. But these projects focus primarily on transmission lines to access in-state renewable energy resources or to import nearby renewable energy resources to meet state clean energy goals, thus directly supporting economic development and jobs within the state, meeting state public policy goals, and/or lowering electricity prices. The task is more

57. Once an electric transmission line is approved and constructed, the federal government, through FERC and NERC, regulates the safety and reliability of the transmission line as well as the cost the owner charges to transmit electricity through the line.
58. Alexandra B. Klass & Danielle Meinhardt, *Transporting Oil and Gas, U.S. Infrastructure Challenges*, 100 Iowa L. Rev. 947, 996-98 (2015).
59. *See* New York v. Federal Energy Regulatory Comm'n, 535 U.S. 1 (2002) (discussing and upholding FERC Order 888); South Carolina Pub. Serv. Auth. v. Federal Energy Regulatory Comm'n, 762 F.3d 41 (D.C. Cir. 2015) (discussing and upholding FERC Order 1000).
60. *See* Klass & Rossi, *supra* note 6, at 130-31 (discussing state transmission line siting process).
61. Alexandra B. Klass, *Takings and Transmission*, 91 N.C. L. Rev. 1079, 1102 (2013); *see also id.* App. A (discussing electric transmission siting laws and eminent domain authority in all 50 states).
62. Klass & Rossi, *supra* note 6, at 130-31.
63. *See* Klass, *Takings and Transmission*, *supra* note 61, at 1107-12.
64. Klass & Rossi, *supra* note 6, at 189-93.
65. *See* Daniel Cusick, *New Power Lines Will Make Texas the World's 5th-Largest Wind Power Producer*, ClimateWire, Feb. 25, 2014; Matthew L. Wald, *Wired for Wind*, N.Y. Times, July 23, 2014 (reporting on completion of Texas CREZ projects); R. Ryan Stain, *CREZ II, Coming Soon to a Windy Texas Plain Near You? Encouraging the Texas Renewable Energy Industry Through Transmission Investment*, 93 Tex. L. Rev. 521 (2015) (discussing the CREZ process).
66. California Energy Commission, *Renewable Energy Transmission Initiative (RETI) 2.0*, http://www.energy.ca.gov/reti/ (last visited June 29, 2017); Marc Campopiano et al., *California Energy Agencies Advance Renewable Transmission Line Planning*, Latham's Clean Energy L. Rep., May 17, 2016.
67. Mich. Pub. Serv. Comm'n, Report on the Implementation of P.A. 295 Wind Energy Resource Zones (Mar. 7, 2016).

difficult when the state is merely a "pass through" state and is neither importing nor exporting the new energy resources in question. And it is important to note that many states do not have renewable portfolio standards or other clean energy goals, and thus there may not be an in-state public policy driver or requirement for transmission expansion to increase renewable energy resource use in the state.

RTOs, which engage in transmission planning for their member utilities, can often help facilitate development of interstate lines for renewable energy in states that are part of RTOs, but progress under current laws may not be fast enough to accommodate the massive growth in renewable energy required for deep decarbonization, and, moreover, RTOs do not exist in all parts of the country. One success story is the Midcontinent Independent System Operator (MISO) RTO, which covers all or part of more than 10 states through the middle of the United States. MISO has used its planning authority successfully to work with states to build a series of multi-value project (MVP) lines designed to improve grid reliability and transport wind energy throughout the region.[68] One set of MVP multistate transmission projects—called the CapX2020 projects—was built to transmit wind energy in Iowa, Minnesota, North Dakota, and Wisconsin. Although each state was required to approve the portion of the line built within its jurisdiction, this regional initiative first proposed by a group of utilities and ultimately integrated within the MISO MVP framework succeeded in convincing state regulators of the benefits of these lines to their states in terms of improved grid reliability and increased use of inexpensive wind energy.

Both MISO's MVP initiative and the CapX2020 projects in particular are considered models for other regions of the country.[69] Notably, the CapX2020 lines took more than a decade to plan, approve, and build, which is typical for a major, interstate transmission line. Finally, a merchant transmission line company, Clean Line Energy Partners, is attempting to build five HVDC lines across multiple states in the Midwest and Southeast to bring wind energy to population centers,[70] although it has faced opposition from landowners and state PUCs in many areas, as described in more detail in the next sections of this Article.

B. *Limited Federal Authority Over Electric Transmission Lines*

Despite the general dominance of states in the realms of electric transmission line siting and eminent domain authority, there are a few limited situations where the federal government can exercise siting and eminent domain authority. First, when electric transmission lines cross federal lands, it is the federal government—generally the Bureau of Land Management within the U.S. Department of the Interior—that must approve that portion of the line, often in coordination with the U.S. Fish and Wildlife Service and other federal agencies.[71] Second, FERC has limited authority under the Federal Power Act to approve transmission lines necessary to connect federal hydropower projects to the electric grid.[72]

Third, §1221 of the EPAct 2005 grants DOE the authority to designate national interest electric transmission corridors (NIETCs) in areas of the country with high transmission congestion. Once an NIETC is designated, FERC can site transmission lines within the NIETC if a state "withholds" approval of the line.[73] Although these provisions would appear to create a framework for expanded federal approval of interstate transmission lines off of federal lands, court decisions have interpreted DOE's and FERC's authority very narrowly to date. They have found DOE's initial designations of NIETCs to be invalid on procedural grounds and also vacated FERC's rulemaking efforts.[74]

Fourth, other provisions of the EPAct 2005 grant the Western Area Power Administration (WAPA) and the Southwestern Power Administration (SWPA) the authority to "design, develop, construct, operate, maintain, or own . . . an electric power transmission facility and related facilities . . . needed to upgrade existing transmission facilities" on their own or in conjunction with private transmission line operators.[75] WAPA and SWPA are federal power marketing administrations that sell and transmit hydroelectric power from federal facilities at wholesale to utilities and other electric providers within designated parts of central, southern, and western states.[76] Existing

68. *See* Illinois Commerce Comm'n v. Federal Energy Regulatory Comm'n, 721 F.3d 764, 771-75, 43 ELR 20124 (7th Cir. 2013) (describing MISO's MVP projects and upholding FERC's approval of MISO's regional cost allocation to pay for those lines); Center for Rural Affairs, *Minnesota-Iowa Transmission Line* (discussing the siting and permitting process for one of several MISO MVP transmission lines), http://www.cfra.org/clean-energy-transmission-map/line/minnesota-iowa (last visited June 29, 2017); MISO, *Multi Value Project Portfolio Analysis* (discussing eight-year planning process prior to permitting and construction), https://www.misoenergy.org/Planning/TransmissionExpansionPlanning/Pages/MVPAnalysis.aspx (last visited June 29, 2017).
69. Marta C. Monti et al., University of Minnesota Humphrey School of Public Affairs, Transmission Planning and CapX2020: Building Trust to Build Regional Transmission Systems (2016).
70. Klass, *The Electric Grid at a Crossroads*, *supra* note 6, at 1927 & n.165 (discussing Clean Line Energy Partners projects); Clean Line Energy Partners, *Projects*, *supra* note 37.
71. *See* U.S. Dep't of the Interior, Bureau of Land Management, *Electric Transmission Facilities and Energy Corridors*, https://www.blm.gov/programs/lands-and-realty/right-of-way/electric-transmission-facilities-and-energy-corridors (last visited June 29, 2017).
72. *See* 16 U.S.C. §797(e) (2012).
73. Energy Policy Act of 2005, 16 U.S.C. §824p; Piedmont Envtl. Council v. Federal Energy Regulatory Comm'n, 558 F.3d 304, 314 (4th Cir. 2009), *cert. denied*, 558 U.S. 1147 (2010).
74. *See* California Wilderness Coalition v. U.S. Dep't of Energy, 631 F.3d 1072 (9th Cir. 2011) (invalidating DOE NIETCs in the Southwest and Mid-Atlantic regions for failure to adequately consult with states); *Piedmont Envtl. Council*, 558 F.3d 304 (invalidating FERC rule allowing agency to approve transmission lines in NIETC corridors where state has denied a siting permit). DOE completed a national electric transmission congestion study in 2015 as required under the EPAct 2005, but did not designate any NIETCs as part of that study. *See* U.S. Dep't of Energy, National Electric Transmission Congestion Study (2015), *available at* http://energy.gov/sites/prod/files/2015/09/f26/2015%20National%20Electric%20Transmission%20Congestion%20Study_0.pdf.
75. Energy Policy Act of 2005, 42 U.S.C. §16421(a).
76. Western Area Power Admin., *About WAPA*, https://www.wapa.gov/About/Pages/About.aspx (last updated June 16, 2017); Southwestern Power

case law and, arguably, the legislation itself, grant those federal power marketing administrations the authority to override state denials of siting permits and to exercise eminent domain authority.[77]

After not using the authority for more than 10 years, in May 2016, DOE, acting through SWPA, granted an application from Clean Line Energy Partners (described above) to partner with SWPA to build the Plains & Eastern Clean Line—a DC transmission line designed to bring wind energy from Oklahoma and Texas to Arkansas, Missouri, and other southern states.[78] Arkansas had denied a siting permit for the line on grounds that only electric utilities that sold electricity at retail in the state, and not merchant transmission lines, could seek siting permits. DOE's approval has been subject to ongoing legal challenges by affected states and landowners who oppose the line and question the benefits of the line for Arkansas and other individual states. The courts have not yet ruled on those challenges.

Although, as just shown, there is limited federal authority for siting transmission lines and using eminent domain authority to build such lines, FERC has issued orders, most notably Order 1000 promulgated in 2011, to require utilities to participate in regional planning processes for interstate transmission lines, even if they are not part of a formal RTO.[79] This can help facilitate planning and, in some cases, approval for interstate transmission lines along the lines of the CapX2020 projects in the MISO region discussed above. Although regional plans developed under Order 1000 might encourage states to more fully consider the regional and in-state benefits of new transmission lines, it remains the states, not RTOs or any regional planning process, that are the ultimate decisionmakers for any particular line.

C. Other Laws That May Help or Hinder Electric Transmission Line Expansion and Efficiency

Beyond the siting and eminent domain laws that directly impact the ability to build new transmission lines, there are other federal and state laws that have the potential to improve the efficiency and functioning of the electric grid as a whole, thus reducing the need for new electric transmission infrastructure to meet deep decarbonization goals. These include laws related to "demand response," energy storage, time-of-use pricing, and the collection and disclosure of energy consumption data.

Demand response: "Demand response" is a practice in which RTOs and other wholesale electricity market operators pay electricity users (e.g., Target, Walmart, sports stadiums, and industrial facilities) to reduce their electricity consumption during times of "peak" demand on the electric grid, such as on hot summer days when air conditioning use is high. Some RTOs, notably the PJM Interconnection RTO in the East, have integrated significant amounts of demand response into regional grid operations and electricity markets, with the help of third-party demand response "aggregators." These aggregators manage the demand of industrial and commercial customers within the region and bid those "negawatts" (as they are often referred to) into the market, resulting in significant cost savings to participants, and potentially lower wholesale electricity prices within the region.[80]

In 2011, FERC issued an order governing demand response—Order 745—to encourage demand response by requiring RTOs and ISOs running wholesale electricity markets to pay incentive rates to companies offering to reduce electricity use during peak demand periods.[81] The incentive rates were set at the same rate that power plants were paid to generate electricity that now would not be needed to meet demand. Electricity generators challenged FERC's authority to require such incentive rates, and in 2016, the U.S. Supreme Court upheld Order 745, finding that FERC's authority under the Federal Power Act to regulate wholesale electricity sales was broad enough to include incentive pricing for demand response.[82]

In its decision, the Court recognized that demand response programs reduced the need for new electricity generation and promoted lower wholesale electricity prices. The laws governing demand response are relevant to transmission needs for deep decarbonization; if grid operators are able to rely more heavily on demand response, it flattens out peak electricity needs, reducing the need for building new generation plants, and thus reducing the need for new long-distance transmission to integrate new generation plants into the grid. It is important to note, however, that many states do not allow large retail electricity customers to participate in wholesale demand response markets (primarily those states that are traditionally regulated), and

Admin., *About the Agency*, http://www.swpa.gov/agency.aspx (last updated May 22, 2017).

77. *See, e.g.*, Citizens & Landowners Against the Miles City/New Underwood Powerline v. U.S. Dep't of Energy, 683 F.2d 1171, 1178 (8th Cir. 1982) (holding WAPA need not seek state siting permit prior to building a transmission line in South Dakota based on federal statutes authorizing DOE, through the federal power agencies, to plan and build transmission lines to implement federal electricity policies and programs); United States v. 14.02 Acres of Land More or Less in Fresno County, 547 F.3d 943, 953-54 (9th Cir. 2008) (holding that WAPA was not required to comply with California siting and eminent domain laws when it partnered with investor-owned utilities to build transmission line to address transmission constraints and to facilitate increased power sales between California and the Pacific Northwest region).

78. U.S. Dep't of Energy, *Plains & Eastern Clean Line Transmission Line*, http://energy.gov/oe/services/electricity-policy-coordination-and-implementation/transmission-planning/section-1222-0 (last visited June 29, 2017).

79. Fed. Energy Regulatory Comm'n, *Order No. 1000—Transmission Planning and Cost Allocation*, http://www.ferc.gov/industries/electric/indus-act/trans-plan.asp (last updated Oct. 26, 2016).

80. *See* EnerNOC, *Homepage*, http://www.enernoc.com/ (last visited June 29, 2017); *see* Press Release, EnerNOC, *EnerNOC Surpasses $1 Billion in Enterprise Customer Savings* (Dec. 10, 2014), http://investor.enernoc.com/releasedetail.cfm?releaseid=887065.

81. Fed. Energy Regulatory Comm'n, Demand Response Compensation in Organized Wholesale Energy Markets, 76 Fed. Reg. 16658 (Mar. 24, 2011) (codified at 18 C.F.R. pt. 35).

82. Federal Energy Regulatory Comm'n v. Electric Power Supply Ass'n, 136 S. Ct. 760, 46 ELR 20021 (2016).

neither FERC Order 745 nor the Supreme Court's decision invalidated those restrictions.[83]

Energy storage: Laws governing how to regulate and incentivize the use of energy storage at the generation, transmission, and distribution levels also impact electric transmission needs for deep decarbonization. As discussed earlier in this Article, if utilities and other electricity providers are able to implement energy storage on a large-scale basis, the variability of renewable energy resources poses far less concerns for grid reliability. In addition, these non-carbon electric energy resources can be better integrated into the grid. Laws governing energy storage are not well developed, and states have had difficulty determining whether energy storage should be regulated as electricity generation, distribution, or transmission.[84] This categorization is important. For example, in some restructured states, utilities can only obtain cost recovery from ratepayers for transmission and distribution services and may not participate in electricity generation markets. If energy storage is seen as part of the generation side of the grid, a utility may not obtain cost recovery (and thus may be less likely to invest) in energy storage technology. Also, as discussed above, FERC regulates wholesale sales of electricity and the transmission of electric energy in interstate commerce while the states regulate retail sales. Is battery storage on the wholesale side or the retail side?

Against the backdrop of these uncertainties, Texas regulators have determined that Oncor's energy storage proposal, described earlier in this Article, should be classified as electricity generation. As a result, Oncor, Texas' largest transmission line network operator, cannot obtain cost recovery for its ambitious utility-scale battery storage process designated to allow it to store wind energy generated at night for reuse during peak times during the day without a change in state law.[85] Other states, however, are requiring their utilities to install energy storage. California law requires that utilities install 1.3 gigawatts of energy storage by 2022, along with additional regional procurements.[86] Hawaii and New York also have multiple storage pilots and projects underway.[87]

For its part, in early 2016, FERC issued a request for information to RTOs asking the extent to which they allowed energy storage technologies to participate in regional wholesale electricity markets.[88] Six RTOs, including PJM and MISO, indicated that they did allow such participation and were evaluating ways to facilitate greater participation.[89] The energy storage industry urged FERC to issue guidance or a rule on energy storage to create more certainty in markets and allow greater energy storage participation.[90] In November 2016, FERC issued a notice of proposed rulemaking that would require RTOs and ISOs to create new market rules to allow storage resources to participate in wholesale electricity markets and included participation by distributed energy resource aggregators.[91]

Time-of-use pricing: Another set of policies that would reduce peak demand periods on the grid, thus reducing the need for new generation and, in turn, new transmission, involves "time of use" pricing. In many states, residential and commercial utility customers have access to time-of-use rates, which divide a 24-hour period into on-peak and off-peak periods of several hours each, with lower electricity rates for off-peak periods when electricity demand is low and higher rates for on-peak periods when electricity demand is high.[92] Other variable pricing programs allow for "real-time rates" where retail electricity prices vary by hour or sub-hour increments based on actual wholesale prices during that time period. This allows customers to react to market prices in a way that reduces peak electricity demand. However, not all utilities offer time-of-use pricing to all customers and most states do not require them to do so. Moreover, even for utilities that do offer time-of-use pricing, its effectiveness is often limited by lack of access to smart meters and other technology that would allow utility customers to easily modify when they use appliances and devices to take advantage of lower prices.

83. *Id.* at 779.
84. Stein, *supra* note 41.
85. *See* Gavin Bade, *Whatever Happened to Oncor's Big Energy Storage Plan?*, Util. Dive, Sept. 1, 2015 (reporting that Oncor, as a regulated transmission and distribution utility, cannot participate in energy generation markets under Texas law, and that Oncor's proposal to use the battery technology to enhance renewable energy storage is considered to be on the generation side of the line rather than the transmission and distribution side of the line); R.A. "Jake" Dyer, *Why the $5 Billion Battery Plan Went Nowhere*, FuelFix, Oct. 8, 2015 (reporting that Oncor failed to obtain changes in Texas statutory law to allow it to implement its battery proposal); Michael J. Allen, *Energy Storage: The Emerging Legal Framework (And Why It Makes a Difference)*, 30 Nat. Resources & Env't 20, 23-24 (2016) (describing Texas legislation governing energy storage).
86. Jeff St. John, *Texas Utility Oncor Wants to Invest $5.2 Billion in Storage: Can It Get Approval?*, GreenTechGrid, Nov. 10, 2014; Jeff St. John, *California Dreaming: 5,000MW of Applications for 74MW of Energy Storage at PG&E*, Greentech Media, May 28, 2015, http://www.greentechmedia.com/articles/read/california-dreaming-5000mw-of-applications-for-74mw-of-energy-storage-at-pg.
87. *See* Hawaiian Electric, *Energy Storage*, https://www.hawaiianelectric.com/clean-energy-hawaii/producing-clean-energy/other-routes-to-clean-energy/energy-storage; Mike Munsell,, *21 US States Have Energy Storage Pipelines of 20MW or More*, Greentech Media, Mar. 28, 2017, https://www.greentechmedia.com/articles/read/21-us-states-have-energy-storage-pipelines-of-20mw-or-more. *See also supra* notes 47-48 (discussion of Aliso Canyon, California, battery storage project).
88. Michael S. Hindus et al., *Energy Storage: Finding a New Home With FERC Policy Statement and Notice of Proposed Rulemaking*, Pillsbury Alert, Mar. 3, 2017.
89. *Id.*
90. *Id. See also* Allen, *supra* note 85 (contending that the development of energy storage will be best served by uniform regulation and that the federal government, through FERC, should promote national uniformity).
91. *See* News Release, Fed. Energy Regulatory Comm'n, *FERC Proposes to Integrate Electricity Storage Into Organized Markets* (Nov. 17, 2016), https://www.ferc.gov/media/news-releases/2016/2016-4/11-17-16-E-1.asp#.WC8lrbROKhA; Fed. Energy Regulatory Comm'n, Notice of Proposed Rulemaking, Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 157 FERC ¶ 61121 (Nov. 17, 2016).
92. *See, e.g.*, Office of the Ohio Consumers' Counsel, Consumers' Fact Sheet, Smart Grid: Dynamic and Time-of-Use Pricing (2016); Kari Lydersen, *Groups Pursue Time-of-Use Electricity Pricing in Illinois*, Midwest Energy News, Feb. 24, 2015; Coley Girouard, *Time Varying Rates: An Idea Whose Time Has Come?*, Advanced Energy Econ., Mar. 12, 2015, http://blog.aee.net/time-varying-rates-an-idea-whose-time-has-come; Ahmad Faruqui et al., Brattle Group & Regulatory Assistance Project, Time-Varying and Dynamic Rate Design 12-16 (2012).

Energy consumption data policies: Another set of laws, most of which are at the state level, govern the collection and disclosure of energy consumption data (also known as customer energy usage data). Such data can allow utility customers, energy-efficiency experts, cities, solar PV installers, and others to better determine how buildings and appliances use energy and thus to develop strategies to increase energy efficiency, reducing both overall electricity demand and electricity transmission infrastructure.[93] In 2015, DOE issued a "voluntary code of conduct" (VCC) on data privacy and the smart grid. A primary purpose of the VCC was to articulate principles to address concerns that an individual's energy consumption data (particularly on an hourly or sub-hourly basis) not be disclosed in a manner that might compromise the individual's privacy by providing detailed information about the individual's whereabouts or activities within the building.[94] The VCC provided best practices for obtaining customer consent for the disclosure of such data and for ensuring customer access to such data, but it did not address important issues such as ways to standardize data collection across utilities for legitimate use, or ways to aggregate individual data to allow it to be used for energy efficiency and other legitimate purposes.

Several state PUCs and legislatures have attempted to create policies regarding customer access to data, standardization requirements for utilities, and aggregation policies to make the data available to third parties without customer consent while still maintaining customer privacy. But these legislative and regulatory efforts are only beginning, and in the meantime, the lack of access to energy consumption data is hindering smart grid and energy-efficiency developments that could reduce the need for new electricity generation and transmission. Moreover, even as regulators develop more sophisticated policies in those areas, that will only reduce the need for new transmission; it will not eliminate it entirely in the face of the deep decarbonization goals that call for doubling and significantly decarbonizing electricity generation in the United States.

VI. Potential New Public Law Approaches

This section discusses a variety of new public law approaches to address the shortcomings of existing laws to support deep decarbonization efforts. These approaches include (1) new federal laws to expand federal siting and eminent domain authority for interstate electric transmission lines; (2) actions by FERC, DOE, and other federal agencies to use existing federal authority more aggressively to expand and improve the interstate transmission grid; (3) actions by Congress and federal agencies to facilitate greater use of demand response, energy storage, and DG resources; and (4) state law legislative and regulatory reforms to expand market participation in grid expansion and to facilitate greater use of demand response, energy storage, and DG resources to increase the reliability and resilience of the grid.

A. *Congressional Action on Electric Transmission Line Siting and Eminent Domain Authority*

As an initial matter, Congress could amend the Federal Power Act or enact new legislation to transfer siting and eminent domain authority for interstate electric transmission lines from the states to FERC, DOE, or another federal agency. This would follow the framework Congress created in the 1930s for interstate natural gas pipelines. In the EPAct 2005, Congress also created exclusive siting authority for FERC for liquefied natural gas (LNG) import and export terminals, thus eliminating the need for states to approve such facilities and limiting the ability of states to block such facilities through their own siting regimes. However, such action by Congress in the electric transmission line realm at the present time is very unlikely. States do not want to relinquish control over siting authority for interstate electric transmission lines, and many will argue that states are in the best position to review and approve these projects because of the potential for significant land use and aesthetic impacts associated with overhead, high-voltage transmission lines. The transfer of siting and eminent domain authority from the states to the federal government for interstate natural gas pipelines occurred during the New Deal, when Congress was expanding federal authority in all aspects of U.S. economic life. By this analysis, today is a very different political time with regard to federalism and states' rights issues than it was in the 1930s.

On the other hand, the transfer of siting authority from the states to the federal government for LNG import and export facilities was a fairly recent change, in 2005, and was prompted by concerns that the nation was at the point of running out of domestic natural gas resources and would need to import significant supplies from across the oceans. Although the hydraulic fracturing boom of the late 2000s eliminated those concerns, it shows that Congress can act to federalize siting authority for critical energy infrastructure if there is a perceived need. Thus, a major blackout or other disaster, or some other recognized need, may prompt Congress to use federal authority to enhance the expansion of the interstate electric grid. Indeed, the limited authority Congress did give to DOE and FERC under §§1221 and 1222 of the EPAct 2005 to approve transmission lines, as discussed above, was a response to the massive 2003 Northeast blackout.

As an alternative to a wholesale transfer of siting and eminent domain authority for all interstate electric transmission lines from the states to the federal government, Congress could take more modest steps. One option would be to expand and/or clarify the existing siting authority given to FERC and DOE under §§1221 and 1222 of the EPAct 2005. With regard to §1221, Congress could revise these provisions to clarify that FERC has authority to grant

93. *See* Klass & Wilson, *supra* note 40.

94. U.S. Dep't of Energy, Voluntary Code of Conduct (VCC): Final Concepts and Principles (2015).

siting permits for lines within NIETCs if a state has denied a siting permit. This would override existing federal court decisions holding to the contrary[95] and would perhaps embolden FERC to grant siting permits for some critical lines. Likewise, Congress could direct DOE to create more NIETCs in the first place, which it has failed to do since a federal court found its initial attempts did not follow proper procedure.[96] Congress could also expand DOE's authority under §1222 of the EPAct 2005 to partner with private transmission line operators in areas beyond WAPA and SWPA. Such an expansion of authority may be feasible if DOE's first effort to use its authority to approve the Plains & Eastern Clean Line is seen as a model federal-private partnership for reliability and clean energy goals.

Another option for Congress would be to create multistate regional siting authorities to approve interstate transmission lines within a region. This option corresponds to the regional nature of the electric transmission grid, and also results in decisionmakers being closer and thus more accountable to where project impacts would occur, rather than transferring authority to a centralized decisionmaker in Washington, D.C.[97] In areas where RTOs currently exist, an RTO could potentially serve in the role of a regional siting authority. In areas where RTOs do not exist, states could enter into interstate compacts that would create regional siting authorities to approve interstate lines within their collective state footprints.[98] Such compacts are currently authorized under the EPAct 2005.

Finally, in the context of cell phone towers, Congress addressed local government roadblocks to infrastructure siting by enacting the Telecommunications Siting Act of 1996.[99] In that law, Congress kept siting authority with local governments but created new, federal standards for processing applications, prohibited outright bans on cell phone towers, set deadlines for local government decisions, and created an expedited right of review in federal court.[100] This law, which attempted to balance local siting concerns with national interests in expanding telecommunications networks, resulted in a dramatic increase in the number of cell phone towers across the country.[101] Congress could take similar action with regard to interstate electric transmission lines by leaving siting authority with the states but requiring that states consider regional and national electricity needs, including decarbonization goals, in making siting decisions and allowing a federal remedy in court for failure to comply.

In sum, a variety of options exist for Congress to transfer either limited or more extensive authority over interstate electric transmission lines from the states to the federal government in order to streamline the process for approving and building such lines without the obstacles the state siting process currently poses. Congress has already done this for interstate natural gas pipelines and LNG import and export facilities, and such infrastructure is generally sited and built much more quickly than interstate electric transmission lines. But there are significant political obstacles to such action in the absence of a major blackout or other natural or man-made disaster, and, thus, such action may be unlikely to help deep decarbonization efforts within the time period required.

B. Federal Agency Action to Expand Interstate Electric Transmission Lines

Even in the absence of new congressional legislation, there are actions federal agencies such as FERC and DOE can take using existing authority to expand the interstate grid in a way that can assist with deep decarbonization efforts. As discussed above, DOE and FERC have existing authority under §§1221 and 1222 of the EPAct 2005 to approve interstate electric transmission lines for reliability purposes and to integrate renewable energy resources into the grid. As a result of adverse court decisions, DOE and FERC have not attempted to exercise their authority under §1221, even though those court decisions did not apply throughout the country and were never reviewed by the Supreme Court. In other words, space remains for DOE and FERC to use existing authority under §1221 more aggressively, even though there are certainly political costs to doing so. These costs include congressional elimination of that authority if requested by states and other interested parties opposed to such action by FERC and DOE.

Likewise, DOE was granted its authority to approve interstate electric transmission lines in the WAPA and SWPA footprint areas in 2005. The first time it exercised that authority was more than 10 years later, in 2016, when it approved the Plains & Eastern Clean Line project. This delay is in part because DOE can only respond to an application by a private party to be a partner to build a line, and it took time for DOE to establish rules and policies for those applications, for Clean Line to make such an application, and for DOE to review and approve the application. Landowners, states, utilities, and others have challenged DOE's authority to partner with Clean Line to override Arkansas' denial of a state siting certificate as well as DOE's ability to exercise eminent domain authority for the project if needed. But if DOE's authority is ultimately upheld, DOE could use its authority to approve other interstate transmission lines designed to bring wind energy (or utility-scale solar energy) from, through, and to states within the WAPA and SWPA footprints. This area covers a large swath of the country with strong renewable energy resources, particularly wind. And interstate lines built in

95. *See supra* note 74, and accompanying text.
96. *See id.*
97. *See* Klass, *The Electric Grid at a Crossroads*, *supra* note 6.
98. *Id. See also* Klass & Wilson, *supra* note 40.
99. Telecommunications Siting Act of 1996, 47 U.S.C. §332.
100. For a discussion of the Telecommunications Siting Act of 1996 and its potential application to electric transmission line siting as well as renewable energy generation facilities, see Ashira Pelman Ostrow, *Process Preemption in Federal Siting Regimes*, 48 Harv. J. on Legis. 289, 293 (2011); Klass, *The Electric Grid at a Crossroads*, *supra* note 6, at 1951-52; Klass & Wilson, *supra* note 40, at 1865-66.
101. Ostrow, *supra* note 100, at 283.

those areas could then connect with existing electric transmission infrastructure to bring these new sources of renewable energy to population centers.

C. Potential Actions by Congress, Federal Agencies, and RTOs to Facilitate New Technologies and Funding for Distribution Grid and Smart Grid Developments

Beyond congressional or federal agency action with regard to long-distance electric transmission line siting, Congress, DOE, and FERC can fund additional research, technology, and development on a whole range of distribution network and smart grid developments. These include new policies to encourage and fund energy storage technologies and integration of those technologies into the grid, better integration of demand response resources, promotion of distributed energy resources such as rooftop solar, and enhanced integration and communication between the "macrogrid" and distributed energy resources. One option for this integration is to encourage the creation of "independent distribution system operators," which former FERC Chairman Jon Wellinghoff has championed.[102]

Notably, it is the states, rather than the federal government, that must take the lead on many regulatory changes to facilitate energy storage and distribution-side developments because they tend to fall on the retail side of the wholesale-retail divide in the Federal Power Act. Nevertheless, Congress and federal agencies can provide funding, guidance, technical support, and structure for these developments. Moreover, in many cases, FERC has its own authority to promote these programs if they are sufficiently tied to wholesale electricity markets or interstate electricity transmission, as illustrated by FERC's demand response rule that the Supreme Court upheld in 2016.[103] RTOs, too, can help facilitate both demand response and energy storage through creating rules, incentives, and frameworks to encourage investment in these technologies.[104] Indeed, it is critical for federal agencies and RTOs to work cooperatively with states on distribution-side developments to ensure that grid operations remain stable as more distributed energy is added to the grid.[105]

D. State-Law Legislative and Regulatory Initiatives

There are numerous public law approaches at the state level that could facilitate the construction of new interstate electric transmission lines to help meet deep decarbonization goals as well as expand and enhance the distribution grid and energy storage.

With regard to interstate electric transmission lines, state legislatures could amend existing laws to direct their state PUCs to consider regional and national need as well as clean energy goals in determining whether there is a "need" for a particular transmission line that will impact the state. Likewise, to the extent state law sets out what is a "public use" for purposes of eminent domain authority, the law could make clear that public use includes benefits to the region as well as to the individual state.[106] If state legislation is unclear regarding how to define "need" and "public use," as is the case in most states, the state PUCs and state courts can interpret those terms expansively to encompass regional need and regional public use as well as clean energy goals within the state or the region.

State legislatures, PUCs, and courts, where appropriate, could also make clear that merchant transmission line companies can seek siting permits and exercise eminent domain authority under the same conditions as utilities. Some states have already done so by statute and others have done so through PUC decisions. However, there are many states that explicitly do not allow merchant transmission line companies to participate in transmission line markets in their states; in other states, the law is unclear, as discussed earlier in this Article.[107] States could also eliminate laws that give utilities the "right of first refusal" to build transmission lines in the state. These laws can serve to limit projects to those that serve only the utility's own local customers and can act to keep out innovative transmission line projects that could meet regional clean energy goals.[108]

States, particularly those that are traditionally regulated, could allow industrial and commercial energy users to participate directly in wholesale demand response programs, where they exist, and in that way reduce the need to build new, fossil fuel-fired generation to meet demand. As noted above, in many traditionally regulated states, state legislatures or PUCs prohibit such companies from participating directly in wholesale markets. The Supreme Court's decision upholding FERC Order 745 did not disturb those state-law prerogatives.

As for the distribution network, microgrids, energy storage, and smart grid developments, states have the potential to engage in a range of innovative policy actions to facilitate greater integration of distributed renewable energy into the grid and support deep decarbonization goals. For instance, the New York Public Service Commission (PSC), with the support of the governor, has created an initiative called "Reforming the Energy Vision" (REV) to

> promote more efficient use of energy, deeper penetration of renewable energy resources such as wind and solar, wider deployment of "distributed" energy resources, such as micro grids, roof-top solar and other on-site power sup-

102. *See* Gavin Bade, *Who Should Operate the Distribution Grid?*, Util. Dive, Mar. 19, 2015.
103. *See supra* notes 82-83 and accompanying text.
104. *See* Hindus et al., *supra* note 88.
105. *See, e.g.*, Peter Behr, *Threats to U.S. Bulk Power Grid Revive Reliability Concerns*, EnergyWire, June 2, 2016 (discussing concerns raised at FERC grid reliability conference that local utilities' distribution of energy resources, particularly rooftop solar, may become large enough soon to pose threats to the reliability of the interstate grid if federal, state, and local players do not coordinate efforts and improve communications).
106. For examples of state siting laws that encourage consideration of regional benefits, see Klass, *Takings and Transmission*, *supra* note 61.
107. *See id.*
108. Klass & Rossi, *supra* note 6.

plies, and storage. It will also promote markets to achieve greater use of advanced energy management products to enhance demand elasticity and efficiencies. These changes, in turn, will empower customers by allowing them more choice in how they manage and consume electric energy.[109]

REV-related activities at the New York Legislature, governor's office, and the PSC include proceedings regarding community choice aggregation, net metering, demand response, new rules to promote distributed energy resources and microgrids, and energy-efficiency standards.[110] And, of course, California has been the major leader in promoting, incentivizing, and mandating the development of distributed energy resources.[111]

As noted earlier, California and a few other states have encouraged energy storage through mandates, incentives, and other policies, but many states are far behind. State legislatures and PUCs can also make it easier for utilities to obtain ratepayer recovery for energy storage initiatives. As noted above, the Texas utility, Oncor, has put its aggressive energy storage efforts on hold because the state agency determined that the storage constituted an energy "generation" project rather than a transmission and distribution project, and state law prohibited Oncor from obtaining cost recovery for generation-related projects.[112] Thus, new state laws or regulatory policies creating additional flexibility for how to classify energy storage projects for purposes of ratepayer recovery, or other means of rewarding energy storage initiatives, would facilitate greater integration of renewable energy into the grid by reducing intermittency problems, and would assist in meeting deep decarbonization goals.

In Illinois, Commonwealth Edison, the dominant utility for the Chicago area, is proposing an ambitious microgrid project on the south side of Chicago. The project would include smart meters, distributed energy resources, the ability to "island" (or detach) from the macrogrid in times of blackouts and brownouts, and lower energy costs for residents and businesses in this predominantly low-income and minority area of Chicago.[113] But the utility says that legal changes are needed to accomplish these goals. The utility states that it needs legislative reforms to "allow it to earn a return on its efficiency investments" because under current law, it cannot include energy-efficiency projects in its rate base and recoup those costs from customers.[114] Illinois law also "prohibits power providers from owning generation assets" and thus the utility cannot build new solar capacity or other distributed energy resources necessary for the proposed microgrid.[115] Therefore, state-law reforms are necessary to encourage and implement these new technologies.

Finally, states have significant authority over incentives for PV rooftop solar and other distributed energy resources, energy efficiency, energy consumption data policies, integration of smart meters, and other distribution-side energy-efficiency developments. Thus, state legislatures and state PUCs should mandate and incentivize the use of these new technologies, create incentives that encourage utility customers to participate, and, where appropriate, allow utilities to recover the costs of implementing these new technologies. Thus, there is a significant role for state public law action to enhance electricity transmission, distribution, and storage networks.

VII. Potential Mixed Public/Private Law Approaches

This section discusses two primary mixed public/private law approaches to address the shortcomings of existing laws governing the construction of new electric transmission infrastructure to support deep decarbonization: (1) mechanisms to reduce landowner opposition to new transmission lines and increase community support for this infrastructure; and (2) technological developments to reduce the need for new transmission. Each approach involves a combination of public law and private law.

A. *Reducing Landowner Opposition to New Electric Transmission Infrastructure*

Landowner opposition can be a significant barrier to new transmission development. Many landowners perceive they are bearing all of the costs of transmission expansion without realizing any of the benefits. State PUCs and courts are often very receptive to these concerns. However, there are steps that electric transmission line companies can take to reduce community opposition to transmission lines.

For instance, the Center for Rural Affairs has considered the issue of how to reduce landowner opposition to electric transmission lines, recognizing that delays and lawsuits associated with such projects have hindered the ability to integrate more renewable energy into the transmission grid.[116] In a 2014 report, the Center considered ways to avoid the need to use eminent domain

109. N.Y. State Dep't of Public Service, *DPS—Reforming the Energy Vision: About the Initiative*, http://www3.dps.ny.gov/W/PSCWeb.nsf/All/CC4F2EFA3A23551585257DEA007DCFE2?OpenDocument (last updated Jan. 20, 2017).

110. N.Y. State Dep't of Public Service, *DPS—Reforming the Energy Vision: REV Related Proceedings*, http://www3.dps.ny.gov/W/PSCWeb.nsf/All/F7EB16F9F65293C285257E6F0073AE9D?OpenDocument (last updated Nov. 12, 2015); Saqib Rahim, *N.Y. Overhaul Means New Models for Chasing Utility Profits*, EnergyWire, May 27, 2016 (discussing New York Public Service Commission rules pursuant to state's REV initiative that would allow utilities to obtain rate recovery for increased energy efficiency and distributed energy advancements in addition to traditional electricity sales).

111. *See, e.g.*, Jeff St. John, *As California Prepares for Wholesale Distributed Energy Aggregation, New Players Seek Approval*, Greentech Media, Mar. 14, 2017; Julia Pyper, *Next Stops on the California PUC's Distributed Energy Roadmap*, Greentech Media, Feb. 7, 2017; Merrian Borgeson, *An Update on California's Distributed Energy Leadership*, Nat. Resources Def. Council, Dec. 16, 2016.

112. *See supra* note 85 and accompanying text.

113. Daniel Cusick, *Historic Chicago Neighborhood Points Way to Energy's Future*, ClimateWire, June 6, 2016.

114. *Id.*

115. *Id.*

116. Rosalie Winn, Center for Rural Affairs, Landowner Compensation in Transmission Siting for Renewable Energy Facilities (2014).

that include the creation of special purpose development corporations (SPDCs) that incorporate the land assembly costs into transmission line easement valuations rather than relying on traditional "just compensation" valuations used by the courts in eminent domain proceedings. According to the report:

> The SPDC is a corporation formed by a public authority for the purpose of aggregating land. Once a parcel of land has been identified, the authority exercises its power of eminent domain to take the land necessary for the project. Landowners whose property is taken are given a choice for just compensation: traditional [fair market value] FMV or shares in the SPDC. Securities in the SPDC are allocated to the landowners who opt in based on the assessed value of the land. Financing for the FMV payments to landowners who opt out of the SPDC is provided by the condemning authority; the authority then receives shares in the SPDC. Shares in the SPDC are tradable. According to financial market theory, the share price will reflect the "true economic value" of the net present value of the profits anticipated from the sale of the SPDC's land. Once all land needed for a project has been acquired by the SPDC, the land is sold or auctioned to a developer. The proceeds from the sale are paid as dividends to the shareholders of the SPDC.[117]

The benefits of an SPDC over traditional just compensation valuation is that it allows the landowners to capture the "assembly value" from their land being pooled into a transmission corridor and gives landowners a stake in the success of the project, potentially reducing holdouts and, ultimately, litigation and delays.[118] Landowner participation in the assembly process through the SPDC can also enhance landowners' ability to highlight localized concerns with the transmission line developer and siting agencies. The report goes on to discuss some of the regulatory and corporate formation challenges associated with the SPDC model, as well as the fact that it may lead to additional construction costs for the project in terms of greater land-related payments.[119]

In a 2008 article in the *Harvard Law Review*, Michael Heller and Rick Hills suggest a similar model, called a land assembly district, to allow greater landowner participation in land assembly decisions, creating a condominium-like decisionmaking structure.[120] Although this would in some cases allow the land assembly district veto power over a project, it would avoid the situation common in the case of traditional eminent domain where a single landowner can veto a project even where a majority of the neighbors support it. This is particularly important in electric transmission line cases, where it is generally only a small group of landowners, far less than a majority, that refuses to enter into a voluntary easement for payment and requires the use of eminent domain and protracted litigation.

Although an SPDC or a land assembly district may just as easily be characterized as a "public law" approach as a "private law" approach (i.e., to the extent state law is needed to authorize an SPDC), it provides an example of an alternative to traditional eminent domain procedures for land assembly. In its 2014 report and an earlier report, the Center for Rural Affairs discussed private initiatives that transmission line companies can take to reduce landowner opposition, such as enhancing the information they provide to communities and addressing potential health and agricultural-related concerns associated with a transmission line project. Just as important, they can structure compensation for easements to make the package more attractive to landowners (thus reducing the need for eminent domain proceedings) by offering landowners annual payments instead of a one-time easement payment, and in that way giving landowners a stake in the transmission project.[121]

For instance, farmers often receive $7,000 to $10,000 per wind turbine on their land each year under lease agreements with wind companies.[122] If a farmer has 10, 20, or 30 turbines on his or her property, this is a significant yearly income that has resulted in many landowners in rural areas welcoming the opportunity to work with wind companies.[123] Although it would increase the cost of the lines, transmission line companies could consider similar agreements to reduce community opposition to electric transmission lines.

Other options include initiatives by landowners, project developers, or governmental entities to create transmission corridor districts and other private arrangements to increase landowner buy-in for the projects.[124] Transmission line operators could also enter into "community benefit agreements" with affected communities that involve payments by the developer to the community to be used for property tax reductions, economic development projects, land and natural resources conservation, tourism, or reduction in energy costs.[125] Community benefit agreements are addressed specifically in Maine statutes governing wind energy development, and have been used more commonly in the urban redevelopment context (for instance, in the Atlantic Yards redevelopment in New York City).[126]

Finally, beyond the formal creation of new types of corporate or community groups, transmission line companies

117. *Id.*
118. *Id.*
119. *Id.*
120. Michael Heller & Rick Hills, *Land Assembly Districts*, 121 Harv. L. Rev. 1465 (2008).

121. *See* Lu Nelson, Center for Rural Affairs, From the Ground Up: Addressing Key Community Concerns in Clean Energy Transmission (2013).
122. *See, e.g.*, Jennifer Oldham, *Wind Is the New Corn for Struggling Farmers*, Bloomberg Businessweek, Oct. 6, 2016.
123. *Id.*
124. *See* Brandon Gerstle, *Giving Landowners the Power: A Democratic Approach for Assembling Transmission Corridors*, 29 J. Envtl. L. & Litig. 535 (2014).
125. *See, e.g.*, Me. Rev. Stat. tit. 35-A, §3451(1-B) (defining "community benefit agreement").
126. *Id. See also* Public Law Center, Summary and Index of Community Benefit Agreements (2011); Edward W. De Barbieri, *Do Community Development Agreements Benefit Communities?*, 37 Cardozo L. Rev. 1773 (2016).

themselves can do much more to hold community meetings early and often, partner with environmental groups, create local construction partners, and provide direct tax benefits to local communities as well as voluntary payments to the communities on a per-mile basis. Clean Line Energy Partners and other merchant transmission line companies have engaged in some of these activities, and in many cases these efforts have minimized, even if not completed avoided, landowner and local government opposition.[127]

B. *The Role of Technology Development in Reducing Transmission Needs*

Another public/private law approach to addressing the transmission, distribution, and storage needs for deep decarbonization is to reduce the need for controversial new transmission infrastructure in the first place. The primary means of accomplishing such a goal is through new technology and innovation in renewable energy generation, energy storage, and enhanced distribution networks discussed in earlier parts of this Article. Although the government has a major role in funding and supporting such developments, the private sector can play a crucial part both on its own and in conjunction with government research and development efforts.

For instance, if engineers and other experts develop taller wind turbines that can capture strong wind energy resources in larger swaths of the United States, it minimizes the need for long-distance transmission to bring existing wind energy resources in the Midwest and Plains states to population centers. Likewise, energy storage developments can reduce the variability of rooftop solar and other forms of distributed renewable energy resources and can allow the existing macrogrid to make better use of utility-scale renewable energy already connected to the grid. This reduces the need for new transmission lines to connect not-yet-built utility-scale energy resources to consumers. Developments in EV battery technology can increase the adoption, range, and cost-effectiveness of EVs and also allow EVs themselves to act as batteries while in charging mode to both take power off the grid and provide it to the grid as needed.[128] The list could continue but the primary point is that technology developments have the potential to play a significant role in providing public/private law solutions to current transmission-related obstacles to deep decarbonization goals.

VIII. Conclusion

This Article addresses the critical role of the electric transmission and distribution grid in achieving deep decarbonization. It discusses the primary federal and state laws that govern the ability to expand the electric transmission and distribution grid and the effect of those current laws on deep decarbonization efforts. Although there are significant legal and political barriers to the new transmission necessary to meet deep decarbonization goals, there are public law and nonpublic law tools available to surmount these barriers. Indeed, these tools have been used in other contexts to facilitate the development of interstate natural gas pipelines, cell phone towers, and other critical infrastructure. Moreover, technology developments in energy storage, demand response, distributed energy resources, and the smart grid can both improve the existing grid and reduce the extent of grid expansion required for deep decarbonization. It will be necessary to work on all these fronts simultaneously to develop the transmission and distribution grid necessary to meet deep decarbonization goals.

127. *See, e.g.*, Center for Rural Affairs, *Grain Belt Express—Community Feedback*, http://www.cfra.org/grain-belt-express (last visited June 29, 2017).

128. *See, e.g.*, Tony Markel et al., National Renewable Energy Laboratory, Multi-Lab EV Smart Grid Integration Requirements Study (2015) (NREL/TP-5400-63963) (describing potential for use of EVs in smart grid); UCLA Smart Grid Energy Research Center, *WINSmartEV* (describing University of California, Los Angeles research platform to create smart plugs and monitoring system to enable EVs to both generate and store power to support the electric grid), http://smartgrid.ucla.edu/projects_evgrid.html (last visited June 29, 2017).