INNOVATING AROUND REGULATORY UNCERTAINTY: CONTRACTING FOR BATTERY ENERGY STORAGE AS A TRANSMISSION ASSET WITHIN RESTRUCTURED MARKETS

*C. Ben Vila**

To avoid the worst impacts of catastrophic climate change, the global energy system must undergo a radical transformation: all fossil fuel-based power generation, that has literally and figuratively kept the lights on for the past century must be entirely replaced with clean energy infrastructure in a little over a decade. However, clean energy resources like wind and solar only produce electricity intermittently (i.e., when the sun is shining, or the wind is blowing) and tend to be in rural areas, far away from major population centers. The transmission lines that can transmit renewable electricity across these long distances are under-equipped to handle the sea-change underway in how power needs to be generated. Battery energy storage is a breakthrough technology that can help fill these gaps. Rather than relying on building new transmission lines, investing in more grid-scale battery energy storage can defer some of the costs of upgrading the transmission system to accommodate a cleaner energy grid.

Despite its huge potential, battery storage fits awkwardly within the siloed frameworks of restructured power markets that separately regulate electricity generation, transmission, and distribution functions under entirely different rules and procedures. Regulatory uncertainty could lead to chronic underinvestment at the peril of a sustainable grid. Lingering questions about how, where, and when to regulate battery storage in restructured jurisdictions could lead to prolonged under-deployment that could create bottlenecks in the transition to a lower-carbon future. However, encouraging more grid-scale storage need not completely upend existing regulatory schema. Three emerging projects in three restructured jurisdictions provide illustrative examples of how developers, utilities, and regulators can resolve some of the uncertainties of storage with innovative contracting, specifically for deploying battery storage as a transmission asset: (i) the Waupaca area storage project in the United States, (ii) the Victorian Big Battery in Australia, and (iii) the GridBoosters pilot in Germany. All three projects legally allocate (a) ownership of storage-as-transmission assets to private developers and regulated utilities, while giving (b) control, or priority access rights, over the use of such assets to independent grid operators. By contractually separating the ownership and control of battery

* J.D. Candidate, James E. Beasley School of Law, 2022; A.B., International Relations and Political Economy, Brown University 2015. Thank you to the TICLJ staff for the hours spent polishing this article and all its technicalities. Thank you to Professor Amy Sinden for invaluable editing, guidance, and mentorship. Thank you to Professor Ken Hurwitz for helping me navigate the labyrinth of energy regulation. And thank you to Alberto Pascucci for always listening through my ideas, despairs, and breakthroughs.

storage, these projects demonstrate that storage-as-transmission, under the right circumstances, is a legal and cost-effective way to meet some of the unique needs of electrical grids in transition. Although this Comment focuses on the United States as its primary example, Germany and Australia provide important comparative perspectives that support this Comment's primary conclusion—that energy lawyers already have the tools at their disposal to contract for much more grid-scale storage-as-transmission than what is currently being offered in the marketplace.

TABLE OF CONTENTS

I. INTRODUCTION

To avoid the worst impacts of catastrophic climate change, experts agree that the global energy system must undergo a radical transformation over the next thirteen years.[1] In advanced economies, electricity systems must achieve net-zero carbon emissions by 2035,[2] meaning that all fossil fuel-based power plants that have literally and figuratively kept the lights on for the past century must be replaced entirely with clean energy infrastructure in a little over a decade.[3] The scale and urgency of this mandate is unprecedented.[4] Although clean energy resources like wind and solar are already the dominant sources of new power generation

1. *See* Int'l Energy Agency [IEA], *Net Zero by 2050: A Roadmap for the Global Energy Sector*, at 99, (July 2021), https://www.iea.org/reports/net-zero-by-2050 ("[E]missions from generation fall to net-zero in aggregate in advanced economies by 2035 and globally by 2040 . . . . Investment in electricity grids triples to 2030 and remains elevated to 2050.").

2. *Id.*

3. In addition to replacing fossil fuel electricity generation with clean energy generation, achieving worldwide net-zero carbon emissions also depends on new innovations in advanced batteries, hydrogen electrolyzers, and carbon capture and storage. *Id.* at 15.

4. Brian C. Black, *Energy Transitions are Nothing New but the One Underway is Unprecedented and Urgent*, CONVERSATION (Oct. 24, 2018, 6:39 AM), https://theconversation.com/energy-transitions-are-nothing-new-but-the-one-underway-is-unprecedented-and-urgent-104821.

worldwide,[5] the clean energy transition is still beset by manifold persistent challenges. One such challenge is that accommodating more renewable energy—and eventually building a carbon-neutral electric grid—will require significant investments in expensive and politically fraught public infrastructure, including power transmission infrastructure.[6]

Geographically, the best conditions for wind and solar farms tend to be in rural areas, far away from major population centers.[7] In terms of infrastructure capacity, however, the transmission lines that can transmit renewable electricity across these long distances are in desperate need of repair and upgrading.[8] In their present condition, the wires and pylons that make up the transmission network are under-equipped to handle the sea-change underway in how electrical power is generated.[9] The transmission grid needs additional capacity investments to accommodate a fast-growing share of renewably-generated electricity and to be able to seamlessly ship large quantities of power from rural areas, with bountiful renewable resources, to urban areas, with concentrations of consumers.[10]

Rather than relying on building new transmission lines, investing in more grid-scale battery energy storage can defer some of the costs of upgrading the transmission system.[11] Battery storage projects compliment large-scale wind and solar farms by adding much-needed electrical capacity at strategic times and places along the grid.[12] Adding utility-scale battery storage to the transmission network is like adding an electricity relief valve at the most distressed nodes at the most congested times—a technical solution that would help ease the transition towards

---

5. Tom Randall, *Wind and Solar Are Crushing Fossil Fuels*, BLOOMBERG (Apr. 6, 2016, 5:00 AM), https://www.bloomberg.com/news/articles/2016-04-06/wind-and-solar-are-crushing-fossil-fuels.

6. *See generally* J. B. Ruhl & James Salzman, *What Happens When the Green New Deal Meets the Old Green Laws?*, 44 VT. L. REV. 693 (2020) (analyzing permitting regimes in relation to goals of the Green New Deal).

7. *See, e.g.*, SAMANTHA GROSS, RENEWABLES, LAND USE, AND LOCAL OPPOSITION IN THE UNITED STATES 6 (2020) ("Wind and solar resources, and thus generation capacity, are distributed differently than oil and gas resources. Solar resources are best in the Sun Belt of the Southwest, although the southeastern United States also has strong resources . . . . Wind resources and development are strongest in the Great Plains states and Texas along with the Upper Midwest . . . . Wind and solar generation is being built in some areas unaccustomed to large-scale industrial energy development.").

8. Jeff St. John, *Transmission Emerging as Major Stumbling Block for State Renewable Targets*, GREENTECH MEDIA (Jan. 15, 2020) [hereinafter St. John, *Transmission*] https://www.greentechmedia.com/articles/read/transmission-emerging-as-major-stumbling-block-for-state-renewable-targets.

9. *See* Ruhl & Salzman, s*upra* note 6, at 706 (describing need for new and improved transmission infrastructure to move clean electricity).

10. *Id.*

11. Ian McClenny*, T&D Asset Operators Look to Critical Energy Storage*, T&D WORLD (Apr. 9, 2019), https://www.tdworld.com/distributed-energy-resources/energy-storage/article/20972452/td-asset-operators-look-to-critical-energy-storage.

12. RYAN HLEDIK ET. AL., THE BRATTLE GRP., SOLAR-PLUS-STORAGE: THE FUTURE MARKET FOR HYBRID RESOURCES 4 (Dec. 2019), https://brattlefiles.blob.core.windows.net/files/17741_solar_plus_storage_economics_-_final.pdf.

cleaner energy resources.

Even though battery energy storage can add value to transmission networks, battery storage has been underutilized, considering all of the benefits it is capable of offering.[13] Unlike any other kind of energy infrastructure, batteries can both produce and consume electricity: when batteries charge, they act like consumers that draw electricity *from* the grid, but when they discharge, they act like power plants that generate electricity *onto* the grid.[14] These unique attributes run directly against the siloed frameworks of restructured power markets, which separately regulate electricity generation, transmission, and distribution functions under entirely different legal rules and procedures.[15] Should storage projects be classified as exclusively generation, transmission, or distribution assets if they can perform all three functions, at times, simultaneously? Which power sector entities should be allowed to invest, operate, and sell storage assets and services, and under what contractual and cost-recovery terms?

Complexity and uncertainty could lead to chronic underinvestment in battery storage at the peril of a sustainable grid.[16] Lingering questions about how, where, and when to best deploy and regulate battery storage in restructured jurisdictions could lead to prolonged under-deployment that could create bottlenecks in the transition to a cleaner energy future.[17] With the rise of intermittent clean energy generation, deploying the full spectrum storage's value will require new and improved regulatory and contractual tinkering in order to achieve the social and political goals of a safe, reliable, and efficient electricity system,[18] in addition to the environmental imperative of deep decarbonization.[19]

Battery energy storage's value proposition may challenge the core assumptions of liberalized electricity markets, but encouraging more grid-scale storage does not need to completely upend the existing regulatory schema. Three emerging projects in three jurisdictions with restructured power markets provide illustrative examples of how developers, utilities, and regulators can resolve some of the uncertainties of battery storage through innovative contracting. These three projects specifically deploy battery storage as a transmission asset: (i) the Waupaca Area Storage Project in the United States, (ii) the Victorian Big Battery in Australia, and (iii) the GridBoosters pilot in Germany.[20] All three projects legally allocate (a) ownership of

13. Amy L. Stein, *Reconsidering Regulatory Uncertainty: Making a Case for Energy Storage*, 41 FLA. STATE UNIV. L. REV. 697, 701–04 (2014).

14. *Id.* at 701–03.

15. *Id.*

16. *Id.* at 702–03.

17. Dan Gearino, *100% Renewable Energy Needs Lots of Storage. This Polar Vortex Test Showed How Much.*, INSIDE CLIMATE NEWS (Feb. 20, 2019), https://insideclimatenews.org/news/20022019/100-percent-renewable-energy-battery-storage-need-worst-case-polar-vortex-wind-solar.

18. *About FERC – Overview*, FED. ENERGY REGUL. COMM'N, https://www.ferc.gov/about/what-ferc (Aug. 19, 2021).

19. Paris Agreement to the United Nations Framework Convention on Climate Change, Dec. 12, 2015, T.I.A.S. No. 16-1104 [hereinafter Paris Agreement].

20. See *infra* Parts III, IV, and V for discussions of these storage projects in the United States,

storage-as-transmission assets to private developers and regulated utilities, while giving (b) control, or priority access rights, over the *use* of such assets to independent grid operators. By contractually separating the ownership and control of battery storage, these projects demonstrate that storage-as-transmission, under the right circumstances, is a legal and cost-effective way to meet some of the unique needs of electrical grids in transition.

By focusing on three particular storage-as-transmission projects, this Comment (1) provides a background on the mechanics of the electric grid and why storage fits awkwardly within present-day restructured electricity markets; (2) compares how three international jurisdictions with restructured electricity markets are dealing with the regulatory uncertainty of battery storage; (3) highlights innovative storage-as-transmission projects as examples of successful ways to circumvent this regulatory uncertainty in grids that must accommodate growing renewables portfolios; and (4) recommends encouraging more battery storage at the scales necessary to meet the needs of the clean energy transition, including by promoting greater investment in storage-as-transmission within restructured markets. Although this Comment focuses on the United States as its primary example, Germany and Australia provide important comparative perspectives that support this Comment's primary conclusion—that energy lawyers already have the tools at their disposal to contract for much more grid-scale storage-as-transmission than what is currently being offered in the marketplace.

II. BACKGROUND

A. The Clean Energy Grid & the Value of Battery Storage Technology

The 20th century electric grid—and the regulations and policies that structured it—was designed around a static set of assumptions.[21] One of the primary assumptions was that, according to the laws of physics, electricity always flows instantaneously through the grid in one direction.[22] Electricity on the grid acts like water flowing through an elaborate system of pipes: water (electricity) comes from a source (power plants or generators) that fills a system of pipes (transmission lines) that travel across long distances, and eventually it trickles down to a series of smaller

---

Australia, and Germany, respectively.

21. *See* ARI PESKOE, KLEINMAN CENTER FOR ENERGY POLICY, POWER OVER THE TWENTY-FIRST CENTURY ELECTRIC GRID 1 (2018), https://kleinmanenergy.upenn.edu/research/publications/power-over-the-twenty-first-century-electric-grid/ ("The division of authority outlined in the Federal Power Act (FPA) accords with the industry's structure and technology that existed at the time. This anachronistic governance framework shapes the industry's ongoing development. Our twenty-first century electric grid is developing within the confines of an early twentieth century regulatory system.").

22. *See* Jim Lucas, *What is Electric Current?*, LIVE SCI. (Feb. 29, 2016), https://www.livescience.com/53889-electric-current.html (discussing conductivity properties of electrons that allow electricity to be available the instant a switch is flipped); *cf.* Harriet Jones, *New Technologies Challenge Old Assumptions About the Electric Grid*, CONN. PUB. RADIO (Apr. 22, 2016, 12:35 PM), https://www.wnpr.org/post/new-technologies-challenge-old-assumptions-about-electric-grid (describing new understanding of how distributed generation allows for electricity to flow on the grid in two directions).

pipes (the distribution grid) that connects homes and businesses to the broader system.[23] However, unlike water that gradually trickles downhill, electricity flows throughout an entire system instantaneously—as soon as power plants turn on, power is immediately distributed throughout the entire system.[24] To harness this instantaneous electricity, electric grids need not only a steady supply of baseload power generation in order to meet baseline consumer demand but also a suite of dispatchable resources that can ramp up or down to exactly match small fluctuations in demand.[25]

Traditionally, the easiest way to accomplish this delicate balancing act was to generate electricity from large-scale, carbon-intensive resources.[26] Coal-fired power plants, hydroelectric dams, and nuclear facilities provided the bulk of baseload power, while nimble oil- or natural gas-powered facilities would make up for smaller differences in demand.[27] All of these resources—coal, hydro, nuclear, natural gas, and oil—are, ultimately, dispatchable.[28] Power plants can be turned on or off as needed to maintain the balance of the supply and demand of electricity on the grid.[29] Today, however, as increasing amounts of variable and intermittent renewable energy resources, like wind and solar, come online at record pace, regulators and grid operators face new challenges in managing a harmonious electricity ecosystem.[30] Wind and solar technologies generate electricity in ways that supplant dirtier, fossil fuel-based generators, albeit with greater intermittency.[31] However, unlike large-scale dispatchable fossil-fuel power plants that can turn on and off on-demand, renewables are not dispatchable and instead depend on weather conditions

23. *See, e.g.*, Nathan Wilson, *Water Model of Electricity*, CLEAN ENERGY INST., https://www.cei.washington.edu/lesson-plans-resources/water-model-for-electricity/ (last visited Nov. 3, 2021) (using water as an analogy for describing the nature of electricity).

24. Lucas, *supra* note 22.

25. *See Electricity Explained: Electricity Generation, Capacity, and Sales in the United States*, U.S. ENERGY INFO. ADMIN., https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php (Mar. 18, 2021) (explaining how electric power plants meet and balance electricity demands instantaneously).

26. *Id.*

27. *Id.*

28. Some generators are more dispatchable than others: baseload resources like coal, hydro, and nuclear are much harder to ramp up or down, while oil and natural gas are much more flexible. *See* JUDY W. CHANG ET AL., THE BRATTLE GRP., ADVANCING PAST "BASELOAD" TO A FLEXIBLE GRID 7, (2017) ("Most 'baseload' generation facilities have significant limits to providing flexibility-related reliability services, both technically and economically. They typically have relatively slow ramping up/ramping down rates, high minimum generation limits, and/or long and expensive start-up and shut-down processes. Many nuclear and coal units operate most economically when they can avoid frequent startups and shutdowns and generate continuously in most hours of the year.").

29. *Id.*

30. *See* Robert Fares, *Renewable Energy Intermittency Explained: Challenges, Solutions, and Opportunities*, SCI. AM.: PLUGGED IN (Mar. 11, 2015), https://blogs.scientificamerican.com/plugged-in/renewable-energy-intermittency-explained-challenges-solutions-and-opportunities/ (describing challenges regulators and grid operators face with fluctuating power).

31. *Id.*

to be able to generate power (e.g., wind turbines only spin when the wind is blowing; solar farms only produce electricity when the sun is shining).[32]

The rise of renewable energy is transitioning electric grids throughout the world towards deeper decarbonization.[33] More money today is invested in renewables than in any other kind of generation resource,[34] and renewables are expected to predominate new sources of electricity generation for the foreseeable future.[35] The cost of building new renewables projects is dropping so low that it is quickly approaching the marginal costs of maintaining existing baseload fossil-fuel resources.[36]

In addition to these favorable economics, policies that support renewables are proliferating,[37] which reflects the environmental imperative of combating global climate change.[38] To hold global average temperatures to well below 2°C above pre-industrial levels under the Paris Climate Agreement,[39] experts at the Intergovernmental Panel on Climate Change (IPCC) warn us that the world needs to reach net-zero carbon emissions by 2050.[40] Within the United States, thirteen states, districts, and territories—and more than two-hundred cities and counties—have already committed to one-hundred percent clean energy targets.[41] President Joe

32. *Id.*

33. *See* Josh Lederman & Denise Chow, *Biden Commits to Cutting U.S. Emissions in Half by 2030 as Part of Paris Climate Pact*, NBC NEWS, https://www.nbcnews.com/politics/white-house/biden-will-commit-halving-u-s-emissions-2030-part-paris-n1264892 (Apr. 22, 2021, 1:12 PM) (discussing global plans to achieve carbon neutrality).

34. *Renewable Energy Investment in 2018 Hit USD 288.9 Billion, Far Exceeding Fossil Fuel Investment*, UN ENV'T PROGRAMME (June 18, 2019), https://www.unep.org/news-and-stories/press-release/renewable-energy-investment-2018-hit-usd-2889-billion-far-exceeding.

35. *See generally* BLOOMBERGNEF, NEW ENERGY OUTLOOK 2020 (2020), https://about.bnef.com/new-energy-outlook-2020/ ("Renewables and batteries capture 80% of the total $15.1 trillion invested in new power capacity").

36. *See* Jules Scully, *Technology Development Driving Solar LCOEs to New Lows, Catching Up with Fossil Fuel Generation – Lazard*, PVTECH (Oct. 20, 2020), https://www.pv-tech.org/utility-scale-renewables-competitive-with-marginal-cost-of-existing-fossil-fuel-generation-lazard/ ("According to Lazard, when U.S. government subsidies are included, the cost of utility-scale solar is now competitive with the marginal cost of coal, nuclear and combined cycle gas generation.").

37. *See* Julia Pyper, *Tracking Progress on 100% Clean Energy Targets*, GREENTECH MEDIA (Nov. 12, 2019), https://www.greentechmedia.com/articles/read/tracking-progress-on-100-clean-energy-targets (discussing states' clean energy targets and other municipal clean energy initiatives).

38. *See* Gerardo Ceballos et al., *Biological Annihilation via the Ongoing Sixth Mass Extinction Signaled by Vertebrate Population Losses and Declines*, PNAS, July 10, 2017, at E6089, E6089, http://www.pnas.org/cgi/doi/10.1073/pnas.1704949114 ("Our data indicate that beyond global species extinctions Earth is experiencing a huge episode of population declines and extirpations, which will have negative cascading consequences on ecosystem functioning and services vital to sustaining civilization. We describe this as a 'biological annihilation' to highlight the current magnitude of Earth's ongoing sixth major extinction event.").

39. Paris Agreement, *supra* note 19, art. II, ¶ 1(a).

40. MYLES R. ALLEN ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Summary for Policymakers*, *in* GLOBAL WARMING OF 1.5°C (2018), https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf.

41. Pyper, *supra* note 37.

Biden's climate plan, which is line with the Paris Accords, calls for (i) cutting carbon pollution in half by 2030, (ii) achieving a carbon-free power sector by 2035, and (iii) achieving economy-wide carbon neutrality by 2050.[42]

In order to replace baseload power generation with high penetrations of carbon-free, intermittent renewable resources like wind and solar, many experts agree that much more storage capacity is needed.[43] Battery storage can help balance the supply and demand of electricity on the grid in ways that mimic the large-scale baseload resources that currently make up the backbone of most electric grids.[44]

Battery storage helps offset the intermittency problems of wind and solar.[45] For example, if a homeowner pairs a battery with rooftop solar panels, they can store excess electricity produced by their own solar panels when the sun is out, and then draw from their battery bank when the sun goes down.[46] This customer-owned, "behind-the-meter"[47] battery storage can help minimize the overall amount of electricity a homeowner draws from the grid, reducing their overall electric bills.[48] In much the same way, although on a much larger scale, renewables developers are increasingly pairing their wind and solar projects with battery storage in order to firm up their power output, making their renewables facilities more closely resemble conventional dispatchable resources.[49]

Battery storage's unique technological flexibility provides what is commonly referred to as the "value stack" or distinct services and value-adding opportunities that batteries offer to electricity systems at various times and points throughout the grid.[50] A non-exhaustive list of some of battery storage's values includes: (i) energy

42. Lederman & Chow, *supra* note 33.

43. Gearino, *supra* note 17.

44. *See* David Roberts, *Getting to 100% Renewables Requires Cheap Energy Storage. But How Cheap?*, VOX (Sept. 20, 2019, 1:28 PM), https://www.vox.com/energy-and-environment/2019/8/9/20767886/renewable-energy-storage-cost-electricity (detailing how increased energy storage can combat the fluctuations that accompany renewable energy sources).

45. DELOITTE CTR. FOR ENERGY SOLUTIONS, SUPERCHARGED: CHALLENGES AND OPPORTUNITIES IN GLOBAL BATTERY STORAGE MARKETS 4 (2018), https://www2.deloitte.com/us/en/pages/energy-and-resources/articles/global-energy-storage-renewable-energy-storage.html.

46. *See Benefits of Energy Storage*, ENERGYSAGE, https://www.energysage.com/energy-storage/benefits-of-storage/ (Aug. 25, 2021) ("When energy storage is paired with renewable resources, it can make renewable energy 'dispatchable', meaning it can be stored for use when it's needed and called upon.").

47. DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 11.

48. *See id.* (illustrating graphically the uses of behind-the-meter electricity).

49. *See* Cheryl Katz, *In Boost for Renewables, Grid-Scale Battery Storage Is on the Rise*, YALE ENV'T 360 (Dec. 15, 2020), https://e360.yale.edu/features/in-boost-for-renewables-grid-scale-battery-storage-is-on-the-rise (discussing development of storage systems that can hold enough renewable energy to power hundreds of thousands of homes).

50. DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 13.

arbitrage;[51] (ii) ancillary services and frequency regulation;[52] (iii) spinning reserves;[53] (iv) generation capacity and resource adequacy;[54] (v) capacity, congestion relief, and deferral;[55] and (vi) reduced carbon emissions.[56] Beyond storing and releasing power, the value stack of grid-scale batteries offers a wide range of beneficial services that energy markets and regulations were not necessarily designed for.[57] Grid-scale batteries can dispatch stored energy on-demand at different times, intervals, and frequencies, and throughout a wide range of strategic locations along the electric grid.[58]

Just as storage can add value behind-the-meter to customers, or when paired with a utility-scale wind or solar facility, it can also provide value to distribution and transmission utilities.[59] Battery storage can help grid operators manage their infrastructure by shifting electricity to deploy at the right times and places on the grid in ways that reduce strain on their wires.[60] By investing in storage, grid operators[61] can defer costly grid improvements and wiring upgrades that a utility

---

51. Batteries are charged during times of low electricity prices, and they release and sell stored energy at times of higher electricity prices. RYAN HLEDIK ET AL., THE BRATTLE GRP., STACKED BENEFITS: COMPREHENSIVELY VALUING BATTERY STORAGE IN CALIFORNIA 5 (2017), https://brattlefiles.blob.core.windows.net/files/17741_solar_plus_storage_economics_-_final.pdf. For generators, energy arbitrage can be used as a price hedge to maintain high returns on the sale of power and to avoid price shocks. *Id.* For grid managers, energy arbitrage can be used to avoid dispatching higher-cost generators with high fuel costs or variable operation and maintenance costs. *Id.*

52. Batteries rapidly charge and discharge to respond to short-duration imbalances in the supply and demand of electricity on the grid. *Id.*

53. Batteries discharge power during contingencies when large quantities of additional power are needed on the grid. *Id.* at 5, 11.

54. Batteries stabilize the outflow of power from a generation resource by discharging during peak demand hours and scarcity events. *Id.* at 5.

55. Battery storage located in resource-constrained points on transmission and distribution networks to reduce demand during times of capacity constraints, reducing strain on wires, and deferring the need for transmission capacity upgrades. *Id.*

56. Batteries store electricity generated by renewable energy resources and reduce the need for fossil fuel-based and other carbon-intensive generators on the electric grid, thus reducing CO2 emissions. *Id.*

57. *See, e.g.*, THOMAS BOWEN ET AL., GRID-SCALE BATTERY STORAGE: FREQUENTLY ASKED QUESTIONS, 1–3 (2019) (discussing characteristics of and services provided by grid-scale battery storage); DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 10 (discussing shortcomings of current energy storage policies).

58. DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 2 (describing how special characteristics of battery storage systems can help supplement electric grids).

59. *See* Alex Eller, *Energy Storage Will Disrupt Transmission and Distribution Investments*, UTILITY DIVE (Oct. 17, 2017), https://www.utilitydive.com/news/energy-storage-will-disrupt-transmission-and-distribution-investments/506945/ (discussing how energy storage systems can supplement existing grids for more efficient energy distribution).

60. *See* DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 4 (describing how battery storage systems can increase system capacity, improve system efficiency, and reduce strain on aging infrastructure).

61. See *infra* Section II.B for an explanation of independent system operators (ISOs), regulated transmission operators (RTOs), and regulated transmission and distribution utilities.

would otherwise need to procure.[62]

Similar to how building new suburban housing developments can lead to increased traffic on roads and highways, building new renewables facilities in rural areas can add electricity onto the grid in places that may lack the adequate infrastructure to accommodate it.[63] If the transmission grid is like an interstate highway for electrons traveling to and from disparate places throughout the country, adding battery storage is like building additional lanes, traffic lights, or roundabouts in exactly the right traffic-prone spots.[64] When there are too many cars on the road, traffic backs up along highways. When there is too much electricity on the transmission network, however, grids can experience far more disruptive issues, like rolling blackouts that can cut off power for millions of people.[65]

In addition to its value as an infrastructure asset, battery storage is increasingly attractive as the technology has become significantly more economical. Lithium-ion batteries are, by far, the most popular battery storage technology and make up more than 90% of the global battery storage market.[66] Between 2010 and 2016, the cost of lithium-ion batteries fell by 73%.[67] For utility-scale storage projects, the drop in lithium-ion prices has been particularly noteworthy: between 2014 and 2015, costs dropped 29%; 2016 saw a further 26% price decline; and in 2017, costs decreased another 12%.[68] As costs continue to fall, the price of utility-scale lithium-ion storage systems is expected to decline another 36% by 2022.[69]

Partially due to these cost reductions, the overall market for battery storage has grown exponentially in recent years.[70] Between 2003 and 2018, the United States installed 922 MW of large-scale battery storage capacity, three-quarters of which was installed only recently—between 2015 and 2018.[71] In 2018 alone, the total installed capacity of energy storage more than doubled.[72]

Battery energy storage is often characterized as the missing link in the clean

---

62. *See* DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 15 (discussing how Terna, Italy's transmission network manager, deferred infrastructure upgrades by using battery storage).

63. *See* GROSS, *supra* note 7, at 14–15 (describing how renewable energy can affect land use policies especially in rural areas).

64. *See* BOWEN, *supra* note 57, at 3 (describing how battery energy storage systems can reduce congestion and improve transmission on existing grids); s*ee also* Russell Gold, SUPERPOWER: ONE MAN'S QUESTION TO TRANSFORM AMERICAN ENERGY 131–33 (2019) (analogizing planned energy infrastructure to a well-designed highway).

65. See *infra* Sections IV.B and V.B for discussions on the grid management issues of intermittent renewable energy in Australia and Germany, respectively.

66. Alexandra Zablocki, *Fact Sheet: Energy Storage*, ENV'T & ENERGY STUDY INST. (Feb. 22, 2019), https://www.eesi.org/papers/view/energy-storage-2019.

67. *Id.*

68. *Energy Storage Market Booms, With More Growth to Come*, ENV'T. DEF. FUND, https://www.edf.org/energy/energy-storage (last visited Feb. 16, 2021).

69. *Id.*

70. U.S. ENERGY INFO. ADMIN., BATTERY STORAGE IN THE UNITED STATES: AN UPDATE ON MARKET TRENDS 5 (July 2020), https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage.pdf.

71. *Id.* at 11.

72. *Id.* at 5.

energy transition.[73] Grid-scale storage can stabilize flows of electricity by diverting excess power in times of high supply and dispatching it during times of high demand.[74] This stabilization is especially relevant today, as massive influxes of renewable energy projects—which can only produce power when the sun is shining or the wind is blowing—are being added to the grid.[75] Beyond merely storing and releasing quantities of electricity at strategic *times*, battery storage offers additional values depending on *where* it is placed along the grid.[76] Such values, which include reducing strain on power lines and lowering the risk of overheating, can help defer expensive upgrades to old or overloaded infrastructure.[77]

Instead of building a new, bigger transmission cable, increased battery storage can remedy congestion and defer other, more expensive infrastructure investments.[78] If deployed strategically and at scale, battery storage's unique value stack—charging, discharging, and deferral[79]—could have transformative effects on electricity systems throughout the world.[80] Almost no other area of energy innovation has a greater potential to make the grid "more reliable, flexible, and cost-effective."[81] As the cost of intermittent renewables continues to fall,[82] and as more and more renewable generation becomes available,[83] storage will play an increasingly critical role in building the clean energy grid that many policy proposals aspire to create.[84]

---

73. *See* David Schmitt & Glenn M. Sanford, *Energy Storage: Can We Get It Right?*, 39 ENERGY L.J. 447, 448 (2018) (describing energy storage as "Holy Grail" of clean energy transition).

74. *See* Steven Ferrey, *The "Green New Deal": Constitutional Limitations; Rerouting Green Technology*, 44 VT. L. REV. 777, 830 (2020) (discussing how energy storage systems could increase grid reliability by storing energy generated during lower demand).

75. *See id.* (describing how distribution of renewable energy resources varies by state).

76. *See* Stein, *supra* note 13, at 739 (noting the cost and installation value arising from PUC's magnetic energy storage system installation in Wisconsin).

77. *See id.* at 711 (detailing how energy storage can assist with system stability by buffering sensitive equipment against power quality issues).

78. *See* Schmitt & Sanford, *supra* note 73, at 473 (explaining how storage can ease congestion by being discharged during peak demand and recharged at times of lower demand, thus reducing price of bottlenecks that otherwise form during high demand).

79. *See* DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 11 (illustrating energy storage value streams).

80. *See* Lindsay Breslau et al., *Batteries Included: Incentivizing Energy Storage*, 17 SUSTAINABLE DEV. L. & POL'Y 29, 29 (2017) (noting large-scale battery storage projects in various countries and highlighting their beneficial effects).

81. *Id.*

82. *See* LAZARD, LAZARD'S LEVELIZED COST OF ENERGY ANALYSIS—VERSION 14.0, at 8 (2020), https://www.lazard.com/media/451419/lazards-levelized-cost-of-energy-version-140.pdf (citing factors like decreasing capital costs, improving technologies, and increased competition as reasons for continued decline of intermittent renewables' cost).

83. *See* Jeremy Hodges, *Wind, Solar Are Cheapest Power Source in Most Places, BNEF Says*, BLOOMBERG (Oct. 19, 2020, 4:15 AM), https://www.bloomberg.com/news/articles/2020-10-19/wind-solar-are-cheapest-power-source-in-most-places-bnef-says (predicting solar and wind power will be more cost-effective than coal or natural gas power in next five years).

84. *See* Recognizing the Duty of the Federal Government to Create a Green New Deal, H.R. Res. 109, 116th Cong. § 2(D) (2019) ("[T]he goals described in [this resolution] will require . . .

B. Electricity Regulation: Restructuring & Deregulation

Despite its enormous potential and its increasing cost-competitiveness,[85] battery storage regulation fits awkwardly within the legal frameworks that govern the restructured energy markets predominant in most Organization for Economic Cooperation and Development (OECD) countries throughout the world.[86] Restructured jurisdictions include two-thirds of the United States,[87] as well as Australia[88] and the European Union,[89] among others. In restructured jurisdictions, distinct cost-recovery models separately regulate generation, transmission, and distribution resources.[90]

The United States is a useful case study for illustrating how storage generally fits into restructured regulatory environments.[91] The modern electric regulatory regime in the United States began with the Federal Power Act (FPA) of 1935.[92] The FPA created the Federal Power Commission, the precursor to the modern Federal Energy Regulatory Commission (FERC), to manage the licensing of the new hydroelectric power plants that would electrify the fast-growing and largely rural western states.[93] Established in 1977, FERC's mission is to ensure reliable, efficient,

building or upgrading to energy-efficient, distributed, and 'smart' power grids . . . ."); *see also The Biden Plan to Build a Modern, Sustainable Infrastructure and an Equitable Clean Energy Future*, BIDEN HARRIS: DEMOCRATS, [hereinafter *The Biden Plan*] https://joebiden.com/clean-energy/ (last visited Oct. 7, 2021) (including battery storage as a means of dramatic cost reductions in critical clean energy technologies).

85. *See* Andy Colthorpe, *Behind the Numbers: The Rapidly Falling LCOE of Battery Storage*, ENERGY STORAGE NEWS (May 6, 2020) [hereinafter Colthorpe, *Behind the Numbers*] https://www.energy-storage.news/blogs/behind-the-numbers-the-rapidly-falling-lcoe-of-battery-storage ("The cost of battery energy storage has continued on its trajectory downwards, making it more and more competitive with fossil fuels.").

86. *See* A. Al-Sunaidy & R. Green, *Electricity Deregulation in OECD (Organization for Economic Cooperation and Development) Countries*, 31 ENERGY 769, 769–70 (2006) (describing electricity deregulation in OECD countries and subsequent market restructuring).

87. *See Electric Power Markets: National Overview*, FERC, https://www.ferc.gov/industries-data/market-assessments/electric-power-markets (July 20, 2021) ("[T]wo-thirds of the nation's electricity load is served in RTO regions.").

88. Ann Rann, *Electricity Industry Restructuring-A Chronology*, PARLIAMENT OF AUSTL. (June 30, 1998), https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/Publications_Archive/Background_Papers/bp9798/98bp21.

89. *Energy and Environment – Overview*, EUR. COMM'N, https://ec.europa.eu/competition/sectors/energy/overview_en.html (last visited Feb. 14, 2021).

90. Severin Borenstein & James Bushnell, *The U.S. Electricity Industry After 20 Years of Restructuring* 3–4 (Davis Econ. Energy Program, Working Paper No. 001, 2015), https://energy.ucdavis.edu/wp-content/uploads/2017/03/07-20-2016-DEEP_WP001.pdf.

91. *See id.* at 21 (describing how batteries and other generation or storage devices could dominate policy discussions in the future).

92. *See* Walter R. Hall II et al., *History, Objectives, and Mechanics of Competitive Electricity Markets*, *in* CAPTURING THE POWER OF ELECTRIC RESTRUCTURING 1, 6 (Joey Lee Miranda ed., 2008) (tracing federal authority over electricity markets to the FPA).

93. ADAM VANN, CONG. RSCH. SERV., IF 11411, THE LEGAL FRAMEWORK OF THE FEDERAL POWER ACT 1 (2020).

and sustainable energy for consumers.[94] This involves two primary goals: (i) ensuring that rates, terms, and conditions for electricity sales are just, reasonable, and not unduly discriminatory or preferential[95] and (ii) promoting the development of safe, reliable, and efficient energy infrastructure that serves the public interest.[96]

FERC has jurisdiction over the rates and services of electricity in interstate commerce.[97] FERC rulemaking covers wholesale power markets and transmission operations.[98] Wholesale power markets effectively act as the clearinghouses for generators to sell their power at auction to distribution utilities.[99] Transmission lines effectively act as the electric grid's interstate highways that transmit this power from generators to consumers, and from sellers to buyers.[100] Anything outside of interstate commerce is left to the states to regulate through state public utility commissions (PUCs).[101]

Historically, electric grids were built, owned, and operated by vertically integrated utilities.[102] This meant that, for a given service area, one corporation had a monopoly over the entire value chain of electricity generation, transmission, and distribution—from power plants to customers' electric meters.[103] Each corporation was regulated by a state public utility commission to ensure it operated in the public interest.[104] Beginning in the 1990s, however, a wave of neoliberal economic policies throughout the world restructured and deregulated formerly monopolistic electricity

94. *About FERC – Overview*, *supra* note 18.

95. *See* Federal Power Act, 16 U.S.C. § 824e(a) ("Whenever the Commission, after a hearing held upon its own motion or upon complaint, shall find that any rate, charge, or classification, demanded, observed, charged, or collected by any public utility for any transmission or sale subject to the jurisdiction of the Commission, or that any rule, regulation, practice, or contract affecting such rate, charge, or classification is unjust, unreasonable, unduly discriminatory or preferential, the Commission shall determine the just and reasonable rate, charge, classification, rule, regulation, practice, or contract to be thereafter observed and in force, and shall fix the same by order.").

96. *See id.* § 824(a) ("It is declared that the business of transmitting and selling electric energy for ultimate distribution to the public is affected with a public interest, and that Federal regulation of matters relating to generation to the extent provided in this subchapter and subchapter III of this chapter and of that part of such business which consists of the transmission of electric energy in interstate commerce and the sale of such energy at wholesale in interstate commerce is necessary in the public interest, such Federal regulation, however, to extend only to those matters which are not subject to regulation by the States.").

97. *See id.* § 824d(a) ("All rates and charges made, demanded, or received by any public utility for or in connection with the transmission or sale of electric energy subject to the jurisdiction of the Commission . . . .").

98. *Id.* § 824(b).

99. *Market for Electricity*, PJM, https://learn.pjm.com/electricity-basics/market-for-electricity.aspx (last visited Sept. 12, 2021).

100. *The Transmission System and How It Works*, TRANSMISSION AGENCY OF N. CAL. (TANC), https://www.tanc.us/understanding-transmission/the-transmission-system-and-how-it-works/ (last visited Sept. 12, 2021).

101. *See* 16 U.S.C. § 824(a) ("[S]uch Federal regulations . . . extend only to those matters which are not subject to regulation by the States.").

102. Jeff Lien, *Electricity Restructuring: What Has Worked, What Has Not, and What is Next* 1 (Econ. Analysis Grp. Discussion Paper, Working Paper No. EAG 08-4, 2008).

103. *Id.*

104. *Id.*

industries to encourage a greater reliance on competitive market pricing.[105] In many jurisdictions, vertically integrated utilities were forced to restructure and sell off their generation assets (i.e., power plants), splitting and reorganizing them as separate corporate enterprises, and effectively separating generation from the transmission and distribution functions of electric utilities.[106] At their core, these policies prohibited regulated transmission and distribution utilities from owning generation resources.[107]

The goal of these policies was to avoid undesirable monopolistic market behavior that could lead to inflated prices for everyday electric service.[108] The idea was that the corporations investing in and owning power plants should not be the same corporations that transmitted, delivered, and sold electricity to customers.[109] According to the proponents of this theory, separating the electricity industry into distinct corporate entities and functions would increase competition and innovation, lower electricity costs, and ultimately increase efficiencies across the entire industry.[110] Not all U.S. states opted to restructure and deregulate—today, roughly a third of the country's population lives in states that maintain vertically-integrated, regulated utility monopolies, mostly in the West and Southeast.[111]

Many restructuring policies also deregulated power generation and power sales by establishing competitive wholesale markets where power plants could sell their electricity at auction to wholesale buyers.[112] Regional transmission organizations (RTOs) and independent system operators (ISOs) were created to ensure the reliability of interstate electricity networks and to oversee the newly created private electricity markets.[113] At these markets, wholesale power could be traded at different quantities and capacities and over different intervals of time.[114] Instead of being part of the same corporate enterprise, distribution companies—utilities that sell electricity directly to consumers—could now buy wholesale power at competitive market prices from a variety of generators within their grid networks, on markets managed by independent RTOs and ISOs.[115]

As part of the nationwide push for liberalization of power markets in the 1990s,

---

105. *Id.*

106. *Id.* at 1, 6.

107. *See, e.g.*, 66 PA. CONS. STAT. § 2802(14) (1997) ("This chapter requires electric utilities to unbundle their rates and services and to provide open access over their transmission and distribution systems to allow competitive suppliers to generate and sell electricity directly to consumers in this Commonwealth. The generation of electricity will no longer be regulated as a public utility function except as otherwise provided for in this chapter. Electric generation suppliers will be required to obtain licenses, demonstrate financial responsibility and comply with such other requirements concerning service as the commission deems necessary for the protection of the public.").

108. Lien, *supra* note 102, at 1.

109. *Id.*

110. *Id.* at 4–5.

111. *Id.* at 6.

112. *Id.* at 7.

113. Borenstein & Bushnell, *supra* note 90, at 5.

114. *Id.*

115. *Electric Power Markets: National Overview*, *supra* note 87.

FERC issued a series of regulatory orders that provided the legal foundation for restructuring.[116] In 1996, FERC issued FERC Order No. 888 around the same time that states were beginning to deregulate their electricity industries and pass legislation that required vertically integrated distribution utilities to unbundle, or sell off, their transmission and generation businesses.[117] Order No. 888 prohibited transmission operators from discriminating against non-utility suppliers.[118] This effectively required transmission owners to transmit power across their lines regardless of who was selling it.[119] Order No. 888 also detailed how the terms and rates charged by transmission operators should be allocated and regulated.[120] It called for "open access non-discriminatory transmission services"[121] that prohibited transmission operators from unfairly discriminating against those who wanted to use their networks, thus preserving the bright-line, arms-length separation between newly distinct, and now differently regulated, sectors.[122] Restructured power plant companies could sell their output on a deregulated market (managed by a RTO/ISO) and could transmit that output on an open highway (transmission lines) that charged regulated prices.

Subsequently, Order No. 889 created a transparent online system for companies to monitor available capacity across different transmission lines.[123] Later, FERC issued Order No. 2000, which encouraged the formation of RTOs and tasked them with overseeing transmission service and encouraging competition among suppliers by creating pricing structures for wholesale power markets.[124] RTOs would act as the regional agents of FERC to ensure effective regulation and compliance with the FPA and were required to maintain strict independence from the entities they were tasked with regulating.[125]

The key legal standard that regulated entities under FERC's jurisdiction must meet in order to comply with the FPA is the mandate to charge their customers just

---

116. Kenneth C. Baldwin, *Energy Facility Siting*, *in* CAPTURING THE POWER OF ELECTRIC RESTRUCTURING 133, 135 (Joey Lee Miranda ed., 2008).

117. Promoting Wholesale Competition Through Open Access Non-discriminatory Transmission Services by Public Utilities; Recovery of Stranded Costs by Public Utilities and Transmitting Utilities, 75 FERC ¶ 61,208 (April 24, 1996) [hereinafter Order No. 888] (to be codified at 18 C.F.R. pts. 35, 385).

118. *Id.*

119. *Id.*

120. *Id.*

121. *Id.*

122. *See* Matthew H. Brown & Richard P. Sedano, *Electricity Transmission – A Primer* NAT'L COUNCIL ON ELEC. POL'Y 5 (2004), https://www.energy.gov/sites/prod/files/oeprod/DocumentsandMedia/primer.pdf ("Order 888 also required utilities to functionally unbundle—i.e., to separate—their transmission and generation businesses and to follow a corporate code of conduct. FERC hoped that this separation would make it impossible for the transmission business to give its own power plants preferential access to the company's transmission lines.").

123. Open Access Same-Time Information System and Standards of Conduct, 75 FERC ¶ 61,078 (Apr. 24, 1996) [hereinafter Order No. 889] (to be codified at 18 C.F.R. pt. 37).

124. Regional Transmission Organizations, 89 FERC ¶ 61,285 (Dec. 20, 1999) [hereinafter Order No. 2000] (to be codified at 18 C.F.R. pt. 35).

125. *Id.* at 151–52.

and reasonable rates.[126] The FPA's "just and reasonable" standard for regulating the price of electricity in interstate commerce applies to both wholesale power markets and transmission operations.[127] The price of electricity on wholesale power markets (i.e., generation sold by power plants) is presumptively just and reasonable because the price is determined by competitive market forces, by auction, on the markets that are managed and operated by RTOs and ISOs.[128] Unlike wholesale power markets, however, interstate transmission lines do not have an equivalent competitive marketplace that would otherwise efficiently allocate just and reasonable rates.[129]

Because interstate transmission lines cannot rely on competitive market pricing, and because of their inherent land constraints, transmission lines are instead managed as regulated natural monopolies.[130] Maintaining and operating networks of transmission lines requires building high-voltage transmission lines that crisscross the country and transmit power from power plants—sometimes across state boundaries—to where power is needed on the distribution grid.[131]

Because of these geographic constraints on infrastructure, and because of the economic advantages of large-scale transmission investment, transmission service is regulated as a natural monopoly service to ensure just and reasonable rates under the FPA.[132] Transmission developers propose transmission projects to the independent RTO or ISO that covers their service area.[133] The RTO or ISO then approves the project and sets the prices grid users (e.g., power plants) must pay the RTO or ISO to use their transmission lines to transport power.[134] RTOs and ISOs only allow transmission operators to charge their customers just and reasonable rates that recoup their operating expenses and capital investments, plus a reasonable rate of return.[135] Revenues for transmission services then flow back to the transmission

126. *See* 16 U.S.C. § 824d(a) ("All rates and charges made, demanded, or received by any public utility for or in connection with the transmission or sale of electric energy subject to the jurisdiction of the Commission, and all rules and regulations affecting or pertaining to such rates or charges shall be just and reasonable, and any such rate or charge that is not just and reasonable is hereby declared to be unlawful.").

127. *Id.*

128. This is also known as the "Mobile-Sierra Doctrine" and is based on two leading U.S. Supreme Court cases on the issue. *See* United Gas Co. v. Mobile Gas Corp., 350 U.S. 332 (1956) (holding companies are not able to change price rates specified in their contracts by simply filing new rates with Federal Power Commission); *see also* Fed. Power Comm'n v. Sierra Pac. Power Co., 350 U.S. 348 (1956) (declaring Federal Power Commission's authority to prescribe change in price rates when it determines them to be unjust and unreasonable).

129. *See* Brown & Sedano, *supra* note 122 (explaining how Order No. 2000 tasked RTOs with promoting competition in wholesale power markets).

130. *Id.* at 51; 16 U.S.C. § 824e.

131. *See* Brown & Sedano, *supra* note 122, at 6, 29 (explaining that current system is interconnected network of high-voltage transmission lines that move power at high voltage from power plants to transformers, which deliver power directly to customers).

132. *Id.* at 2–4.

133. *See id.* at 50–52 (describing characteristics and roles of transmission owners and of ISOs and RTOs as regional planners).

134. Order No. 2000, *supra* note 124, at 206–07.

135. 16 U.S.C. § 824d(a).

operators based on what is called a cost-of-service model.[136] Under this cost-of-service model, RTOs and ISOs must also submit regional plans to FERC detailing the costs of maintenance and any expansions of the transmission networks within their service territories.[137] These plans include the rates and fees of local transmission operators that were already tentatively approved by their respective RTO or ISO.[138]

C. The Regulatory Uncertainty of Battery Energy Storage

Despite some problems along the way,[139] proponents of restructuring and deregulation argue that these policies have achieved their stated goals of increasing competition and innovation, reducing electricity prices for consumers, and stymieing the influence of monopolistic and politically powerful utility corporations.[140] Restructuring and deregulation, however, also gave rise to a structure of energy governance with an extraordinary degree of complexity and jurisdictional tension.[141] In the United States, federal regulators control the RTOs and ISOs that govern inter-regional transmission operators and wholesale power markets in interstate commerce, while states, via their public utility commissions, retain jurisdiction over electric distribution utilities[142] and policies that affect the resource-mix of in-state power generation.[143]

Restructuring and deregulation created new markets that were largely designed around a static set of assumptions, foremost of which was that electricity would flow

---

136. *See* Order No. 2000, *supra* note 124, at 235 ("[T]he RTO, in turn, will make section 205 filings to recover from transmission customers the cost of the payments it makes to transmission owners as well as its own costs . . . .").

137. *See id.* at 485–86 (explaining RTO requirement to file plan with FERC with specific targets in specific time).

138. *Id.*

139. *See, e.g.*, Jason Leopold, *Enron Linked to California Blackouts*, MARKETWATCH (May 16, 2002, 11:55 AM). https://www.marketwatch.com/story/enron-caused-california-blackouts-traders-say (describing problematic rolling blackouts in California).

140. Whether restructuring and deregulation have achieved their intended goals is contested. *See, e.g.*, Emily Hammond & David B. Spence, *The Regulatory Contract in the Marketplace*, 69 VAND. L. REV. 141, 215 (2016) ("The move from comprehensive regulation and administrative price-setting to competition and market prices has not provided us with an electric generation mix that satisfies all of the important attributes we seek."); *see also* Jim Rossi, *The Brave New Path of Energy Federalism*, 95 TEX. L. REV. 399, 402–03 (2016) (noting that agency regulators are sometimes crippled in their ability to adapt proactive regulatory approaches that promote their intended goals, including expansion of clean energy and monitoring of anticompetitive practices harming customers).

141. *See* Rossi, *supra* note 140, at 403 (describing potential effects of shifting from dual-sovereignty to concurrent-jurisdiction doctrine).

142. *See* 16 U.S.C. § 824(b)(1) ("The provisions of this subchapter shall apply to the transmission of electric energy in interstate commerce and to the sale of electric energy at wholesale in interstate commerce, but . . . [t]he Commission . . . shall not have jurisdiction . . . over facilities used for the generation of electric energy or over facilities used in local distribution . . . .").

143. *See* Hughes v. Talen Energy Mktg., LLC, 136 S. Ct. 1288, 1298 (2016) ("States, of course, may regulate within the domain Congress assigned to them even when their laws incidentally affect areas within FERC's domain.").

instantaneously in one direction through a centralized grid from power plants, across transmission lines, and then be distributed to customers by utilities.[144] Just like its physical infrastructure, the legal and regulatory infrastructure of electricity was based on the assumption that, unlike oil or natural gas, electricity could not be stockpiled, warehoused, or stored.[145] Inherent to the physics of electricity, power generation needed to precisely match demand at all times and needed to be available for instantaneous delivery throughout every link of the system's chains.[146] This delicate balancing act was managed by the interdependent and coordinated efforts of generators, transmission operators, RTOs and ISOs, and distribution companies.[147] The innovation of battery storage technology challenges these fundamental assumptions because it provides the added flexibility to store electricity at strategic times and places on the grid.[148]

Today, private markets determine the revenues and profit margins of generation resources (e.g., power plants), while transmission and distribution investments must be approved by regulators.[149] If approved, regulated transmission and distribution operators socialize their costs of service by passing them on to ratepayers.[150] Battery storage—which does not "generate" electricity in the conventional sense, but rather stores and discharges electricity according to set parameters—defies the strict categorization of restructured electricity markets that silos grid networks into generation, transmission, and distribution functions, all with different cost-recovery dynamics.[151]

Battery storage has the potential to add distinct values across all sections of the grid simultaneously if the incentives and pricing signals align to allow battery storage to capture its full value stack.[152] Battery storage has some attributes resembling generation that would ordinarily recover costs on private markets (e.g.,

144. Stein, *supra* note 13, at 698–700.

145. *See id.* at 746 (explaining how some scholars cite inability of regulations to keep up with changing technology as source of storage uncertainty).

146. *See* Pippa Stevens, *The Battery Decade: How Energy Storage Could Revolutionize Industries in the Next 10 Years*, CNBC, https://www.cnbc.com/2019/12/30/battery-developments-in-the-last-decade-created-a-seismic-shift-that-will-play-out-in-the-next-10-years.html (Dec. 30, 2019, 3:25 PM) (explaining how the electric grid typically balances supply and demand by generating power only moments before it is used).

147. *See* JESSICA KATZ ET AL., BALANCING AREA COORDINATION: EFFICIENTLY INTEGRATING RENEWABLE ENERGY INTO THE GRID 1 (2015) ("Power system operators maintain the balance of electricity supply and demand within geographic boundaries known as balancing areas . . . each balancing area operator maintains this balance by committing . . . generators in advance of when they are needed, then dispatching power from the available generators in combinations that minimize operating cost and maintain reliability.").

148. *See* KIRAN KUMARASWAMY ET AL., REDRAWING THE NETWORK MAP: ENERGY STORAGE AS VIRTUAL TRANSMISSION 2 (2020) (explaining the ability of battery storage to both inject and absorb power as needed and to be moved to adapt to pattern changes).

149. *See* Lien, *supra* note 102, at 8 ("The evidence seems clear that allowing generators an unfettered profit motive . . . enhances the efficiency of plant operations.").

150. *See* Brown & Sedano *supra* note 122, at 22–23 (citing example of regulated utility in Texas socializing costs by paying for initial upgrades and later passing on those costs to ratepayers).

151. DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 11–13.

152. *See id.* at 13 (explaining phenomenon of value stacking).

charging and discharging electricity for resale) and other attributes resembling transmission and distribution functions that would typically recover costs under regulated cost-of-service models (e.g., reducing strain on and overheating of power lines).[153] Battery storage's ability to offer several distinct values, which normally accrue to different entities under various regulatory schemes, presents significant challenges to developers, investors, regulators, policymakers, and the energy lawyers who advise them.[154]

Where battery storage adds the most value, however, may not be in sectors of the grid that are best positioned to innovate and act quickly enough to keep pace with the rapid clean energy deployments that are expected to continue for decades to come. Roughly half of installed battery storage capacity is owned by independent power producers (generators), while the other half is owned by investor-owned utilities, most of which operate in unrestructured markets.[155] In fact, much of the recent growth in storage is concentrated within vertically integrated utilities in the one-third of the United States that has not restructured.[156] Part of this discrepancy may be because storage is not yet cost-effective in all places and applications.[157] The more likely explanation, however, is that the uncertainty of storage regulation in restructured jurisdictions encumbers investment in segments of the grid where battery storage could add significant value.[158]

Deferring expensive transmission system upgrades is another of the unique, largely untapped applications of battery storage. Investment in the United States' transmission infrastructure remains far behind what many experts say is needed to integrate large amounts of wind and solar resources that are far away from population centers.[159] Then-FERC Commissioner Richard Glick, who has since been appointed FERC Chairman, recently stated that the Biden administration will not be able to meet its decarbonization goals "unless we can access significant amounts of newly built renewable resources," which will not be possible "unless we significantly build out the grid."[160] Building this requisite new transmission

---

153. *See id.* at 11 (depicting various attributes and functions of battery storage).

154. *See id.* at 10–11 (noting need for regulatory bodies, policymakers, and operators to adapt).

155. U.S. ENERGY INFO. ADMIN., *supra* note 70, at 12.

156. *See* Julian Spector, *2019 Was the Year Everything Changed for Utilities and Energy Storage*, GREENTECH MEDIA (Jan. 24, 2020), https://www.greentechmedia.com/articles/read/as-time-goes-on-utilities-want-loads-more-energy-storage ("The integrated resource plan (IRP) data points come primarily from regulated utility markets that engage in long-term planning of electricity supply; additional construction is already underway from independent developers in competitive markets.").

157. *See* DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 9 (noting that battery storage cost or cost-perception can sometimes be prohibitive to implementation).

158. *See id.* at 10 (explaining energy policy's lag behind energy technology innovation).

159. *See* St. John, *Transmission*, *supra* note 8, at 2–3 (noting mismatch between location of wind and solar energy supply centers and areas with the largest demand for it).

160. Jeff St. John, *The Top Priorities of FERC's Most Likely New Chairman Under Biden*, GREENTECH MEDIA (Nov. 18, 2020) [hereinafter St. John, *Priorities*] https://www.greentechmedia.com/articles/read/the-top-priorities-of-fercs-most-likely-new-chairman-under-a-biden-administration.

infrastructure, however, is an incredibly difficult, lengthy, and controversial process.[161] One of President Biden's proposed solutions to this problem utilizes existing rights of way around already built transmission lines and railroad infrastructure to better integrate distant, more abundant renewable resources.[162] Using existing rights of way may solve some of transmission infrastructure's land constraints, but it still fails to overcome the significant cost challenges of building new high-voltage lines.

Battery storage could help alleviate the physical, political, and legal constraints of building transmission infrastructure, and in certain instances, could present prudent, lower-cost alternatives. Storage could play a vital role as an alternative to traditional wire-based transmission upgrades and could defer some of the needed investments in expensive, new lines.[163] Transmission-level storage could enhance the efficiency and effectiveness of existing transmission assets to provide additional capacity in targeted areas of the grid.[164] As the costs of storage continue to decline, storage as a non-wires alternative to new transmission upgrades has an increasingly greater potential to fall within the Federal Power Act's "just and reasonable" standard, and, under the right circumstances, could make storage-as-transmission investments eligible for regulated cost recovery.[165]

Under present conditions, Navigant Research anticipates that 35.5 GW of new energy storage capacity will be built globally for critical infrastructure by 2027.[166] Only about 25% of that capacity is expected to address issues on the transmission and distribution grids.[167] Despite storage's potential, the prospect for deploying storage on the transmission grid is complicated by regulations that prohibit transmission owners from exercising rights or control over a generation or supply resource.[168] This includes owning generation assets that are supposed to be separately owned under the laws of restructuring to preserve the independence of different market actors.[169] Because storage must be charged and discharged—and therefore must purchase and sell electricity to and from somewhere—it has some attributes that resemble generation.[170] These attributes would arguably prohibit regulated transmission operators from procuring storage and recouping the expense

161. *See* Ruhl & Salzman, *supra* note 6, at 718–20 (discussing the practical difficulties of implementing Green New Deal energy policies).

162. *The Biden Plan, supra* note 84.

163. KUMARASWAMY ET AL., *supra* note 148, at 1, 6.

164. See *infra* Parts III, IV, and V for a discussion of the use of storage for transmission in the United States, Australia, and Germany, respectively.

165. McClenny*, supra* note 11.

166. *Id.*

167. *Id.*

168. *See* Order No. 889, *supra* note 123, at i (requiring public utilities to separate transmission from generation marketing functions and communications).

169. *Id.*

170. Utilization of Electric Storage Resources for Multiple Services When Receiving Cost-Based Rate Recovery, 158 FERC ¶ 61,051, at ¶ 2 (Jan. 19, 2017) [hereinafter Utilizing Electric Storage] (to be codified at 18 C.F.R. pt. 35).

with cost-recovery.[171]

This regulatory quandary has caused considerable confusion.[172] However, utility investment in storage does not need to involve buying and selling electricity supply, nor does it require ownership of the storage assets themselves, which would rub against the laws of restructuring. By identifying specific needs and requesting competitive proposals, private developers could own storage-as-transmission and sell multiple services to multiple markets, while also giving priority rights or operational control to transmission operators and regulators to meet their specific needs.

Today, the fundamental legal conundrum of battery storage is that under restructured regulatory frameworks, many of the values battery storage offers accrue to different corporate entities, at different sections of the grid, under different levels of jurisdiction, which are regulated under separate and distinct pricing frameworks.[173] In different sections of the restructured electricity grid, the system operates according to either (i) the logic of private markets or (ii) the central planning of regulated public utilities.[174] Enabling one storage project to capture enough of its values—and therefore make the project economically feasible—often requires unbundling and separately selling the batteries' services across differently regulated markets to different buyers.[175] This method not only complicates the business case for storage but could also result in considerable undervaluing—or overvaluing[176]—of battery storage technology.[177]

Complexity, uncertainty, and underinvestment could lead to chronic underdevelopment of storage to the detriment of a sustainable grid. Coupled with the influx of intermittent, clean energy resources, deploying the full spectrum of storage's value calls for new and improved regulatory and contractual tinkering in order to pursue the social and political goals of a safe, reliable, and efficient electricity system, in addition to the environmental imperative of deep decarbonization.[178] To unleash its full stack of values, investment in battery storage within restructured jurisdictions should not be limited to the generation sector. All market actors, including regulated transmission and distribution utilities, should be

171. *Id.* at 10–11.

172. *See* Stein, *supra* note 13, at 701 ("Energy storage faces a number of obstacles . . . including technological, financial, and regulatory uncertainty.").

173. *See* DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 11 (depicting graphically the various value streams of battery storage between different customer segments and different levels of the grid).

174. *See* Hammond & Spence, *supra* note 140, at 142–43 (describing the tensions between competitive markets and state-regulated utilities within the electricity sector).

175. Utilizing Electric Storage, *supra* note 170, at ¶ 2.

176. *See, e.g.*, Schmitt & Sanford, *supra* note 73, at 493–94 (describing double counting or double recovery problem of battery storage as situation when multiple buyers value and pay for the same battery storage service).

177. *See* Stein, *supra* note 13, at 729 (describing controversies and opposition over the risks of double counting through both cost-based rate treatment and market-based rate treatment).

178. *See id.* at 766 ("To realize its full potential, however, energy storage also needs to be integrated into the labyrinth of regulated and restructured energy regimes."); *see also* MYLES R. ALLEN ET AL., *supra* note 40, at 12 (explaining pathways to decarbonization).

allowed—and encouraged—to invest in storage under the right technological circumstances and under the appropriate cost-recovery frameworks.

The market for storage is already growing. Without changing the fundamental regulatory regime, further innovation among restructured market actors is necessary to accelerate storage adoption and to meet the needs of the ongoing clean energy transition. This is true both in the United States and similarly restructured jurisdictions throughout the world. By encouraging different market participants to invest in storage under their respective cost-recovery models, storage can attract more investment and wider deployment at the scales necessary to build out the low-carbon electric grid to which climate policies aspire.

The following Sections explore the legal and policy regimes for battery storage in three leading markets—the United States, Australia, and Germany. These Sections highlight noteworthy battery storage projects that have innovated around regulatory uncertainty and successfully proposed storage as a cost-of-service transmission asset.[179] Comparing these three jurisdictions is helpful for a regulatory analysis of storage-as-transmission because these markets share (i) three of the largest international battery storage markets; (ii) highly developed economies and OECD membership; (iii) privatized, restructured, and deregulated electricity sectors since the 1990s; and (iv) federal legal systems with similar jurisdictional tension over their energy industries. This Comment focuses on three emerging storage-as-transmission projects to emphasize that, with the proper contracting, these (and similar) projects can be legally viable even under the existing laws of restructuring.[180] Developers, investors, utilities, regulators, and policymakers should look to these projects as examples of how storage-as-transmission is possible within restructured markets. These examples illustrate how resolving the regulatory uncertainties of storage as a cost-of-service asset gives grid operators a new tool to help build the infrastructure needed to support a cleaner energy grid.

III. UNITED STATES

A. Legal & Regulatory Regime

The challenge of storage regulation today is to enable the right market participants to deploy and invest in storage resources at the right points and times on

179. *See* W. Grid Dev., LLC, 130 FERC ¶ 61,056 (Jan. 21, 2010) [hereinafter Western Grid Decision] (holding that U.S. transmission developer's proposed energy storage device projects are wholesale transmission facilities); Adam Morton, *Victoria Plans 300MW Tesla Battery to Help Stabilise Grid as Renewables Increase*, GUARDIAN (Nov. 4, 2020, 9:38 PM), https://www.theguardian.com/australia-news/2020/nov/05/victoria-plans-300mw-tesla-battery-to-help-stabilise-grid-as-renewables-increase (discussing Australian city's plan to build one of the largest lithium-ion batteries in the world); Andy Colthorpe, *Germany's Grid Could Use Gigawatt-Scale ESS as Alternative to 'Billions in Infrastructure Spending'*, ENERGY STORAGE NEWS (Nov. 11, 2019) [hereinafter Colthorpe, *Germany's Grid*] https://www.energy-storage.news/germanys-grid-could-use-gigawatt-scale-ess-as-alternative-to-billions-in-infrastructure-spending/ (discussing innovative manner of Germany's gigawatt-scale energy initiative).

180. See *infra* Parts III, IV, and V for a discussion of storage-as-transmission projects in the United States, Australia, and Germany, respectively.

the grid. Despite this challenge, existing frameworks and market incentives are already showing significant growth in certain market segments within the United States.[181] To a certain extent, recent FERC orders helped clarify some early regulatory ambiguities of battery storage.[182] In 2018, FERC Order No. 841 expanded the scope of energy storage's role within wholesale markets.[183] This order mandates RTO- and ISO-operated markets to allow qualified storage resources to participate in a wide range of energy-generation-related markets.[184] When faced with a challenge from industry groups, the U.S. Court of Appeals for the District of Columbia Circuit upheld Order No. 841, citing FERC's authority under the Federal Power Act to regulate the sale of electric energy at wholesale in interstate commerce.[185]

In 2020, FERC's Order No. 2222 elaborated on the Commission's previous rules by allowing aggregated behind-the-meter storage to similarly participate in wholesale markets.[186] Order No. 2222 clarified that private companies could aggregate the cumulative storage capacity of hundreds or thousands of small, customer-owned battery systems and sell their cumulative capacity as a wholesale power resource.[187] One shining example of this in practice is leading national developer Sunrun, which successfully aggregated customers' storage resources to offer peak demand services in places like California[188] and New England.[189] Order No. 2222 was heralded as a major win for distributed and decentralized clean energy and as a new business opportunity for tech-savvy developers to aggregate and coordinate small customer-owned resources for sale to different segments of the grid.[190]

---

181. See *supra* notes 144–46 and accompanying text for a discussion of how non-restructured jurisdictions have seen a disproportionate amount of storage investment.

182. *See* Electric Storage Participation in Markets Operated by Regional Transmission Organizations and Independent System Operators, 84 Fed. Reg. 23,902 (Aug. 21, 2019) [hereinafter Order No. 841] (to be codified at 18 C.F.R. pt. 35) (removing barriers to participation of electric storage resources in RTO/ISO markets); Participation of Distributed Energy Resource Aggregations in Markets Operated by Regional Transmission Organizations and Independent System Operators, 86 Fed. Reg. 16,511 (June 1, 2021) [hereinafter Order No. 2222] (to be codified at 18 C.F.R. pt. 35) (removing barriers to participation of distributed energy resources aggregations in RTO/ISO markets).

183. Order No. 841, *supra* note 182.

184. *Id.*

185. Nat'l Ass'n of Regul. Util. Comm'rs v. Fed. Energy Regul. Comm'n, 964 F.3d 1177, 1190 (D.C. Cir. 2020).

186. Order No. 2222, *supra* note 182.

187. *Id.*

188. Jeff St. John, *Sunrun Lands Contract for 20MW Backup Battery-Solar Project in Blackout-Prone California*, GREENTECH MEDIA (July 30, 2020) [hereinafter St. John, *Sunrun*] https://www.greentechmedia.com/articles/read/sunrun-lands-20mw-backup-battery-solar-contract-for-northern-california-communities.

189. Julian Spector, *Sunrun Wins Big in New England Capacity Auction with Home Solar and Batteries*, GREENTECH MEDIA (Feb. 7, 2019), https://www.greentechmedia.com/articles/read/sunrun-wins-new-england-capacity-auction-with-home-solar-and-batteries.

190. Jeff St. John, *'Game-Changer' FERC Order Opens up Wholesale Grid Markets to*

While FERC Orders No. 841 and No. 2222 signal important, new opportunities for storage resources to capture additional value-streams in wholesale power markets, their application has several practical limitations. Participating in multiple markets and collecting all values from all appropriate revenue streams requires considerable contractual complexity and adept navigation of multiple levels of power market bureaucracy. A sophisticated developer of utility-scale storage may have the requisite understanding of energy markets to properly align the incentives for a successful project. However, relying on thousands of small-scale storage owners to agree to aggregate and sell their batteries' capacity may prove difficult to satisfy the grid's anticipated storage needs—not to mention difficult to operate, even for sophisticated national developers like Sunrun.

Transmission and distribution operators themselves may be better positioned to recognize how, where, and when storage resources add the most value to their own networks, including how to use storage resources to defer traditional wires-based solutions for grid upgrades.[191] Increasing opportunities for distributed storage resources to participate in wholesale markets is a good thing,[192] but it should not overshadow regulated utilities' ability to offer their own solutions on their own networks. Cautious utilities and transmission operators may be hesitant to propose investing in storage, but as technology costs continue to decline, regulators at the state and federal levels should approve such investments under cost-of-service models, where they are more cost-effective than traditional wires-based solutions and therefore are just and reasonable.[193]

For battery storage to realize its full potential and to fully support a carbon-neutral electric grid, restructured energy jurisdictions need to pursue the right mix of regulatory collaboration and innovation. This pursuit includes encouraging more cost-of-service storage investment within the regulated distribution and transmission networks that structure the backbone of the electric grid, as opposed to only aggregating, unbundling, and selling storage capacity as an ad hoc generation resource in wholesale power markets.

B. Storage as Transmission: Waupaca Area Storage Project (2.5 MW)

Limiting and defining ownership, control, and use of a storage asset can allow transmission operators to procure a limited slice of storage's transmission-specific services and include these costs within their regulated cost-of-service tariffs. The question of whether or not storage can be utilized as a transmission asset—and therefore included in a cost-of-service model in a restructured jurisdiction—has been the subject of several recent FERC rulings. In the 2008 *Nevada Hydro* decision,

---

Distributed Energy Resources, GREENTECH MEDIA (Sept. 17, 2020) [hereinafter St. John, *Game-Changer*] https://www.greentechmedia.com/articles/read/ferc-orders-grid-operators-to-open-wholesale-markets-to-distributed-energy-resources.

191. *See* KUMARASWAMY ET AL., *supra* note 148, at 1 (discussing transmission companies' desire to look to energy storage in place of major system upgrades).

192. *See generally* St. John, *Game-Changer*, *supra* note 190.

193. *See* DELOITTE CTR. FOR ENERGY SOLUTIONS, *supra* note 45, at 9 ("Costs have been dropping so quickly . . . that decision-makers may have outdated notions . . . thinking that batteries still cost the same as they did a couple of years ago.").

FERC rejected a hydroelectric company's request that the California Independent System Operator (CAISO)—an independent system operator (ISO) under FERC jurisdiction—include the costs of a proposed pumped-hydro storage facility within its rate recovery tariff as a transmission asset.[194] The Commission stated that treating a storage facility as a cost-recoverable transmission asset would compromise CAISO's independence because it would require CAISO to make decisions about charging and discharging the facility, which would effectively require it to buy and sell power on its own market, in violation of restructuring principles.[195] Further, FERC stated that the purpose of CAISO's cost-of-service transmission tariff is to recover the costs of transmission facilities, not to cover the costs of the "bundled services" that such a storage facility would offer to the grid (i.e., the batteries' broader value stack).[196] The Commission found that it would be improper, under these circumstances, for an ISO to treat a storage facility as a transmission asset under a cost-of-service model.[197]

The Commission reached a different decision, under only slightly different circumstances, two years later in its *Western Grid* ruling, again dealing with an issue within CAISO.[198] In a 2010 proposal, Western Grid, a transmission operator, asserted that its batteries could help solve transmission reliability problems identified by CAISO at a significantly lower cost than traditional wires upgrades.[199] Although the batteries would be controlled by CAISO, the storage operator, Western Grid, would be responsible for charging and discharging them.[200] CAISO proposed that having full operational control and exclusive use of the batteries for transmission-supporting services maintained its independence.[201] Rather than buying and selling power on its own wholesale markets to charge and discharge, CAISO would only direct the batteries to alleviate thermal overload and address voltage support, leaving the responsibility to buy power and charge the batteries exclusively with Western Grid, the transmission operator.[202] Any incidental revenues from charging and discharging would be credited back to Western Grid's customers through a reduction in their transmission charges, rather than resold on CAISO's markets and potentially distorting the wholesale price of power.[203] Under these fact-specific circumstances, the Commission approved Western Grid's batteries as a transmission asset and allowed for cost-recovery within CAISO's tariff.[204] The Commission found that, because the proposed battery storage devices

---

194. The Nev. Hydro Co. Inc., 122 FERC ¶ 61,272 (Mar. 24, 2008) [hereinafter Nevada Hydro Decision].

195. *Id.* ¶ 81.

196. *Id.* ¶ 83.

197. *See id.* ¶ 82 (concluding that CAISO should not have operational control over LEAPS facility).

198. Western Grid Decision, *supra* note 179.

199. *Id.* ¶ 3.

200. *Id.*

201. *Id.* ¶ 22.

202. *Id.*

203. *Id.* ¶ 49.

204. *Id.* ¶¶ 47, 50.

would operate under the full control of CAISO and not participate in wholesale energy markets, the batteries could be treated as a transmission facility subject to regulated cost-recovery.[205]

Seven years later in 2017, FERC issued a Policy Statement on storage-as-transmission to clarify these two rulings.[206] The Policy Statement sets out guidance for resolving three ongoing issues. First, the Statement lays out how storage projects can utilize a combination of cost-based and market-based recovery for different services offered to avoid the problem of double-counting revenues to the detriment of ratepayers.[207] Storage projects can foreseeably serve multiple functions—both storage-as-transmission and other energy services in wholesale markets—as long as the transmission functions receive priority treatment.[208] Second, the Statement addresses how the cost-based recovery of storage-as-transmission assets could avoid distorting wholesale electricity prices to the detriment of market-based competitors.[209] Lastly, the Statement discusses how the degree of required RTO and ISO independence depends on the level and exercise of control over the storage resources in order to preserve the ring-fenced distinctions between transmission utilities, independent system operators, and regulators.[210]

In 2019, the Midcontinent Independent System Operator (MISO), an ISO covering a huge swath of North America from Manitoba to Louisiana, adapted to the precedent set by *Nevada Hydro* and *Western Grid* and applied lessons learned from FERC's Policy Statement.[211] As such, MISO requested that a new storage project—the proposed Waupaca Area Storage Project—be included within its transmission tariff for cost-recovery under a cost-of-service model.[212] In its proposal to FERC, American Transmission Co., a regulated transmission utility, would own and operate a 2.5 MW lithium-ion battery storage facility.[213] MISO asserted that (1) the storage project's owner, American Transmission, would be responsible for maintaining the necessary state of charge required to perform transmission functions, thus preserving MISO's independence; (2) MISO would exercise full functional control over the storage project for transmission purposes only, and would not be responsible for buying power to charge Waupaca's batteries; (3) any incidental revenues from charging and discharging the batteries would be credited back to American Transmission Co.'s customers; and (4) the Waupaca storage project was a preferred solution to a pre-identified transmission issue that would

205. *Id.* ¶¶ 47–50.

206. Utilizing Electric Storage, *supra* note 170, ¶ 1.

207. *Id.* ¶ 9; *see also* Schmitt & Sanford, *supra* note 73 (explaining double-counting problem).

208. Utilizing Electric Storage, *supra* note 170, ¶¶ 11, 23, 26.

209. *Id.* ¶ 13.

210. *Id.* ¶¶ 1, 13, 24–29.

211. Midcontinent Indep. Sys. Operator, Inc., 172 FERC ¶ 61,132 (Aug. 10, 2020) [hereinafter MISO Tariff Order].

212. *Id.* ¶¶ 6–7.

213. *ATC's Storage as Transmission Project Featured on Podcast*, AM. TRANSMISSION CO.: BLOG (Sept. 1, 2020), https://www.atcllc.com/whats-current/atcs-storage-as-transmission-project-featured-on-podcast/.

otherwise be more expensive to solve with traditional wires-based investments.[214]

In a decision issued in August 2020, FERC accepted MISO's proposal and allowed MISO to treat the storage project as a transmission facility eligible for regulated cost-recovery.[215] FERC analyzed the project under the FPA's just and reasonable standard and its own precedent set by *Nevada Hydro* and *Western Grid*.[216] It found that treating the Waupaca project as a transmission asset was just, reasonable, and not unduly discriminatory because the batteries were limited to serving transmission functions in the same manner that any other transmission asset, like wires or pylons, ordinarily would.[217] The storage facility would maintain its independence from MISO because, while American Transmission would be responsible for buying power to charge the batteries, contractually, MISO would have the ability to draw from the batteries whenever a transmission need arose.[218] To cover the costs of building the project, both MISO and American Transmission could pass their costs into their approved cost-of-service revenue streams.[219]

FERC's recent decision to include the Waupaca project within MISO's tariff confirms that, under certain identified circumstances, the regulatory foundation has already been laid for transmission operators to invest in storage within regulated cost-of-service models in restructured jurisdictions in the United States. FERC's *Waupaca* precedent could have sweeping impacts if it encourages transmission operators and RTOs/ISOs in other parts of the country to similarly invest in storage under cost-of-service mechanisms within their tariffs. For example, PJM Interconnection—the largest RTO in the United States, covering the mid-Atlantic and parts of the Midwest—already has some of the highest installed capacity of storage in the country.[220] However, the majority of these projects are owned by independent power producers that sell into competitive markets for generation-related services.[221] PJM's current power mix is dominated by nuclear, coal, and gas, though a quickly growing share comes from intermittent wind and solar.[222] Rapid growth in renewable generation could soon put increased pressure on PJM's transmission infrastructure, resulting in congestion and other resiliency issues on the grid.

According to global management consulting firm McKinsey's projected status quo growth scenario, PJM will require about 10 GW of storage to balance the grid by 2040.[223] However, under a deep decarbonization scenario, which forecasts much

214. MISO Tariff Order, *supra* note 211, ¶ 5.

215. *Id.* ¶¶ 1, 73–74.

216. *Id.* ¶¶ 12, 18.

217. *Id.* ¶¶ 71, 107.

218. *Id.* ¶ 56.

219. *Id.* ¶ 54.

220. U.S. ENERGY INFO. ADMIN., *supra* note 70, at 9.

221. *Id.* at 6.

222. PJM, REGIONAL TRANSMISSION EXPANSION PLAN 7 (2020), https://www.pjm.com/library/reports-notices/rtep-documents.aspx.

223. Rory Clune et al., *A 2040 Vision for the US Power Industry: Evaluating Two Decarbonization Scenarios*, MCKINSEY & CO. (Feb. 21, 2020), https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/a-2040-vision-

higher penetrations of renewables, three times as much storage capacity would be needed—about 30 GW—to balance the grid.[224] Exactly how much of this storage capacity would come from private developers selling services into wholesale power markets versus storage facilities operated by regulated public utilities remains to be seen, but if PJM follows MISO's lead, a growing proportion of storage investment could come directly from transmission utilities, as opposed to exclusively private generators. Tellingly, PJM initiated a study in 2019 to determine how energy storage could be used as a transmission resource, the results of which are forthcoming.[225]

The regulatory framework and precedent are arguably set for treating battery storage as a transmission asset in restructured markets in the United States. Opening up the storage market to transmission operators could untap an important opportunity for building out the necessary grid infrastructure to help accommodate the clean energy transition. As some storage industry representatives advocate, FERC could also develop additional rulemaking to give clarity—beyond its precedents and Policy Statement—for how to include storage-as-transmission within transmission tariffs.[226]

The United States' emerging experience with regulating battery storage should serve as a model for other restructured jurisdictions around the world. In the United States, MISO's innovative contract for storage-as-transmission maintained its independence from the transmission operator while allowing the transmission operator to finance the storage project under its cost-of-service rate structure. However, MISO's experiment with storage-as-transmission is not unique to the United States.[227] In fact, in contrast to the massive storage-as-transmission projects already under construction in Australia and Germany,[228] the 2.5 MW Waupaca project seems comparatively unambitious in scale.

IV. AUSTRALIA

A. Legal & Regulatory Regime

Recent investments in battery storage-as-transmission infrastructure in Australia[229] show how stakeholders in restructured jurisdictions can innovate around

---

for-the-us-power-industry-evaluating-two-decarbonization-scenarios.

224. *Id.*

225. PJM, *supra* note 222, at 23.

226. Energy Storage Assoc., No. 11640205.1.2, Opinion Letter on Midcontinent Indep. Sys. Operator, Inc. (Jan. 21, 2020), https://energystorage.org/wp/wp-content/uploads/2020/01/2019-Policy-Position-Storage-as-Transmission.pdf.

227. Morton, *supra* note 179.

228. *See id.* (describing Australia's plan to build 300MW battery in Victoria to aid non-dispatchable energy generation); Andreas Franke, *German Grid Operators Plan Mega-Batteries to Reduce Redispatch Costs*, S&P GLOB. MKT. INTEL. (Feb. 14, 2019), https://www.spglobal.com/marketintelligence/en/news-insights/trending/_GQgJi6WJjXBMhUzHN3VRw2 (detailing German transmission system operator TransnetBW GmbH's plans for 500MW battery to boost grid).

229. Natalie Filatoff, *Batteries Boom in Australia as Renewable Investments Decline*, PV MAG. (June 1, 2021), https://www.pv-magazine.com/2021/06/01/batteries-boom-in-australia-as-renewable-investments-decline/.

regulatory uncertainty to deploy batteries at a massive scale to support the transition to cleaner energy on resource-constrained grids. Spanning over 5,000 kilometers, Australia has one of the world's *longest* interconnected power systems, known as the National Electricity Market (NEM).[230] Similar to the United States, Australia's power sector underwent a wave of privatization in the 1990s.[231] Restructuring and deregulation of Australia's grid began with the National Electricity Law (NEL), first enacted by the state of South Australia's National Electricity Act of 1996, and then adopted by other jurisdictions through mirroring legislation.[232] Under the NEL, Australia's grid assets are owned either by private entities or state governments with clear ring-fencing and separation between (i) private generation and (ii) regulated transmission and distribution assets.[233]

The NEL and its companion regulations, the National Electricity Rules (NER), also set out processes for liberalizing electricity markets, such as establishing several key regulators, like the Australian Energy Market Operator (AEMO).[234] The AEMO's role in Australia's energy sector is similar to the role of RTOs and ISOs in the United States: AEMO's chief responsibility is to regulate wholesale electricity markets.[235] However, unlike the RTOs in the United States, Australia has a separate regulator—the Australian Energy Regulator (AER)—that more closely regulates the electricity sector's natural monopolies: the transmission and distribution sectors.[236] Importantly, the AER regulates the revenues of transmission operators, also called Network Service Providers (NSP).[237] The AER ensures that transmission operators are independent from other market actors and establishes revenue caps for transmission investments.[238] Similar to the "just and reasonable" standard in the United States, Australian NSPs are given a reasonable opportunity to recover "at least the efficient costs" of providing network services.[239] The AER determines the efficient costs of providing transmission network services and puts a corresponding ceiling on the revenues and prices that a transmission operator can charge or earn

230. AUSTL. ENERGY REGUL., STATE OF THE ENERGY MARKET 2020, at 69 (2020) [hereinafter STATE OF THE ENERGY MARKET], https://www.aer.gov.au/publications/state-of-the-energy-market-reports/state-of-the-energy-market-2020.

231. Rabindra Nepal & John Foster, *Electricity Networks Privatization in Australia: An Overview of the Debate*, 48 ECON. ANALYSIS & POL'Y (forthcoming 2015) (manuscript at 2–3) (on file with author).

232. *See National Electricity (South Australia) Act 1996* (implementing National Electricity Law by reference); *Australian National Uniform Law Schemes and Associated Legislation of Participating Jurisdictions*, AUSTRALASIAN PARLIAMENTARY COUNS.'S COMM. (Nov. 2020), https://pcc.gov.au/ (click "Australian National Uniform Law Schemes and Associated Legislation").

233. *See id.* sch National Electricity Law s 11 (explaining that a person cannot engage in the interconnected national electricity system unless the person is registered or subject of a derogation).

234. *See id.* sch National Electricity Law pt 5 (defining role of AEMO under NEL).

235. *See id.* sch National Electricity Law s 49(1)(a) (establishing function of AEMO to operate and administer wholesale exchange).

236. *See id.* sch National Electricity Law pt 3 (establishing function and powers of AER).

237. *Id.* sch National Electricity Law s 15.

238. *See id.* sch National Electricity Law s 18A–18Y (requiring AER to promote effective competition and establish binding rate of return instruments).

239. *Id.* sch National Electricity Law s 7A.

during a given regulatory period.[240] Transmission operators must periodically apply to the AER to reassess their revenue requirements based on their anticipated needs for maintaining a stable and secure grid.[241]

B. Battery Storage & the Clean Energy Transition

Like many other parts of the world, Australia's electric grid is quickly transitioning towards greater renewable energy generation.[242] Though coal-fired power plants still provide around 68% of Australia's electricity needs, a rising proportion of electricity is provided by wind (8.2%) and solar (7.7%) facilities.[243] As aging coal generators slowly exit the market,[244] 93% of all new power plant investments since 2012 have been in wind and solar projects.[245] Between 2009 and 2011, Australia's installed solar capacity increased tenfold.[246] Between 2011 and 2016, installed solar capacity quadrupled.[247] Most of the initial investments in renewable energy were driven by aggressive feed-in tariffs and renewable energy targets set at the federal level.[248] Despite already having reached their mandated targets,[249] high levels of renewables investment persist, mostly because building new renewables facilities is cheaper than building any other kind of generation resource today.[250]

Australia's electric grid has several distinctive characteristics that give rise to unique grid management issues as it transitions towards a greater reliance on renewable, but intermittent resources.[251] Because of Australia's large size and the particular concentration of its population, most of Australia's electric grid hugs the

---

240. *See id.* sch National Electricity Law s 18F–18Y (granting AER power to make binding rate of return instruments).

241. *Our Role in Networks*, AUSTL. ENERGY REGUL., https://www.aer.gov.au/networks-pipelines/our-role-in-networks (last visited Sept. 28, 2021).

242. *See* STATE OF THE ENERGY MARKET, *supra* note 230, at 13, 36 (describing trends in Australian energy generation).

243. *Id.*

244. *See id.* at 13 ("Around 15 per cent of the NEM's coal generation capacity in 2010 has since retired, and a further 29 per cent is scheduled to retire by 2035.").

245. *Id.*

246. Ali Danyal, *Solar Power in Australia – Future*, AUSTL. SOLAR CTR. (June 12, 2018), https://australiansolarcentre.com.au/solar-power-in-australia-future/.

247. *Id.*

248. *See* STATE OF THE ENERGY MARKET, *supra* note 230, at 13.

249. *See Renewable Energy Target Scheme*, DEP'T INDUS., SCI., ENERGY & RES., https://www.industry.gov.au/funding-and-incentives/renewable-energy-target-scheme (Oct. 22, 2021) (noting 33,000GWh target was met in 2021 and that annual target will remain same through 2030).

250. *See Renewables Increasingly Beat Even Cheapest Coal Competitors on Cost*, INT'L RENEWABLE ENERGY AGENCY (June 2, 2020), https://www.irena.org/newsroom/pressreleases/2020/Jun/Renewables-Increasingly-Beat-Even-Cheapest-Coal-Competitors-on-Cost ("[M]ore than half of the renewable capacity added in 2019 achieved lower power costs than the cheapest new coal plants.").

251. Liz Hobday & Lisa Divissi, *Australia's Old Powerlines Are Holding Back the Renewable Energy Boom*, ABC NEWS (Sept. 1, 2019), https://www.abc.net.au/news/2019-09-02/powerline-infrastructure-holding-back-renewable-energy-boom/11457694.

continent's southeastern and eastern coastlines.[252] Unlike the U.S. transmission grid—a network that interconnects across different regions at multiple nodes[253]—Australia's transmission grid is shaped like a boomerang.[254] The grid overlays the southeast corner of the continent: going eastward, it connects South Australia, to Victoria, to New South Wales, and then up north to Queensland.[255] In contrast to networked grids, Australia's transmission grid does not connect at either end.[256] This curvilinear grid layout has presented several issues for integrating large amounts of renewable power and transmitting it to where electricity is needed.[257] Similar to the United States, the regions with the best conditions for wind and solar are located far away from Australia's population centers.[258] Australia's transmission problems are further compounded because the sunniest and windiest regions are located at the peripheries of its oblong grid, in places with relatively weak transmission capacity.[259]

The geographic concentration of renewable energy resources at the tips and edges of Australia's grid places an increased reliance on its transmission network.[260] As more renewables come online, existing transmission lines need additional capacity to transmit large influxes of power during optimal weather conditions.[261] These weather dynamics have led to increased volatility in electricity prices.[262] In 2019, Australia's power markets set a new record for the number of times its power prices went negative.[263] In similar high-output, low-demand scenarios that create negative power prices, inadequate transmission capacity has increased the risk of congestion and forced curtailment.[264]

Even more concerning, however, is the way Australia's grid architecture has led to grid security issues, like the widespread rolling blackouts South Australia

---

252. *Energy in Australia 2009*, GLOB. ENERGY NETWORK INST. FOUND., https://www.genifoundation.org.au/images/Energy_Grid_Aust_2009_April_m.jpg (last visited Feb. 17, 2021) (diagramming Australia's transmission lines).

253. *United States Transmission Grid*, WIKIMEDIA COMMONS, https://upload.wikimedia.org/wikipedia/commons/d/d4/UnitedStatesPowerGrid.jpg (last visited Feb. 17, 2021) (diagramming U.S. transmission lines).

254. *See Energy in Australia 2009*, *supra* note 252 (showing shape of Australia's transmission system).

255. *Id.*

256. *Id.*

257. *See* Kiran Kumaraswamy, *Reworking the Grid's Circulatory System: Energy Storage as a Transmission Asset*, FLUENCE (June 13, 2019), https://blog.fluenceenergy.com/australia-energy-storage-solutions-transmission-asset (describing congestion in Australia's transmission lines).

258. Hobday & Divissi, *supra* note 251.

259. *Id.*

260. *See* Julian Spector, *Australia Picks Massive Tesla-Supplied Battery to Ease Transmission Constraint*, GREENTECH MEDIA (Nov. 10, 2020) [hereinafter Spector, *Australia*] https://www.greentechmedia.com/articles/read/australia-picks-massive-tesla-battery-to-ease-transmission-constraint (describing current deficiencies in Australia's transmission lines).

261. *Id.*

262. See STATE OF THE ENERGY MARKET, *supra* note 230, at 14 (discussing fluctuations in Victoria's energy prices due to extreme weather in areas of Australia).

263. *Id.*

264. *See id.* at 12 (diagramming curtailment of renewable energy in 2020).

faced in 2017.[265] During the summer months with high wind and solar production, large amounts of power flood South Australia's electric grid at times when there is relatively little local demand for power.[266] In 2017, South Australia was acutely affected by rolling blackouts: millions of customers lost power when a series of storms knocked out several transmission lines, which shut off power generation from the grid's tips and cut power off from the rest of the region.[267] These blackouts caused severe disruption over several months.[268] In response, the government of South Australia put out an open call for competitive bids to address the need for more stability on its section of Australia's grid.[269]

Elon Musk, the CEO of Tesla,[270] responded to South Australia's bid with a tweet and a wager: Tesla could not only solve South Australia's grid stability problem with a massive, utility-scale battery storage project, but also it could install and commission the system within one hundred days of signing the contract.[271] If Tesla failed to build the project on time, it would build the project for free.[272] Tesla eventually won a AU$90 million contract to build a 100 MW utility-scale storage project, the largest lithium-ion battery storage project in the world.[273] Though the project was officially named the "Hornsdale Power Reserve" because it was co-located with the existing Hornsdale Wind Farm, the project is now colloquially referred to as the "Tesla Big Battery."[274] Individual batteries are packed in shipping-container-sized "Powerpacks."[275] In terms of physical footprint, the entire project is about as large as a suburban big box store.[276] Relative to the amount of space and

265. *See Thousands Still Without Power as Wild Weather Continues*, INDAILY (Sept. 28, 2016), https://indaily.com.au/news/local/2016/09/28/thousands-still-without-power-as-wild-weather-continues/ (providing a map locating numerous blackouts in South Australia).

266. *See* Matthew Doran, *SA Weather: No Link Between Blackout and Renewable Energy, Experts Say*, ABC NEWS (Sept. 28, 2016), https://www.abc.net.au/news/2016-09-29/sa-weather:-no-link-between-blackout-and-renewables-expert-says/7887052 (discussing reliance on renewable energy in South Australia); *see also* STATE OF THE ENERGY MARKET., *supra* note 230, at 41 (explaining changing patterns in demand for electricity due to reliance on renewable sources).

267. *See* Doran, *supra* note 266 ("That infrastructure failure put extra strain on the interconnector system that links the South Australian electricity grid with the east coast — and tripped safeguards which shut down the power supply to the state.").

268. *Id.*

269. Spector, *Australia*, *supra* note 260.

270. In addition to manufacturing batteries for electric vehicles, Tesla also manufactures utility scale batteries. Tesla Team, *Introducing Megapack: Utility-Scale Energy Storage*, TESLA (July 29, 2019), https://www.tesla.com/blog/introducing-megapack-utility-scale-energy-storage.

271. Elon Musk (@elonmusk), TWITTER (Mar. 9, 2017, 9:50 PM), https://twitter.com/elonmusk/status/840032197637685249.

272. *Id.*

273. Giles Parkinson, *Revealed: True Cost of Tesla Big Battery, and its Government Contract*, RENEW ECON. (Sept. 21, 2018), https://reneweconomy.com.au/revealed-true-cost-of-tesla-big-battery-and-its-government-contract-66888/.

274. *Id.*

275. *Powerpack*, TESLA, https://www.tesla.com/powerpack (last visited Feb. 17, 2021).

276. *See* Fred Lambert, *Tesla's Giant Battery in Australia Reduced Grid Service Cost by 90%*, ELECTREK (May 11, 2018, 7:45 AM) [hereinafter Lambert, *Reduced Grid Service*], https://electrek.co/2018/05/11/tesla-giant-battery-australia-reduced-grid-service-cost/ (providing images of Tesla's Powerpack battery in Australia).

rights of way required to upgrade an entire high-voltage transmission line, the Tesla Big Battery—like utility-scale storage in general—is significantly less land-intensive.[277]

Though it supports grid stability, the Tesla Big Battery is technically a generation asset, not a transmission asset.[278] French renewables developer, Neoen, owns and operates the project, and sells its services on wholesale energy markets.[279] The batteries supplement the nearby wind farm's output by load shifting: when the wind farm generates more electricity than the transmission wires can transport, the excess electricity overflows into the batteries and charges them.[280] This transportation gives the grid greater "inertia," or flexibility when capacity is constrained, and more flexibility helps prevent blackouts.[281] The Tesla Big Battery also provides additional ancillary services for generation markets, including frequency regulation.[282] After six months of operation, the batteries were responsible for 55% of all frequency regulation services in South Australia.[283] Together, the batteries reduced the cost of grid services in the AEMO wholesale market by 90%,[284] mostly by replacing 35 MW of expensive fuel-powered ancillary generators (i.e., peaker plants).[285] In its first two years alone, the project saved consumers over AU$150 million.[286] Beyond just serving South Australia's particular grid needs, the Tesla Big Battery is a massive display of how grid-scale battery storage technology has matured enough to address some of the most pressing security issues faced by grids in the midst of clean energy transitions, and how it can do so cost-effectively.

C. Storage as Transmission: Victorian Big Battery (300 MW)

A new Australian project is even more clearly illustrating battery storage's potential, specifically as it applies to transmission infrastructure. Though the Tesla Big Battery is still the biggest battery in the world, the "Victorian Big Battery" recently won a bid to construct a battery three times larger than Tesla's.[287] The

---

277. Spector, *Australia*, *supra* note 260.

278. Julian Spector, *Tesla Fulfilled Its 100-Day Australia Battery Bet. What's That Mean for the Industry?*, GREENTECH MEDIA (Nov. 27, 2017), https://www.greentechmedia.com/articles/read/tesla-fulfills-australia-battery-bet-whats-that-mean-industry.

279. Fred Lambert, *Tesla's Giant Battery Saved $40 Million During Its First Year, Report Says*, ELECTREK (Dec. 6, 2018, 7:04 AM) [hereinafter Lambert, *Saved Millions*], https://electrek.co/2018/12/06/tesla-battery-report/.

280. *See* Giles Parkinson, *Tesla Big Battery Adds New Capacity and Services on March to 100pct Renewables Grid*, RENEW ECON. (Nov. 19, 2019), https://reneweconomy.com.au/tesla-big-battery-adds-new-capacity-and-services-on-march-to-100pct-renewables-grid-55121/ (diagramming evolution of South Australia's Big Battery).

281. *Id.*

282. Lambert, *Reduced Grid Service*, *supra* note 276.

283. *Id.*

284. *Id.*

285. Lambert, *Saved Millions*, *supra* note 279.

286. *Overview*, HORNSDALE POWER RSRV., https://hornsdalepowerreserve.com.au/ (last visited Feb. 17, 2021).

287. Morton, *supra* note 179.

project is expected to come online by November 2021 and is contracted to provide services through 2032.[288]

Even more noteworthy than its scale, the Victorian Big Battery will be one of the world's first battery projects to operate as transmission infrastructure.[289] Neoen also owns the Victorian Big Battery.[290] Instead of only selling the battery's services on wholesale markets, the Victorian Big Battery will also tender transmission services directly to AEMO, Australia's wholesale market operator.[291] Given the weather-dependent nature of renewables, the 300 MW battery system will provide up to 250 MW of additional transmission capacity during the peak-output summer months between November and March.[292] The battery will guarantee instantaneous power delivery in the event of an unexpected power outage, giving the transmission network extra stability and flexibility as it balances influxes of renewable energy and transmits it to different areas of the grid.[293] The remaining 50 MW of battery capacity will participate as a supply resource in wholesale markets.[294] At other times of the year, when renewable output is not as high, the full 300 MW of capacity will participate in wholesale markets, earning additional revenues.[295] Though the Victorian Big Battery is still under construction, once completed, consumers are expected to save AU$220 million from reductions in the cost of electricity service.[296] Just as the Tesla Big Battery signaled the advent of a new era for large grid-scale storage generally, the Victorian Big Battery is a "massive signpost" that battery storage will specifically be a key asset for transmission infrastructure during the clean energy transition.[297]

Similar to the Waupaca storage project in the United States, the Victorian Big Battery provides a cost-effective storage-as-transmission service within the parameters of its restructured regulatory context. A private entity owns the storage asset itself, but it is controlled, in part, by a regulated entity (AEMO), which receives priority rights for drawing power from the battery whenever it is needed.[298] The separate allocation of ownership and control sidesteps *some* restructuring issues because it provides priority transmission services at lower rates and is therefore more efficient than other possible options (e.g., instead of building more high-voltage

288. Spector, *Australia*, *supra* note 260.

289. *Id.*

290. *Id.*

291. *Id.*

292. Dep't of Env't, Land, Water & Planning, *The Victorian Big Battery*, VICTORIA STATE GOV'T (June 11, 2020), https://www.energy.vic.gov.au/renewable-energy/the-victorian-big-battery.

293. Spector, *Australia*, *supra* note 260.

294. Dep't of Env't, Land, Water & Planning, *supra* note 292.

295. *Id.*

296. Giles Parkinson, *Neoen, Tesla Win Contract to Build Australia's Biggest Battery in Victoria*, RENEW ECON. (Nov. 5, 2020), https://reneweconomy.com.au/neoen-tesla-win-contract-to-build-australias-biggest-battery-in-victoria-87327/.

297. Spector, *Australia*, *supra* note 260.

298. See *id.* (The battery is set to come online by November 2021, fulfilling a System Integrity Protection Scheme contract with AEMO through 2032. That grid jargon means that the battery will guarantee instantaneous power in case in transmission network suffers an unexpected outage.").

transmission lines).[299]

However, other restructuring issues—particularly independence and ring-fencing—are arguably more suspect with the Victorian Big Battery than they are with the Waupaca project in the United States.[300] Though regulators approved the Victorian Big Battery for cost-of-service rate-recovery, it is unclear if, and by how much, its services may distort wholesale energy markets—and therefore other market participants—if the project must purchase electricity on wholesale markets to charge and discharge its batteries. This could open the door to incidental revenues from energy arbitrage and volatile power price fluctuations. Some commentators have cautioned that "[w]hile it is clear this battery will participate in the energy market, it is not clear who will make decisions on when or how it will be used, which will unavoidably affect other market participants."[301] Unlike FERC's distinctions in *Waupaca*,[302] Australian regulators appear to have prioritized energy security and cost-efficiency over market purity by not factoring in the potential ripple effects of wholesale market distortions.[303] While this may not be surprising given the gravity and urgency of Australia's grid needs, this decision could provide industry groups a legal avenue for later challenges to cost-of-service storage-as-transmission in the future.

Together, the United States and Australia have both used a regulator-first approach to storage-as-transmission: proposing and approving novel projects through administrative proceedings that interpreted existing restructuring laws within the principles of energy liberalism.[304] This approach stands in contrast to other restructured jurisdictions, like the European Union, which are piloting new projects in response to top-down legislative clarifications for the role of battery storage within restructured energy markets.[305] The simple explanation is that this difference in approaches is a result of different legal systems—common law in Australia and the United States, versus civil law in the European Union. Nevertheless, this contrast is relevant for other jurisdictions contemplating storage-

299. See Spector, *Australia*, *supra* note 260 (noting that storage-as-transmission can avoid contentious permitting battles for new transmission lines).

300. *See* Bridget Rollason, *Victoria's New Tesla Battery in Moorabool to Drive Down Power Prices, State Government Says*, ABC NEWS (Nov. 4, 2020, 9:17 PM), https://www.abc.net.au/news/2020-11-05/new-tesla-battery-for-moorabool-victoria/12851698 (considering arguments that Victorian Big Battery will help utility costs and discussing fears that it will adversely affect other market participants).

301. *Id.*

302. See *supra* Section III.B for a discussion of FERC's rationale for its *Waupaca* decision.

303. *See* Rollason, *supra* note 300 (discussing impact of Victorian Big Battery on other market providers).

304. See *supra* Sections III.A and IV.A for a discussion of the United States' and Australia's regulator-first approach to storage-as-transmission. Specifically, the AEMO chiefly regulates Australia's wholesale electricity markets in a similar way that RTOs and ISOs do in the United States.

305. Vivienne Halleux, European Parliamentary Rsch. Serv., *New EU Regulatory Framework for Batteries: Setting Sustainability Requirements*, PE 689.337 (2021), https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/689337/EPRS_BRI(2021)689337_EN.pdf.

as-transmission in that national policies can play an important role in clarifying storage's regulatory ambiguities.[306]

V. GERMANY

A. Legal & Regulatory Regime

Like Australia and the United States, innovative storage-as-transmission projects in Germany are circumventing the regulatory uncertainties of restructured power markets. Germany is connected to the Synchronous Grid of Continental Europe—the largest electrical grid in the world—which serves over four hundred million customers across twenty-four different countries, including most European Union member states.[307] Germany's electric grid is, thus, more similar to the United States' networked regional electric grid than it is to Australia's boomerang-shaped, curvilinear grid.[308]

Similar to the United States and Australia, Germany also began restructuring its electricity industry in the late 1990s. In the initial move towards liberalization of its interconnected energy markets, the European Union's first energy directive was formally adopted by member states in 1996.[309] Germany incorporated aspects of the European Union's energy liberalization package through the reform of the Energy Industry Act (*Energiewirtschaftsgesetz,* or EnWG) of 1998.[310] Germany, however, was the only E.U. country that initially decided against a regulatory approach and instead opted for an alternative framework, which called for "negotiated grid access."[311] Rather than regulate and approve the revenues and rate structures of generators, transmission operators, and distribution utilities, industry groups and consumer advocates directly negotiated participation in German energy markets until 2003.[312] This unique approach was largely in response to Germany's long history of centralized, vertically integrated energy monopolies with strong ties to organized labor.[313] However, in 2003, a second E.U. energy package called for

306. See *supra* Section II.B for a discussion on the role of national policies in clarifying storage's regulatory ambiguities.

307. Bruno Lajoie, *Europe's Interconnected Electricity System: An In-Depth Analysis*, MEDIUM: ELECTRICITYMAP (June 8, 2018), https://medium.com/electricitymap/what-does-it-take-to-decarbonize-europe-d94cbed80878.

308. Fabian Hofmann et al., *Flow Allocation in Meshed AC-DC Electricity Grids*, ENERGIES, Mar. 6, 2020, at 1, 9 fig.3, https://mdpi-res.com/energies/energies-13-01233/article_deploy/energies-13-01233.pdf.

309. Directive 96/92/EC, of the European Parliament and of the Council of 19 December 1996 Concerning Common Rules for the Internal Market in Electricity, 1997 O.J. (L 027) 20, 20.

310. *See* KONSTANTIN LENZ ET AL., AGORA ENERGIEWENDE, THE LIBERALISATION OF ELECTRICITY MARKETS IN GERMANY: HISTORY, DEVELOPMENT AND CURRENT STATUS 13 (2019), https://www.agora-energiewende.de/fileadmin2/Projekte/2019/Liberalisation_Power_Market/Liberalisation_Electricity_Markets_Germany_V1-0.pdf (discussing first steps of market liberalization in Germany).

311. *Id.*

312. *See id.* at 14 (discussing parties involved in negotiations for conditions for grid access).

313. *See* Lukas Prinz & Anna Pegels, *The Role of Labour Power in Sustainability Transitions: Insights from Comparative Political Economy on Germany's Electricity Transition*, 41 ENERGY

further market liberalization and required Germany to finally "unbundle" its electric monopolies into ring-fenced, distinct generation, transmission, and distribution corporations, paralleling other restructured jurisdictions worldwide.[314]

Domestically, these requirements were eventually incorporated into German law with a major amendment to the EnWG in 2005.[315] In addition to addressing restructuring, the 2005 amendment called for the creation of a national energy regulatory authority.[316] The Federal Network Agency, or *Bundesnetzagentur* (BNetzA), was charged with regulating previously negotiated grid access and with supervising the unbundling of large German utilities.[317] Under the BNetzA's authority, utilities were unbundled into separate competitive energy suppliers (with wholesale generation assets) and regulated enterprises—Transmission Service Operators (TSOs) and Distribution Service Operators (DSOs).[318]

Today, the BNetzA regulates Germany's four main transmission operators: Amprion GmbH, TenneT TSO GmbH, 50Hertz Transmission GmbH, and TransnetBW GmbH.[319] These four TSOs must submit to BNetzA their ten-year Network Development plans assessing their efficiency measures, the adequacy of their systems, and any transmission network security needs.[320] Importantly, these ten-year plans must identify all necessary infrastructure upgrades and expansion projects for BNetzA to review and approve after opportunities for public comment and oversight from the Federal Administrative Court.[321] Ownership of transmission assets must be "unbundled" to meet restructuring requirements, and infrastructure investments must be demonstrably competitive and cost-efficient to pass regulatory muster.[322]

B. Battery Storage & the Energiewende

By far, the most important legal and regulatory initiative in German energy law since the early 2000s is the German *Energiewende*, which was formally enacted and launched in 2011.[323] Literally meaning "energy turnaround" or "energy revolution," the *Energiewende* is the German government's overarching policy framework not only for a transition to clean energy, but also a transition away from a centralized

---

RSCH. & SOC. SCI. 210, 210 (2018) (describing vigor of Germany's industrial heritage around coal mining and its resultant strong ties to organized labor and vertically integrated energy monopolies).

314. Lenz, *supra* note 310, at 14.

315. *Id.*

316. *See id.* at 15 (discussing creation of the Federal Network Agency).

317. *Id.*

318. *Id.* at 18–19.

319. *ENTSO-E Member Companies*, ENTSO-E, https://www.entsoe.eu/about/inside-entsoe/members/ (last visited Feb. 17, 2021).

320. Fritz von Hammerstein, *Electricity Law and Regulation in Germany*, CMS (Jan. 1, 2015), https://cms.law/en/int/expert-guides/cms-expert-guide-to-electricity/germany.

321. *Id.*

322. *Id.*

323. *See* David Jacobs, *The German* Energiewende *– History, Targets, Policies and Challenges*, 3 RENEWABLE ENERGY L. & POL'Y REV. 223, 223–25 (2012) (explaining origination and effects of legislation).

power system and toward a decentralized, consumer-owned power system.[324] Some *Energiewende* policies, such as subsidies and feed-in tariffs for rooftop solar,[325] have been so successful that some experts credit them with jumpstarting the modern global solar industry.[326] Other experts even suggest that Germany's massive policy-driven demand drove the manufacturing innovations in Chinese-produced solar modules, which in turn led to the most significant cost-of-scale improvements and to the sharpest equipment cost declines from which renewables developers still benefit to this day.[327] Thanks in part to ambitious *Energiewende* targets, Germany has some of the highest penetrations of renewable energy in the world today, with 25% of electricity coming from wind and 9% coming from solar.[328] In line with the updated targets passed in December 2020, Germany appears on track to reach a 65% share of renewables by 2030.[329]

Despite Germany's leadership and historically high penetration of renewable generation, up until recently, the European and German legal frameworks left the role for battery storage within energy markets poorly defined. Until 2019, there was no definition whatsoever for the term "energy storage" in the EnWG or other relevant energy laws, which made batteries an awkward fit within the German liberalized market setting.[330] Although storage remains ill-defined, *Energiewende* policies that encourage self-consumption of residential rooftop solar power provide significant incentives for customer-owned, behind-the-meter storage projects in the residential sector.[331] Around half of all new residential solar photovoltaic systems in

---

324. *See id.* at 223–25, 231 (describing translation of *Energiewende,* its representation of a transition from fossil fuels and nuclear energy to renewable energy sources, and the current and potential participation of private citizens in the market).

325. *See* Spencer Fields, *Feed-in Tariffs: A Primer on Feed-in Tariffs for Solar*, ENERGYSAGE (Apr. 15, 2021), https://news.energysage.com/feed-in-tariffs-a-primer-on-feed-in-tariffs-for-solar/ (defining feed-in tariffs).

326. *See* Christian Roselund & John Bernhardt, *Has Germany's Energy Transition Stalled?*, IEEE SPECTRUM (May 4, 2015), https://spectrum.ieee.org/has-germanys-energy-transition-stalled ("This policy led to a rapid growth of solar and established a model that has been adopted by many other countries.").

327. *See* John Fialka, *Why China is Dominating the Solar Industry*, SCI. AM. (Dec. 19, 2016), https://www.scientificamerican.com/article/why-china-is-dominating-the-solar-industry/ (explaining how China responded to Germany's increased clean energy demand by mass producing solar technology).

328. *Public Net Electricity Generation in Germany 2019: Share from Renewables Exceeds Fossil Fuels*, FRAUNHOFER ISE (Jan. 15, 2020), https://www.ise.fraunhofer.de/content/dam/ise/en/documents/News/0120_e_ISE_News_Electricity%20Generation_2019.pdf.

329. Dave Keating, *Germany Commits to 65% Renewable Power by 2030*, FORBES (Dec. 29, 2020, 7:12 AM), https://www.forbes.com/sites/davekeating/2021/12/29/germany-commits-to-65-renewable-power-by-2030/.

330. *See* Mira Klausen, *Market Opportunities and Regulatory Framework Conditions for Stationary Battery Storage Systems in Germany*, 135 ENERGY PROCEDIA 272, 281 (2017) ("The system consideration 'energy storage' does not exist: in the EnWG (as well as in other relevant laws) there is no definition of the term 'energy storage' . . . .").

331. *See* Andy Colthorpe, *Germany: Growth in Home and Industrial Sectors but Large-Scale Battery Storage Slowed Down in 2019*, ENERGY STORAGE NEWS (Dec. 7, 2020), [hereinafter Colthorpe, *Germany: Growth*], https://www.energy-storage.news/germany-growth-in-home-and-

Germany now include a battery.[332]

Compared to residential storage, commercial storage and utility-scale storage suffered more acutely from this lack of regulatory definition.[333] Presently, Germany has about twenty utility-scale storage projects installed with less than 48 MW of cumulative capacity—a stark contrast to its roughly 385 MW of residential storage capacity.[334] Most non-residential storage projects are designed to act as generators for frequency regulation or coupled with other generators, like wind and solar farms.[335]

Since 2019, however, a new European Clean Energy Package (CEP), which some have likened to a European "Green New Deal" in terms of overarching policy ramifications,[336] has clarified the role and importance of storage within liberalized electric grids.[337] As a general rule, transmission and distribution service operators are still discouraged from owning and operating storage facilities, according to the unbundling rules of restructuring.[338] However, the 2019 CEP presented an important new caveat allowing regulated TSOs and DSOs to invest in and utilize storage resources if the projects are considered "fully integrated network components."[339] This legal recognition of the potential role of storage as a piece of energy infrastructure for regulated network operators, under certain contracting conditions, marks an important development in the European battery storage market.[340] Germany, in particular, has taken an active role in experimenting with new

industrial-sectors-but-large-scale-battery-storage-slowed-down-in-2019/ (describing economic and personal benefits pushing homeowners to invest in battery storage systems).

332. Sören Amelang, *Energy Storage and the Energiewende: Electricity Storage is Next Feat for Germany's Energy Transition*, CLEAN ENERGY WIRE (Oct. 10, 2018, 9:00 AM), https://www.cleanenergywire.org/dossiers/energy-storage-and-energiewende.

333. *See* Colthorpe, *Germany: Growth*, *supra* note 331 (discussing stagnant growth of battery storage in commercial contexts).

334. Amandine Delsaux et al., *Regulatory Progress for Energy Storage in Europe*, NORTON ROSE FULBRIGHT (Mar. 2019), https://www.nortonrosefulbright.com/en/knowledge/publications/8b5285f4/regulatory-progress-for-energy-storage-in-europe.

335. *See* Colthorpe, *Germany: Growth*, *supra* note 331 (explaining how renewable energy auctions or "Innovation Tenders" will allow for wind or solar projects to combine with storage).

336. *See* Dave Keating, *EU Beats U.S., Adopts Its Own Green New Deal*, FORBES (Dec. 11, 2019, 8:50 AM), https://www.forbes.com/sites/davekeating/2019/12/11/eu-beats-us-adopts-its-own-green-new-deal/?sh=7d0d3f0515de (comparing European Commission's legislation with U.S. proposals for Green New Deal).

337. *See* Brittney Elzarei, *The Clean Energy Package is Here – Now What?*, PVTECH POWER, Aug. 30, 2019, at 38, 38, https://solar-media.s3.amazonaws.com/assets/Pubs/ESN%20resources/The%20Clean%20Energy%20Package%20is%20here%20%E2%80%93%20now%20what.pdf (explaining how the CEP defines plans for energy storage within E.U. law).

338. *See Third Energy Package*, EUR. COMM'N (May 21, 2019), https://ec.europa.eu/energy/topics/markets-and-consumers/market-legislation/third-energy-package_en (explaining methods and purpose of unbundling in the European Union).

339. Elzarei, *supra* note 336, at 38.

340. *See id.* ("Prior to the CEP, the lack of clarity on ownership of storage held back the development of storage devices; addressing this point therefore represents an important step forward.").

opportunities for grid-scale battery storage within its regulated sectors, specifically among transmission operators.[341]

C. Storage as Transmission: GridBoosters Pilot (1,300 MW)

Despite its high levels of interconnection within the wider European electric grid, Germany has difficulty transmitting large amounts of renewable energy[342] within its domestic grid from good wind resources in the north to where more power is needed in the bigger population centers in the west and south.[343] At the same time, because of its high connectivity with the European grid, more and more of Germany's existing transmission capacity is used for cross-border power flows and thus constantly needs expanding and upgrading in order to accommodate its unique position at the crossroads of multiple continental transmission lines.[344]

Since the 2019 CEP's clarification of the potential role for storage on transmission networks, German grid operators proposed—and the BNetzA has approved—a massive demonstration project for storage-as-transmission within its restructured legal framework. Named the "GridBooster," the pilot involves the construction of a cumulative 1,300 MW of battery storage across five facilities to efficiently address Germany's need for more transmission capacity.[345] Depending on construction schedules, the 300 MW Victorian Big Battery in Australia may only be the world's largest battery for a brief window of time—the largest single GridBooster facility, located in the small town of Kupferzell, a major north-south transmission hub, will be 500 MW.[346]

Similar to the Waupaca project in the United States and the Victorian Big Battery in Australia, the GridBoosters are designed to act as "virtual" transmission infrastructure.[347] In periods of high grid load (e.g., when wind farms in the north are producing at their highest capacity), the GridBoosters will kick on and charge their batteries with spillover electricity to protect transmission lines from overheating.[348]

341. *See* Amelang, *supra* note 332 (discussing Germany's new energy storage methods).

342. *See* Jason Deign, *Germany's Maxed-Out Grid Is Causing Trouble Across Europe*, GREENTECH MEDIA (Mar. 31, 2020), https://www.greentechmedia.com/articles/read/germanys-stressed-grid-is-causing-trouble-across-europe (discussing Germany's renewable capacity versus Germany's ability to transport energy).

343. *See What Is a Grid Booster?*, FED. MINISTRY FOR ECON. AFFS. & ENERGY (Feb. 26, 2020), https://www.bmwi-energiewende.de/EWD/Redaktion/EN/Newsletter/2020/02/Meldung/direkt-account.html (discussing German program designed to quickly transport renewable energy from northern wind farms to high demand areas in south and west of country).

344. *See id.* (discussing Germany's cross-border energy transmission).

345. *See* Colthorpe, *Germany's Grid*, *supra* note 179 (discussing Germany's plan to utilize GridBoosters to increase transmission capacity).

346. Franke, *supra* note 228. See *supra* Section IV.C for a discussion of the Victorian Big Battery.

347. *See* Kiran Kumaraswamy, *Avoiding Gridlock on the Grid: A Practical Approach to Energy Storage as Transmission*, FLUENCE (Sept. 17, 2019), [hereinafter Kumaraswamy, *Avoiding Gridlock*] https://blog.fluenceenergy.com/avoiding-gridlock-energy-storage-as-transmission (discussing virtual transmission as a tool to increase grid efficiency).

348. *What Is a Grid Booster?*, *supra* note 343.

While the GridBoosters will not substitute all of the German transmission network's expansion needs, the batteries will help make better use of existing lines by intervening when problems arise and by providing quick responses when solutions are needed.[349] As an emergency outlet for over-supplies of electricity, the GridBoosters' batteries will help transmission operators avoid critical bottlenecks.[350] These services will alleviate strain on the grid and are estimated to significantly reduce redispatch orders (e.g., curtailing wind farm production) and other associated costs and inefficiencies.[351]

The GridBoosters, while an incredible engineering undertaking given their magnitude, also represent an impactful new area of permissive storage development within the framework of European unbundling and restructuring requirements. The actual storage facilities will not be owned by the TSOs themselves,[352] but rather will be shared assets in line with the 2019 CEP's "fully integrated network components" caveat.[353] Though the projects will be owned by private developers who were solicited through competitive bidding, the GridBoosters will be contractually obligated to absorb excess electricity whenever the regulated TSOs come calling.[354] This obligation gives the TSOs a significant degree of *control* over the assets, without directly *owning* the assets, and thus avoids running afoul of European unbundling requirements.[355] Because the GridBoosters were approved by German regulators, the TSOs' costs of contracting for the GridBoosters' storage-as-transmission services can be passed down to the TSOs' ratepayers.[356] These costs will eventually trickle down to consumers' electricity bills in the form of transmission charges.[357] In contrast to the expense of upgrading entire transmission lines or building new lines altogether, consumers are collectively expected to save considerable amounts of money from the GridBooster pilot.[358]

---

349. *See id.* (describing GridBoosters as rapid response system that steps in when powerlines are at risk of overloading).

350. *See id.* (noting GridBoosters' ability to serve as a quick stop-gap measure to supply energy to consumers during a bottleneck until conventional power stations are able to take over again).

351. *Id.*

352. Franke, *supra* note 228.

353. *See* Colthorpe, *Germany's Grid*, *supra* note 179 (highlighting relationships between GridBoosters and TSOs); Elzarei, *supra* note 336 (noting same).

354. *See* Franke, *supra* note 228 (discussing TSOs' priority access rights).

355. *See* Colthorpe, *Germany's Grid*, *supra* note 179 (noting ownership and business models for GridBoosters); *Questions and Answers in the Third Legislative Package for an Internal EU Gas and Electricity Market*, EUROPÄISCHE KOMMISSION (Mar. 2, 2011), https://ec.europa.eu/commission/presscorner/detail/de/memo_11_125 (explaining E.U. unbundling requirement's aim to ensure companies involved with energy transmission are separate from those in production and supply).

356. *See What Is a Grid Booster?*, *supra* note 343 (discussing GridBoosters' cost-recovery structure).

357. *Id.*

358. *See* KUMARASWAMY, *supra* note 148, at 7 ("[T]he GridBooster projects offer key opportunities to save money for ratepayers by reducing the redispatch of power on both sides of congested transmission corridors and allowing generation to run more efficiently.").

Along with the Waupaca project and the Victorian Big Battery, the German GridBoosters pilot is a successful example of innovating around the regulatory complexities of restructured electric markets and of deploying storage-as-transmission assets to remedy some of the biggest grid management problems associated with transitioning to cleaner energy resources. Unlike the Waupaca and Victorian Big Battery projects, however, the GridBoosters represent an important way that top-down policies (like the European Union's 2019 CEP) can provide critical avenues for jumpstarting innovation and for generating massive investments in a critical area of grid infrastructure: storage-as-transmission.[359]

VI. CONCLUSION

The electric grids of the United States, Australia, and Germany all have particular geographically constrained challenges for transporting large amounts of renewable energy to the population centers that need it. Instead of upgrading transmission lines, or building entirely new lines, storage can save space and time because it can be deployed modularly. Batteries can provide targeted, pinpoint solutions to specific grid issues, particularly transmission issues, that would otherwise require more expensive, and more onerous, fixes.

The Waupaca area project in the United States, the Victorian Big Battery in Australia, and the GridBoosters pilot in Germany are notable storage projects because they provide cost-effective benefits and services within their respective regulatory standards—whether that standard means just and reasonable, non-discriminatory, competitive, or cost-efficient services. All three projects are located in jurisdictions with restructured, liberalized energy markets with rapidly increasing penetrations of renewable generation. By employing particular ownership and contracting structures, these projects maintain the integrity of restructuring, ring-fencing, and unbundling. They show how developers, utilities, and regulators can—with clearly delineated contracting terms—both resolve the regulatory uncertainties of storage and support grids in transition within cost-of-service models.

The Waupaca project exemplifies an innovative, storage-as-transmission investment that both justly and reasonably saves costs and preserves the market purities of restructured markets.[360] Despite the project's clean, contractual delineations, its relatively small scale (when contrasted with the Australian and German projects) shows that the United States could be significantly more ambitious with its emerging storage-as-transmission aspirations.

The Victorian Big Battery is a testament to storage-as-transmission's ability to modularly solve urgent grid needs at massive scale.[361] However, questions linger about its potential ripple effects on Australian wholesale power markets and about the implications for the formerly bright-line separation between restructured

359. *See* Kumaraswamy, *Avoiding Gridlock*, *supra* note 347 (discussing storage-as-transmission projects ongoing in Australia, Germany, and United States).

360. See *supra* Section III.B for a discussion on the Waupaca project.

361. See *supra* Section IV.C for a discussion on the Victorian Big Battery, one of the first batteries to operate as transmission infrastructure.

generation and transmission assets.[362]

The GridBoosters pilot demonstrates the value of storage-as-transmission at an even larger scale, as it can accommodate an overloaded grid with diverse infrastructure expansion needs.[363] Germany's response to a top-down European Union legislative change acknowledges that storage-as-transmission is not only legally permissible but also that jurisdictions can disambiguate regulatory uncertainties with policy first, followed by regulatory approval of demonstration projects later.

When considered together, these three projects are significant signposts that storage-as-transmission—under the right circumstances—is a legal and cost-effective solution for meeting some of the under-addressed needs of electrical grids in transition. Investment in storage-as-transmission does not need to involve buying and selling electricity supply, nor does investment in storage necessarily equate to outright ownership of the assets themselves in ways that would otherwise rub against the laws of restructuring. By identifying specific technical needs—and by requesting competitive proposals—these three projects show that storage-as-transmission can be owned and partially controlled by private developers or transmission utilities that sell multiple services to multiple markets, while also giving priority rights or operational control to independent grid operators for their transmission-specific needs. Limiting and defining ownership, control, and use of a storage asset can allow transmission operators to procure a limited slice of storage's transmission services and include these costs within their regulated cost-of-service tariffs without violating the laws of restructuring.

Presently, uncertainties and regulatory hurdles hamper the degree of growth needed for battery storage to fill the gaps and sustain the kinds of carbon-neutral electric grids needed to avoid the worst impacts of catastrophic climate change.[364] To unleash battery storage's full value stack, investment in battery storage within restructured jurisdictions should not be limited to the generation sector. Rather, all market actors, including regulated transmission and distribution utilities, should be allowed—and encouraged—to invest in storage under the right circumstances and the appropriate cost-recovery mechanisms. Encouraging transmission operators to invest in battery storage within regulated cost-of-service models can simplify regulatory uncertainties, broaden demand, and spread the costs of storage within restructured energy regimes at the scale necessary to better meet the needs of the transition to clean energy.

Battery storage's unique value stack challenges assumptions and strikes at the core of jurisdictional tensions within liberalized electricity systems. Battery storage is the missing link in the clean energy transition, yet encouraging more battery storage deployment need not upend existing restructured regulatory frameworks. Battery storage-as-transmission infrastructure can be a legal and cost-effective

362. See *supra* Section IV.C for a discussion on the possible distortive impacts of the Victorian Big Battery on Australia's power markets.

363. See *supra* Section V.C for a discussion on the GridBoosters pilot.

364. See *supra* Section II.A for a discussion on the clean energy grid and the value of battery storage technology.

solution to meet some of the unique needs of the electrical grids of tomorrow. Transmission owners in restructured jurisdictions should heed the lessons learned from the Waupaca Area Storage Project, the Victorian Big Battery, and the GridBoosters pilot and solicit more storage-as-transmission projects to help meet their infrastructure needs. It is incumbent upon regulators to approve these storage-as-transmission projects when the projects meet their respective legal standards for cost-efficiency. These projects demonstrate that transmission operators, regulators, and energy lawyers already have the contractual tools at their disposal to innovate around the regulatory uncertainty of storage and to help build the sustainable grid of the future we all depend on.