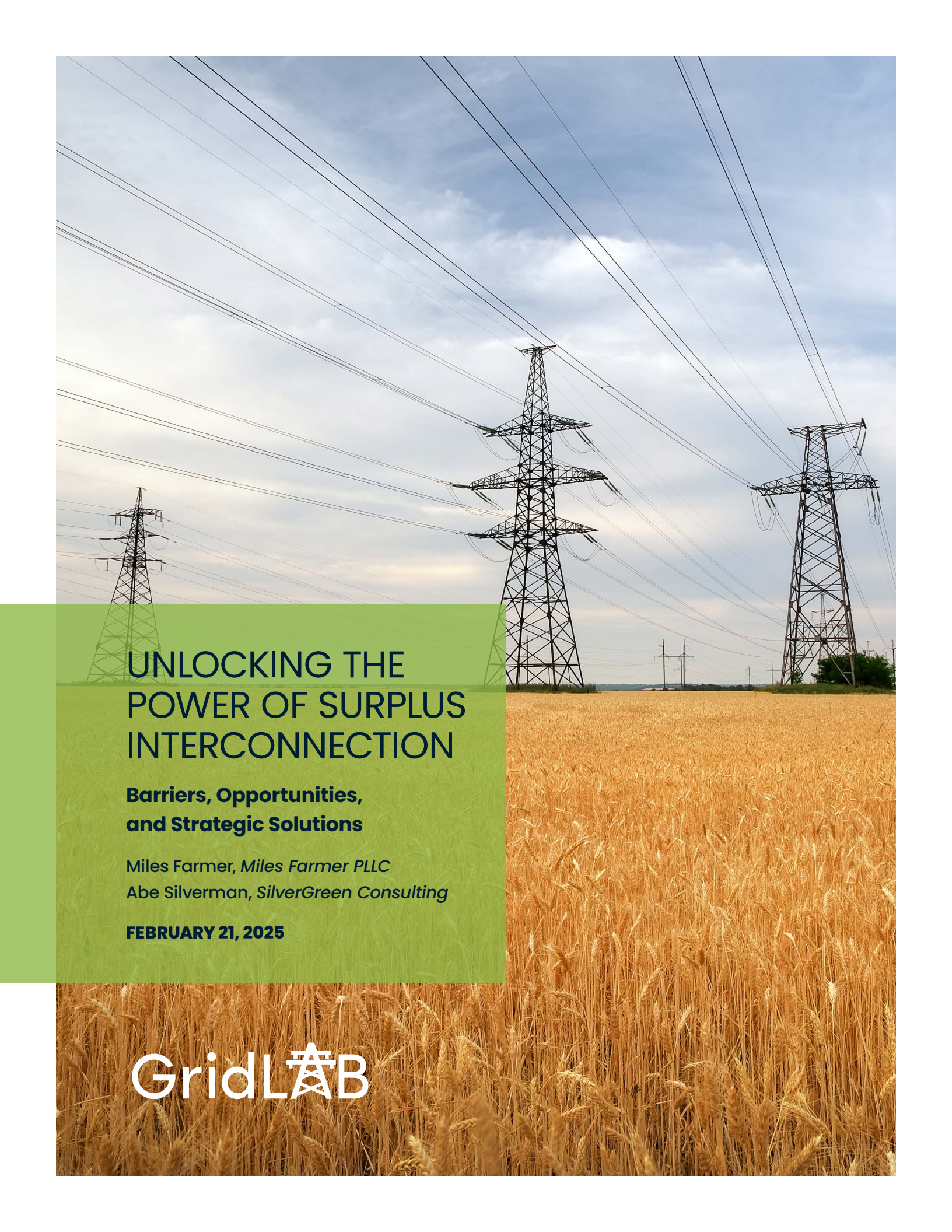




UNLOCKING THE POWER OF SURPLUS INTERCONNECTION

**Barriers, Opportunities,
and Strategic Solutions**

Miles Farmer, *Miles Farmer PLLC*

Abe Silverman, *SilverGreen Consulting*

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GridLAB

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ACRONYMS

AI	Artificial Intelligence
CAISO	California Independent System Operator
CIR	Capacity Injection Rights
EIA	U.S. Energy Information Administration
ERCOT	Electric Reliability Council of Texas
FERC	U.S. Federal Energy Regulatory Commission
GW	Gigawatt
ISO	Independent System Operator
ISO-NE	ISO New England
MISO	Midcontinent ISO
MW	Megawatt
MWh	Megawatt hour
NREL	National Renewable Energy Laboratory
NYISO	New York ISO
PJM	Pennsylvania-New Jersey-Maryland (PJM) Interconnection
PPA	Power Purchase Agreement
RE	Renewable Energy
RFP	Request for Proposals
RTO	Regional Transmission Organization
SPP	Southwest Power Pool
U.S.	United States

EXECUTIVE SUMMARY

The ability to bring new power plants and energy storage resources online quickly is critical to ensuring the reliability of the United States' electrical grid, lowering prices for consumers, and allowing the nation to lead in advanced manufacturing and AI. While electricity demand is increasing and many of the oldest power plants are no longer economically viable,¹ new energy resources face tremendous challenges in connecting to the grid. Even though thousands of new resources—representing more than double the capacity of the entire nation's demand—are in line, only a slow trickle of new projects are entering the market.² The most significant obstacle delaying the integration of these resources is the interconnection process, a mechanism through which the potential addition of a new resource to the grid is studied, infrastructure needed to reliably integrate the potential resource is identified, and responsibility for paying for and constructing such infrastructure is determined. The interconnection process generally takes nearly five years from the point a potential new resource submits its request to connect, depending on the grid operator administering the process.³ There is an urgent need for grid operators⁴ to develop new tools for accelerating the interconnection process to ensure affordability and reliability.

One such innovative tool is “surplus interconnection,” a concept where existing generation or energy storage resources share their grid access with new resources, allowing new electricity sources to come online in months instead of years. The key to surplus interconnection is that existing power

1 See John D. Wilson and Zach Zimmerman, *The Era of Flat Power Demand Is Over* (Dec. 2023) (summarizing load growth trends), available at <https://gridstrategiesllc.com/wp-content/uploads/2023/12/National-Load-Growth-Report-2023.pdf>; North American Electric Reliability Organization (NERC), *2024 Long-Term Reliability Assessment*, at 27-28 (Dec. 2024) (summarizing resource retirement trends), available at https://www.electric.coop/wp-content/uploads/2024/12/NERC_Long-Term-Reliability-Assessment_2024.pdf.

2 See Joseph Rand et al., Lawrence Berkeley National Laboratory, *All Queued Up: 2024 Edition Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2023*, Joseph Rand, et al., available at https://emp.lbl.gov/sites/default/files/2024-04/Queued%20Up%202024%20Edition_R2.pdf (“All Queued Up 2024”). A large majority of the resources seeking to interconnect to the system are solar and wind generators, as well as battery energy storage arrays. *Id.* at 11.

3 *Id.* at 41.

4 In this report, we refer to this subset of transmission providers who administer interconnection processes as “grid operators.”

plants are often located at critical points on the grid where the transmission infrastructure is strongest. Many existing power plants do not fully utilize the infrastructure that was built to ensure that their electricity is deliverable to customers, leaving “surplus” capacity unused on the grid. Relatively simple regulatory and market innovations can help unlock the potential of surplus interconnection.

Recent analysis suggests that surplus interconnection has the potential to make a meaningful difference in quickly adding new energy resources to meet increasing load growth and demand with low-cost, clean energy. Researchers estimate that “the renewable energy potential that is both technically and economically viable comprises the 836 GW of actionable renewable potential near existing fossil plants today, which increases to 977 GW by 2030 as the costs of new renewable energy (RE) decline. If integrated, this actionable RE potential could nearly double the U.S. generation capacity.”⁵

This paper surveys the existing state of play for surplus capability across the United States, focusing on regulatory, reliability and financial barriers to expanding the use of surplus interconnection, as well as potential solutions to those barriers. Based on research into existing regulatory proceedings, along with interviews with companies deploying surplus interconnection and other experts in the field, we find that surplus interconnection provides developers and customers with a host of benefits, including increased speed to market, lower costs associated with reduced infrastructure needs, reduced study burden for grid operators; enhanced reliability and resource adequacy, and preservation of economic benefits that existing assets provide to communities.

While surplus interconnection service has obvious benefits and its use has been expanding, barriers remain. Using surplus interconnection requires proper engineering and operations controls, and if grid operators or energy resource owners do not have adequate staff or processes to ensure these elements, it can create grid reliability issues. At the same time, overly restrictive and unworkable study processes by grid operators may unjustifiably preclude the use of surplus interconnection. For example, until recently, market rules in PJM, the largest electricity marketplace in the country, effectively prohibited the use of surplus interconnection service. Use of surplus interconnection also faces a host of commercial barriers, many of which stem from the need to coordinate the operation of the existing and newly proposed resources that will be sharing the same interconnection rights.

5 Umed Paliwal et al., Existing power plants sharing grid access with renewables can lower costs and double U.S. generation capacity, (2025), available at <https://www.scarcitytosurplus.com/> (“Surplus Interconnection Technical Whitepaper”).

However, most of these barriers can be overcome. Power plant controllers and advanced protection and metering schemes can be integrated into new project proposals to ameliorate potential reliability impacts. Grid operators can reform their study practices to create a more workable system, as PJM recently did. And owners of existing and new energy resources are increasingly becoming aware of the commercial potential of surplus interconnection and gaining familiarity with the necessary contractual structures, easing the commercial barriers associated with using surplus interconnection.



A. Summary of Recommendations

RECOMMENDATIONS TO OVERCOME TECHNICAL BARRIERS

Barrier	Solution	Venue
Grid operator's approach to evaluating surplus interconnection requests disqualifies proposals based on minimal transmission system impacts, and/or disallows or sharply curtails surplus interconnection for capacity resources.	Adopt best practices for evaluating surplus interconnection requests that (1) allows for use of surplus interconnection wherever it does not trigger network upgrades; (2) permits the construction of interconnection facilities or other infrastructure that does not impact other customers in the interconnection queue; and (3) allows for surplus interconnection to be used by capacity resources.	Grid operators; FERC (could require these practices in an update to Order No. 845 or encourage them in a policy statement)
In isolated cases, surplus interconnection studies reveal a reliability issue, specific to a particular combination of proposal characteristics and system characteristics at the point of interconnection and the request is rejected.	In some cases, incorporation of grid-forming battery energy storage systems or other power plant control technologies will alleviate reliability issues that would otherwise be identified in surplus interconnection studies. ⁶	Project developers (responsible for modeling and deploying the relevant technology); grid operators (responsible for appropriately studying the proposed technology in interconnection studies)

RECOMMENDATIONS TO OVERCOME COMMERCIAL BARRIERS

Barrier	Solution	Venue
Use of surplus interconnection requires the owner of an existing resource to share its interconnection rights.	Design specific RFPs to target surplus interconnection opportunities, or design broader RFPs in a manner that renders resources using surplus interconnection eligible.	Incumbent utilities
	Encourage or require consideration of surplus interconnection.	State public service commissions
	Require grid operators to publish information concerning surplus interconnection potential in their region or service territories, as applicable.	Congress or FERC; state public service commissions in vertically integrated states
Surplus interconnection rights expire shortly after the retirement of the existing resource that is sharing its interconnection.	Adopt flexible generator replacement or interconnection rights transfer provisions.	Grid operators; FERC (could require or standardize these provisions)

⁶ For an overview of the potential reliability benefits of grid-forming battery energy storage systems, see Ryan Quint et al., Benefits of Grid Forming Battery Energy Storage Systems: Project Findings and Recommendations (Feb. 4, 2025), available at <https://www.esig.energy/event/webinar-benefits-of-gfm-study-discussion/>.

RECOMMENDATIONS TO OVERCOME COMMERCIAL BARRIERS

Barrier	Solution	Venue
Surplus interconnection requires agreements that govern coordination of interconnection rights, operation, and dispatch.	Adopt pro forma agreements for the FERC-jurisdictional portion of these arrangements that govern the shared use of interconnection rights.	Grid operators (can include pro forma provisions in their tariff); FERC (could promulgate default provisions that apply in the absence of individually negotiated contracts)
The value of surplus interconnection resources is not fully captured by existing market mechanisms. Grid operators may not fully credit the capacity value of hybrid resources, including those that use surplus interconnection. Adding resources at locations with resources running at low capacity factors and that may soon retire can offer reliability value not fully captured in wholesale capacity market or resource adequacy accreditation mechanisms.	Improve underlying models so as to more accurately capture the capacity value of hybrid resources.	RTOs/ISOs; FERC (could require modifications to existing tariffs through section 206 of the Federal Power Act)
	Design state incentive or procurement mechanisms to help resources become commercially viable. Ensure that surplus interconnection resources are eligible to participate in state incentive and procurement programs.	State public service commissions and/or energy agencies
Financing, tax equity, and offtake structures introduce transaction costs to using surplus interconnection.	Wait until existing commercial arrangements expire and incorporate surplus interconnection into new arrangements; promote greater understanding of the value of surplus interconnection across the various entities that would benefit from it, including financial institutions that provide debt and equity to projects with surplus interconnection rights.	Project developers and financing parties; owners of existing resources
	Prioritize evaluating surplus service additions at facilities that are coming to the end of a contractual arrangement.	State public service commissions in vertically integrated states

I. WHAT IS SURPLUS INTERCONNECTION?

Surplus interconnection refers to the practice of allowing new electricity supply resources to connect to the grid using the same interconnection rights that have already been allocated to existing generators.⁷ As outlined in the Surplus Interconnection Technical Whitepaper, hundreds of gigawatts (GW) of power plants across the United States are not fully using the interconnection service originally granted to them.⁸ Many fossil power plants have been operating at reduced output over time, as their marginal costs increase relative to the rest of the supply stack, while numerous wind and solar generators have never made full use of the interconnection capacity allotted to them.⁹ Recent rule changes on capacity accreditation across several markets have further increased the amount of surplus capacity available on the grid.¹⁰

This under-use of the existing system represents an opportunity for bypassing the lengthy standard interconnection queue process, potentially cutting years off the process of bringing new electricity sources online. By sharing existing infrastructure, new resources that use surplus capacity can be connected through a highly streamlined study process, requiring no new

7 FERC defines surplus interconnection service as “any unneeded portion of Interconnection Service established in a Large Generator Interconnection Agreement, such that if Surplus Interconnection Service is utilized the total amount of Interconnection Service at the Point of Interconnection would remain the same.” *Reform of Generator Interconnection Procedures and Agreements*, Order No. 845, 163 FERC ¶ 61,043 (2018), at Appendix B (changes to *pro forma* LGIP), § 1, *errata notice*, 167 FERC ¶ 61,123 (2019), *order on reh’g*, Order No. 845-A, 166 FERC ¶ 61,137 (2019), *errata notice*, 167 FERC ¶ 61,124 (2019), *order on reh’g*, Order No. 845-B, 168 FERC ¶ 61,092 (2019).

8 Surplus Interconnection Technical Whitepaper, at 7.

9 As FERC explains, surplus interconnection service occurs where “generating facility capacity that the transmission provider originally studied pursuant to the *pro forma* LGIP may be in excess of the actual interconnection service required by the generating facility, at least during some periods.” Order No. 845, at P 471.

10 Capacity accreditation determines the extent to which different resources may be relied upon in order to meet electricity demand at times when the grid is most constrained. A number of regions have adopted Effective Load Carry Capability (“ELCC”) rules in the past several years, which have generally reduced the amount of capacity different resources are given to the extent that the availability of such resources is correlated with that of others. ELCC values for solar and energy storage resources, in particular, have declined as penetration of these resource types increases. *See, e.g., PJM Interconnection*, 186 FERC ¶ 61,080, at PP 26–40 (2024) (describing PJM’s ELCC framework in the context of an order approving a proposal from PJM to update its methods for calculating ELCC), *order on reh’g*, 189 FERC ¶ 61,043 (2024); Nick Schlag et al., *Energy+Environmental Economics, Capacity and Reliability Planning in the Era of Decarbonization*, at 11 (2020) (explaining that “the marginal ELCCs of most resources will decline with increasing penetration”). As grid operators expand these methodologies to thermal resources, the capacity accreditation of those resources will also decline.

grid infrastructure to accommodate the new capacity, or else only discrete network upgrades that would facilitate the service and could be built without materially impacting queued resources waiting to connect.¹¹ To minimize the impacts on grid reliability and speed the interconnection study process, surplus interconnection service is limited such that the combined output of the existing generator and the new units, operating together, cannot exceed the output allocated to the existing supply resource.

Importantly, the Federal Energy Regulatory Commission (FERC) already requires transmission providers who administer interconnection processes for new electricity supply to offer surplus interconnection service. FERC Order No. 845, issued in 2018, established a framework for implementation. FERC Order No. 2023 expanded on this framework by requiring grid operators “to allow interconnection customers to access the surplus interconnection service process once the original interconnection customer has an executed [interconnection agreement],” as opposed to allowing it only once the original interconnection customer has already reached commercial operation.¹² In regions with a Regional Transmission Organization (RTO) or Independent System Operator (ISO), the relevant RTO or ISO is responsible for administering the interconnection process and facilitating surplus interconnection service, while in non-RTO regions these responsibilities fall to individual utilities.

¹¹ See, e.g., *Southwest Power Pool*, 181 FERC ¶ 61,269, at PP 7–10 (2022) (describing SPP’s proposed process for evaluating surplus interconnection requests, which FERC approved).

¹² *Improvements to Generator Interconnection Procedures and Agreements*, Order No. 2023, 184 FERC ¶ 61,054, at P 1436 (2023), *order on reh’g*, 185 FERC ¶ 61,063 (2023), *order on reh’g*, Order No. 2023–A, 186 FERC ¶ 61,199, at PP 560–63 (2024), *errata notice*, 188 FERC ¶ 61,134 (2024). Order No. 2023 also requires grid operators to offer surplus interconnection service where the relevant resource has requested the filing of an unexecuted interconnection agreement. *Id.*

II. BENEFITS OF SURPLUS INTERCONNECTION SERVICE

Surplus Interconnection Service offers a host of benefits, outlined as follows.

A. Speed to Market

A significant advantage of surplus interconnection is that it bypasses the standard interconnection queue process, allowing new generation or storage resources to avoid the multi-year delays that have plagued the standard interconnection process over the past few years. This means Surplus Interconnection Service thus has the potential to bring new generation and storage resources to market considerably faster than the standard process, allowing states, utilities, and grid operators to address pressing reliability, economic, and other goals. Without new strategies, the sluggish pace of new connections means that we may not have sufficient electricity supply resources to allow existing power plants to retire, to keep energy affordable, or to meet the increasing demand for new data center and advanced manufacturing load.

The process for bringing new generation resources online through the traditional interconnection queue is extremely slow, with the “typical project built in 2023 [taking] nearly 5 years from the interconnection request to commercial operations.”¹³ These massive delays present a significant challenge to system reliability and are exacerbating already significant siting and permitting challenges. The scale of the problem is significant, with “over 1,570 GW of generation and an estimated 1,030 GW of storage capacity” in the interconnection queue as of the end of 2023, representing more than 11,000 separate generation projects.¹⁴

The streamlined study and interconnection process for resources using surplus interconnection can be completed in under a year, in contrast to

¹³ All Queued Up 2024, at 3.

¹⁴ *Id.*

the five years or more of many standard interconnection processes.¹⁵ One analysis from Southwestern Public Service Company (“Southwestern”), an affiliate of Xcel Energy, reported that “from initial submittal to the final published report,” the timeline for surplus projects “ranges from 86 days to 186 days, which is many years shorter than [the standard Southwest Power Pool (SPP) interconnection process].”¹⁶

B. Maximizing Grid Strength and Value with Minimal Infrastructure Needs

By connecting resources without network upgrades or with only limited network upgrades, surplus interconnection service provides savings on infrastructure costs. According to Lawrence Berkeley National Laboratory, interconnection costs average approximately \$100/kW, that is, approximately \$10 million for a 100 MW project.¹⁷ These costs can be largely avoided through surplus interconnection. Moreover, because much of the infrastructure needed for network upgrades, such as transformers and breakers, face supply chain constraints,¹⁸ the infrastructure saved through surplus interconnection allows these supply-chain constrained components to be used in other projects, increasing the total amount of resources that can be integrated into the system across a given time period.

The benefits of locating surplus projects at existing sites extend beyond simply expediting deployment. Many existing facilities are positioned at key locations across the grid, allowing surplus resources to strengthen the backbone of the system. For example, in a 2023 petition for new solar and battery projects, Southwestern proposed placing solar generation at two power plants dating from the 1950s. The company explained that these facilities were embedded in a well-developed transmission network, with substations that had expanded over time. As highlighted by Southwestern, one of the replaced plants now connects to ten transmission lines, and the other to nine, providing multiple pathways for energy during transmission

¹⁵ For example, MISO’s process requires MISO to respond to the customer seeking surplus interconnection within 30 days, conduct all necessary studies within 90 days (after allowing the interconnection customer 30 days to respond to MISO’s initial evaluation), and tender an interconnection agreement within 30 days of the final study report, for a total process length of roughly 8 months. See MISO, Open Access Transmission Tariff (OATT), at Attachment X § 3.3.1.2.

¹⁶ Direct Testimony of Jarred Cooley on behalf of Southwestern Public Service Co., *Application of Southwestern Public Service Company to Amend its Certificate of Convenience and Necessity to Construct Generation Facilities in Lamb County, Texas and Lea County, New Mexico*, Docket No. 55255 Public Utility Commission of Texas, at 23 (July 26, 2023).

¹⁷ J. Seel et al., Lawrence Berkeley National Laboratory, *Generator Interconnection Costs to the Transmission System*, at 11 (2023), available at https://live-lbl-eta-publications.pantheonsite.io/sites/default/files/berkeley_lab_interconnection_cost_webinar.pdf.

¹⁸ For example, as the National Infrastructure Advisory Council reports, “Currently an electric utility or generation developer that orders a transformer may have to wait 2 to 4 years for it to be delivered, compared to a wait of just months as recently as 2020.” National Infrastructure Advisory Council, *Addressing the Critical Shortage of Power Transformers to Ensure Reliability of the U.S. Grid*, at 3 (June 2024).

contingencies. A greenfield site, by contrast, would likely have had only two connections to the system.¹⁹ This reduced need for new infrastructure offered redevelopment opportunities, faster deployment, and enhanced reliability services.

C. Reducing Consumer Costs and Improving Resource Adequacy and Reliability

Surplus Interconnection Service is one of the few existing means of quickly bringing new resources onto the grid, in order to resolve resource adequacy shortfalls or price spikes.²⁰ Although market rules have been slow to adapt to properly reflect the resource adequacy value of new hybrid generation interconnected via Surplus Interconnection Service, these resources can still help reduce costs and improve resource adequacy in several key ways. First, the resource utilizing Surplus Interconnection Service may be able to inject power into the grid at times when the original resource is offline or not generating. For instance, when energy storage connects using surplus service at the site of an existing wind generator, that combined resource might now inject energy into the system even during periods of low or no wind. Similarly, adding energy storage to an existing gas plant can enable use of available interconnection capacity even during gas supply disruptions or failures in extreme weather. Even if the additional injection capacity is not formally accredited, it still helps meet demand under such conditions. Because surplus interconnection increases the amount of power injected into the grid, it puts downward pressure on locational marginal prices by adding supply at key points in the system.

Second, while a legacy generation resource may not be capable of providing the same resource adequacy value as when it was first commissioned, adding a new resource using surplus interconnection capacity can help restore some or all of that value thanks to the combined output of the two resources. Resource adequacy value may decline due to age-related deterioration of the facility's maximum sustainable output, tightening environmental regulations that restrict runtime, or capacity accreditation rules that reduce the amount of capacity of the legacy unit. Whatever the reason, adding a new resource to the system can only improve the resource adequacy picture and reduce costs to consumers. Innovative contractual

19 Direct Testimony of Jarred Cooley on behalf of Southwestern Public Service Co. in Docket No. 55255 before the Public Utility Commission of Texas, at 26.

20 Governor Shapiro of Pennsylvania recently filed a complaint with FERC explaining that "Three unexpected developments—(1) significant load growth; (2) the country's most snarled interconnection queue; and (3) a compressed capacity auction schedule—have collided with PJM's inapt design decisions to produce record high prices that are ineffective at delivering new power generation." *Governor Josh Shapiro and the Commonwealth of Pennsylvania vs. PJM*, Complaint, Docket No. EL25-46 (Dec. 30, 2024).

mechanisms may allow the surplus resource to operate whenever the host resource is offline, making this approach particularly beneficial for peaking plants that operate only a few hours a year. Additionally, the potential retirement of a resource may highlight local reliability concerns due to the loss of capacity at a particular location.²¹ Surplus interconnection, followed by generator replacement, offers a solution by enabling energy injection at the same location as the retiring resource.

D. Reduced Study Burden on Grid Operators

Another related benefit of surplus interconnection is its relative simplicity compared to new generator interconnection requests. Because surplus interconnection service allows resources to interconnect onto the system without undergoing the full standard interconnection process, it helps reduce the number of projects that need to be studied. This is particularly significant given that interconnection queues have grown substantially in recent years, leading to longer study times and delays.²²

New generator interconnection requests require the grid operator to perform a number of studies that look at grid reliability under a variety of load conditions and seasons, up to the full operating output of the new generating resource. The studies are required to identify upgrades on both the local system where the generator is connecting, as well as network upgrades to the bulk power system.

In contrast, studying a surplus interconnection request is a much simpler process. The host resource has already undergone comprehensive power flow analyses before connecting to the grid, and any necessary transmission grid upgrades have already been constructed to ensure reliability under a variety of operating conditions, up to the generator's full approved output. In addition, the grid operator already possesses extensive operational data on power injections at the relevant point of interconnection, given that an existing plant is already injecting power there. Since a key condition of surplus interconnection is that the combined output of the surplus resource and the host resource will never exceed the host resource's existing injection rights, fewer studies are likely to be required beyond the baseline information already available. While the grid operator must still conduct confirmatory reliability studies to prevent excess short circuit duty or other unusual electrical outcomes, the analysis is considerably simpler. Any analysis of new grid upgrades is usually limited to minor upgrades to the system protection

21 See, e.g., Sonal Patel, PJM Urges Delayed Retirement of 840-MW Fossil Fuel Power Plant, Citing Reliability Impacts (Jan. 10, 2024), available at <https://www.powermag.com/pjm-urges-delayed-retirement-of-840-mw-fossil-fuel-power-plant-citing-reliability-impacts/>.

22 See All Queued Up 2024, at 8, showing a "surge" in interconnection requests over the past decade that has coincided with significantly longer queue wait times.

facilities²³ or upgrades near the point of interconnection.²⁴

Not only is each surplus interconnection request simpler to study than a conventional interconnection request, but these studies can also typically be conducted independently, without affecting other generators in the queue.

E. Maintaining Economic and Reliability Benefits While Reducing Emissions and Fostering Growth

Where surplus interconnection enables the addition of clean resources such as solar, wind, or energy storage to existing fossil assets, it can create a “win-win-win-win” scenario that extends to electricity consumers and local communities, by reducing costs, enhancing reliability, lowering emissions, and supporting additional jobs while maintaining those tied to the existing facility.

A number of the surplus interconnection applications reviewed involved high-heat rate peaking units serving as the host facility.²⁵ These resources typically operate with low-capacity factors and generally operate only when the grid is stressed. The addition of energy storage or new wind or solar resources adds low cost, emissions-free electricity to the system on a near continual basis but still allows for the legacy asset to support grid reliability when needed. Where emissions requirements limit facility run-time and phase toward eventual unit retirement,²⁶ surplus interconnection can facilitate a pragmatic transition: co-located resources using surplus interconnection can augment the existing resource’s reduced capacity factor and help replace its capacity when it retires. Beyond their reliability value, these arrangements also offer economic benefits to the relevant host communities by repurposing brownfield locations and creating new jobs.²⁷

23 System protection facilities are facilities used to protect electrical power systems from faults or other electrical disturbances.

24 See, e.g., SPP OATT, at Attachment V § 3.3, noting that “Surplus Interconnection Service is only available up to the amount that can be accommodated without requiring additional Network Upgrades, unless (a) those additional Network Upgrades are either (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective GIA, or (2) are System Protection Facilities....”

25 See *infra* Prairie Rose Wind Farm and OG&E request for proposals.

26 For example, the New Jersey Department of Environmental Protection has set emissions limits for electric generating units that decline from 1,700 pounds of CO₂ per MWh gross energy output in June 2024, to 1,000 pounds of CO₂ per MWh gross energy output in 2035. N.J. Admin. Code § 7:27F-2.5 (2025).

27 See Chelsea Mattioda et al., Synapse Energy Economics, Inc., No Regrets Solutions for Accelerating Grid Interconnection, at 13–14 (Aug. 2024) (“No Regrets Solutions”) (describing economic benefits, including property tax revenues and additional jobs, spurred by development of new resources at existing power plant sites), available at https://www.synapse-energy.com/sites/default/files/No-Regrets%20Solutions%20for%20Accelerating%20Grid%20Interconnection_Final%20Synapse%20Report%208.19.24%2023-132.pdf

F. Example of Surplus Interconnection in Action

The Prairie Rose Wind Farm operated by Enel Green Power was able to interconnect using Surplus Interconnection Service in the Midcontinent Independent System Operator (MISO) region. The 200 MW wind plant connected via a 30-mile gen-tie line into the Angus Anson Power Station in Sioux Falls, ND, comprised of three simple-cycle “peaking” natural gas turbines with dual-fuel backup. Cooperation between the developer and Xcel Energy, the legacy plant owner, was essential. As part of the arrangement, the Prairie Wind project secured a power purchase agreement (PPA), similar to other power purchases by Xcel Energy. The parties also entered into an energy displacement agreement,²⁸ allowing Prairie Rose to inject up to 200 MW of energy at the point of interconnection for the Angus Anson facility, with a combined capacity limit of 392 MW (i.e., the size of the existing Anson facility), subordinate to the right of the Anson Plant to utilize the existing interconnection capacity.²⁹ This PPA-interconnection arrangement between the parties accelerated Xcel’s acquisition of low-cost, carbon-free, electricity, significantly advancing the timeline compared to the conventional interconnection process



28 See Energy Displacement Agreement, MISO OATT, at Attachment X, Appendix 12.

29 “[A]ll rights of [Prairie Wind] to utilize the interconnection capacity of the Angus Anson plant are subordinated to the rights of the Anson Plant to utilize the existing interconnection capacity.” Docket No. EL12-046, South Dakota Public Utilities Commission (Sept. 26, 2012), Data Request No. 11-1, available at <https://puc.sd.gov/commission/dockets/electric/2012/EL12-046/stafftestimony/jpt-18.pdf>.

III. BARRIERS AND SOLUTIONS FOR SURPLUS INTERCONNECTION

Surplus interconnection offers a unique opportunity to deploy resources quickly and at scale. However, despite its potential, its use to date has been limited, especially when considering the urgent need for new resources to meet growing electricity demand. This section explores several barriers contributing to the underuse of surplus interconnection, which can be grouped into two main categories: (A) transmission system impacts and (B) commercial barriers.

A. Transmission System Impacts

When a new resource connects to the transmission system, the grid operator conducts a series of studies to ensure that the resource can be reliably integrated and to identify any necessary infrastructure upgrades to maintain system reliability. According to FERC Order No. 845, these studies for surplus interconnection “shall consist of reactive power, short circuit/fault duty, stability analyses, and any other appropriate studies.”³⁰ While the specific process may vary across grid operators (as discussed further below), if the analysis shows that a reliability violation would occur absent the construction of a network upgrade affecting other customers in the interconnection queue, surplus service may be inappropriate and the study process concludes.

Two types of barriers to accessing surplus interconnection emerge in the context of the study process. First, there may be legitimate reliability issues, which are not captured in the Surplus Interconnection Technical Whitepaper by UC Berkeley. For example, adding grid-following inverter-based resources to existing points of interconnection, while switching off high-inertia resources including thermal generation, could erode system strength below acceptable limits. Depending on the nature of the reliability violation, modifications to the

30 Order No. 845, at Appendix B, § 3.3.1. As discussed *supra* section II.B.4, the study process can be more streamlined in the context of surplus interconnection than for the standard interconnection queue process for two reasons: (1) the existing resource that will share its interconnection rights with the surplus resource has already been studied, so many of the power flow scenarios and contingencies associated with injection at that point of interconnection up to the existing resource’s interconnection capacity have already been studied; and (2) the surplus process is generally not intended to advance the construction of network upgrades needed to integrate large groups of resources.

proposed project may resolve the issue, but it is crucial that transmission planners have sufficient time and resources to study and identify these potential problems.

A second type of barrier arises not from disqualifying reliability issues but from the design of the study and evaluation process. While some grid operators have implemented frameworks in compliance with Order No. 845 that allow surplus interconnection wherever it does not necessitate network upgrades, others have established criteria that effectively block the use of surplus interconnection altogether. Experience has shown that some grid operators apply evaluation frameworks that disqualify surplus interconnection requests based on minor impacts that do not require network upgrades or threaten system reliability.

While this barrier has posed a significant obstacle to the use of surplus interconnection in certain regions, particularly in PJM, progress is being made to address it. As discussed in section III.A.2 below, revisions to these frameworks are increasingly allowing for surplus interconnection service, even when it necessitates limited network upgrades at the point of interconnection. This paves the way for the surplus interconnection market to take off, provided that state regulators, commercial actors, and other relevant stakeholders address the remaining barriers.

1. System Impacts

While surplus interconnection proposals are less likely to cause thermal overloads and voltage violations than standard interconnection requests, any grid addition—including battery energy storage systems—can impact system performance.³¹ Although rare, such issues require careful analysis to prevent real-time operational risks. Fortunately, many problems can be resolved with software updates or minor hardware adjustments. In addition, emerging technologies such as grid-forming inverter-equipped energy storage systems offer a promising solution by providing grid stability services comparable to those of thermal generation.

Adding generation capacity can affect multiple aspects of system reliability. For instance, it may over-duty breakers, requiring short-circuit studies to assess these impacts. Similarly, increasing inverter-based resources in a given area will inherently affect system strength and could cause control instability or control interactions between devices. While rare, these types of issues require careful analysis and modeling, including electromagnetic

³¹ These impacts extend beyond thermal and voltage concerns to include issues such as breaker over-duty and system strength. Adding generation capacity can require short-circuit studies and electromagnetic transient modeling to assess potential instability.

transient (EMT) modeling and simulations in some cases. Without such studies, latent instability could emerge in real-time operations, jeopardizing bulk power system reliability.

The key takeaway is that many of these issues can be corrected with software updates or minor hardware fixes on the proposed interconnecting resource. Grid-forming battery energy storage systems are one commercially available solution, offering grid-stabilizing attributes more akin to synchronous generators. These systems enhance stability in areas of high intermittent resource penetration, low system strength, and complex reliability challenges such as sub-synchronous control interactions.³² By improving stability margins, they may even unlock additional renewable hosting capacity, reduce costly network upgrades, prevent curtailment, and improve overall grid stability at minimal incremental cost. **Integrating grid-forming battery storage into project design can help mitigate stability-related barriers, enabling faster and more efficient under surplus interconnection processes for all resource types.**

2. Grid Operator Criteria for Surplus Interconnection Availability

The *pro forma* interconnection procedures established under Order No. 845 outline an evaluation process for surplus interconnection service requests that assesses the impact of the proposed service on the transmission system.³³ But while FERC envisioned that the study results would determine whether a request is granted, it provided little guidance on how transmission owners should interpret these studies and grant or deny surplus interconnection service. As a result, the availability of surplus interconnection service largely hinges on the manner in which different grid operators have interpreted this process.

In complying with FERC Order No. 845, grid operators have taken divergent approaches. Some have adopted a workable approach that facilitates the use of surplus interconnection service wherever it does not cause legitimate reliability violations (as described above) or spur a need for network upgrades that would adversely impact prospective customers in the standard interconnection queue. Others have implemented restrictive criteria that effectively block the use of surplus interconnection, disqualifying many—if not most—use cases even when they pose no reliability risks or trigger network upgrades impacting other customers.

³² The Energy Systems Integration Group (ESIG) maintains a regularly updated database of Grid Forming Inverter technology developments including real-world deployments, benchmark testing, and modeling best practices. See ESIG, *The Grid-Forming Landscape*, available at <https://www.esig.energy/working-users-groups/reliability/grid-forming/gfm-landscape/> (last accessed Feb. 11, 2025).

³³ Order No. 845, at Appendix B, § 3.3.1.

MISO and SPP exemplify surplus interconnection processes that are working effectively.³⁴ MISO adopted its approach in compliance with Order No. 845, while SPP developed its method through subsequent tariff updates. MISO's process applies "a material adverse impact analysis to confirm that the proposed surplus interconnection service will not generate new network upgrades."³⁵ In practice, this analysis therefore permits some grid impacts, (e.g., "some increased contribution on the loading of transmission elements"), focusing on whether the change triggers additional network upgrades.³⁶ This aligns with FERC's statement in Order No. 845-A that "surplus interconnection service is only available up to the level that can be accommodated without requiring the construction of new network upgrades."³⁷

SPP takes a similar approach but permits surplus interconnection service under a broader range of circumstances. The SPP Tariff allows for the tendering of a Surplus Interconnection Service Agreement where it confirms that no new Network Upgrades or certain other facilities are required.³⁸ However, it also permits surplus interconnection service even when Network Upgrades are necessary, provided that:

"(a) those additional Network Upgrades are either: (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective [generator interconnection agreement (GIA)], or (2) are System Protection Facilities; and (b) there are no material adverse impacts on the cost or timing of any Interconnection Requests pending at the time the Surplus Interconnection Service request is submitted."³⁹

In these regions, a market for surplus interconnection service has begun to take shape. As of January 31, 2025, SPP had completed 14 surplus interconnection project requests, representing 1,218 MW of capacity, with 23 pending projects representing an additional 2,573 MW.⁴⁰ Meanwhile, MISO had completed 24 surplus interconnection requests for a total of 2,275 MW of capacity, and is processing 36 more requests representing an additional 3,247 MW.⁴¹ These surplus interconnection processes are set to expand as market participants

34 See Chelsea Mattioda et al., No Regrets Solutions (discussing the MISO and SPP approaches to surplus interconnection).

35 *Midcontinent Independent System Operator*, 169 FERC ¶ 61,221, at P 120 (2019).

36 *EDP Renewables North America LLC v. PJM Interconnection, L.L.C.*, Docket No. EL24-125, Motion for Leave to File Comments Out-of-Time and Comments of EDF Renewables, Inc. In Support of Complaint, at 8-9 (July 30, 2024).

37 Order No. 845-A at P 138.

38 SPP OATT, at Attachment V § 3.3.5.

39 *Southwest Power Pool*, 181 FERC ¶ 61,269, at P 7 (2022).

40 See Southwest Power Pool Generator Interconnection Queue, available at <https://www.spp.org/engineering/generator-interconnection/> (last accessed Jan. 31, 2025).

41 See Midcontinent Independent System Operator Surplus Interconnection Service Queue, available at <https://cdn.misoenergy.org/Surplus%20Interconnection%20Service%20Requests458123.xlsx> (last accessed Jan. 31, 2025).

establish the necessary contractual structures and become more familiar with the opportunities they offer.

In contrast, PJM's compliance with Order No. 845 has made surplus interconnection unworkable in the region, effectively eliminating the development of a surplus interconnection market.⁴² PJM permits surplus interconnection service only if the Surplus Interconnection Study confirms that three conditions are met:

- (i) no new Network Upgrades are required,
- (ii) there are no impacts affecting the determination of what upgrades are necessary for [other customers in the queue], and
- (iii) there are no material impacts on short circuit capability limits, steady-state thermal and voltage limits or dynamic system stability and response."⁴³

Despite the superficial similarity to MISO's material adverse impact analysis, PJM applied a very different meaning to this language. PJM reasoned that because its tariff "provides that generation units requesting surplus interconnection service cannot use any available system headroom ... any impact is the threshold to determine whether a surplus interconnection request is material and, consequently, terminated and withdrawn."⁴⁴

In its business practices manual (see "Table 1," hereafter), PJM published examples of eligible and ineligible surplus interconnection requests, thereby excluding entire categories of resource pairings—including the most common business cases for surplus interconnection:⁴⁵

42 As discussed below, PJM recently adopted tariff revisions that overhaul its surplus interconnection study and evaluation process, so as to provide for a much more workable set of rules.

43 See *PJM Interconnection, L.L.C.*, Docket No. ER25-778, Transmittal Letter Attachment A, SIS Redline (Dec. 20, 2024) (showing PJM's prior tariff language, much of which was struck through its recent revisions).

44 *PJM Interconnection, L.L.C.*, 171 FERC ¶ 61,145, at P 34 (2020) (emphasis in original; internal quotation marks omitted).

45 *EDP Renewables North America LLC v. PJM Interconnection, L.L.C.*, Docket No. EL24-125, Complaint of EDP Renewables North America LLC, at 11 (July 5, 2024) (citing PJM Manual 14H, at 130-31 (2023), available at <https://www.pjm.com/-/media/DotCom/documents/manuals/m14h.ashx>).

TABLE 1. MANUAL 14H – EXAMPLES OF ELIGIBLE AND INELIGIBLE REQUESTS

Examples of Requests that May Be Eligible for Surplus Interconnection Service	Examples of Requests that May Not Be Eligible for Surplus Interconnection Service
1. Adding a DC-coupled battery storage surplus unit that is not charging from the grid to an existing wind facility.	1. Adding an AC-coupled battery storage surplus unit that is charging from the grid to an existing wind or solar facility.
2. Adding a DC-coupled solar unit to an existing battery storage facility	2. Adding a DC-coupled battery storage surplus unit that is not charging from the grid to an existing solar facility.
	3. Adding a battery storage, wind or solar surplus unit to an existing Synchronous generating facility.
	4. Adding a synchronous surplus unit that operates in parallel with an existing Synchronous Generating Facility.

Source: *EDP Renewables North America LLC v. PJM Interconnection, L.L.C.*, Docket No. EL24-125, Complaint of EDP Renewables North America LLC, at 11 (July 5, 2024) (citing PJM Manual 14H, at 130-31 (2023), available at <https://www.pjm.com/-/media/DotCom/documents/manuals/m14h.ashx>).

In a complaint against PJM’s surplus interconnection tariff, EDP Renewables North America LLC (“EDP”) explained that PJM summarily denied its request to interconnect a new solar facility at an existing wind facility site, citing EDP’s intention to operate the two facilities simultaneously (while limiting output to the existing interconnection capacity).⁴⁶ Interviews with other developers in the PJM region confirmed that many found critical flaws in the PJM process, which they believed hindered the deployment of surplus interconnection service, ultimately leading them to abandon such projects.

Other RTOs have adopted similar approaches that have severely curtailed the use of surplus interconnection. ISO-NE restricts surplus interconnection service for Capacity Network Resource Interconnection Service to the level of service that is “continuously available,” meaning that a power plant may not have access to surplus interconnection capacity even if it operates at a very low capacity factor, as long as there are any instances where it injects power at its full interconnection rights capacity.⁴⁷ Meanwhile, the New York Independent System Operator (NYISO) secured a waiver that fully exempts it from the Order No. 845 requirement to facilitate the use of surplus interconnection.⁴⁸

As this discussion illustrates, the availability of surplus interconnection service

⁴⁶ *Id.* at 2.

⁴⁷ *ISO New England*, 170 FERC ¶ 61,209, at P 110 (2020).

⁴⁸ *New York Independent System Operator*, 170 FERC ¶ 61,117 (2020).

depends on the transmission provider's approach to surplus interconnection studies. When transmission providers apply an overly sensitive impact analysis that disqualifies requests due to minimal impacts on the transmission system, even when Network Upgrades are not required, the use of surplus interconnection service by project developers will likely prove unfeasible. The workability of a given grid operator's approach may not be immediately apparent from the tariff, as tariff language may be sparse (as is the case with the pro forma),⁴⁹ and because different entities may interpret similar tariff language in varying ways due to their distinct business practices and planning procedures. Several non-RTO transmission providers have adopted the Commission's pro forma tariff provisions for Surplus Interconnection Service as outlined in Order No. 845 without modification,⁵⁰ while others have expanded upon the Commission's pro forma language by providing a more detailed description of the surplus interconnection study process.⁵¹

The good news is that grid operators are increasingly adopting workable frameworks for interconnection service that will facilitate its use. In response to concerns over looming capacity shortages in PJM, as well as significant stakeholder support for a workable interconnection process, PJM recently amended its approach to surplus interconnection service. The new framework, similar to that of SPP,⁵² allows Surplus Interconnection Service wherever it does not trigger a Network Upgrade, effectively removing prongs (ii) and (iii) of its legacy surplus interconnection test.⁵³ Additionally, PJM's tariff now explicitly allows "the construction of additional physical interconnection facilities where Surplus Project Developers need them to accommodate the requested Surplus Interconnection Service."⁵⁴

PJM's newly approved approach mirrors that of SPP by allowing surplus interconnection wherever it does not trigger Network Upgrades. It also permits the construction of certain limited infrastructure necessary to enable surplus service, as long as such infrastructure can be built without adversely impacting the standard interconnection queue. FERC approved SPP's approach under the

49 See Order No. 845, Appendix B, at § 3.

50 See, e.g., *Pacificorp.*, 169 FERC ¶ 61,223, at P 59 (2019); *Black Hills Power, Inc.*, 169 FERC ¶ 61,145, at P 31 (2019).

51 See, e.g., *Nevada Power Co.*, 170 FERC ¶ 61,210, at PP 57–62 (2020). Nevada Power's tariff proposal specified that surplus interconnection service will not be granted where the study report identifies any new network upgrades, and specifies that surplus interconnection service "should have no additional impacts affecting the determination of what upgrades are necessary for interconnection customers that are already in the queue." See Nevada Power Co. OATT, § 3.4.3.5 (effective Jan. 2024).

52 See *PJM Interconnection, LLC.*, 190 FERC ¶ 61,083 (2025).

53 *Id.* at 7.

54 *Id.* at 6. Under PJM's Tariff, Interconnection Facilities are a subclass of Network Upgrades, so like SPP's Tariff, PJM's newly proposed rules would allow for surplus interconnection service even where it triggers a limited category of network upgrades. Under PJM's filing tariff proposal, Part VIII, Subpart E, section 414 would now specify that "[s]urplus Interconnection Service cannot be granted if doing so would require new Network Upgrades not inclusive of additional Interconnection Facilities necessary to accommodate the Surplus Interconnection Service."

Commission's independent entity variation standard,⁵⁵ noting that SPP's limits on when network upgrades can proceed for Surplus Interconnection Service requests ensure that "SPP's proposal will not result in inappropriate queue jumping."⁵⁶

This approach of permitting certain limited system upgrades, as used by SPP and now PJM, is particularly promising because it facilitates surplus interconnection in a wider range of circumstances. As the California Independent System Operator (CAISO) explained in its own proposal to allow certain network upgrades, "Providing surplus interconnection service without the ability to build some new reliability Network Upgrades would achieve little, as it is difficult to add generating capacity without affecting the electrical characteristics such that no new facilities would be required."⁵⁷

While the Commission has applied the independent entity variation to its review of RTO proposals, a similar approach can be taken in the non-RTO setting due to the distinction the *pro forma* tariff makes between interconnection facilities and network upgrades. For instance, when Louisville Gas and Electric proposed restricting the use of surplus interconnection service not only where network upgrades were required, but also where "the system impact study identifies a need for new interconnection facilities,"⁵⁸ the Commission ordered the utility to "remove this limitation."⁵⁹ Therefore, non-RTOs can (and are arguably required to) implement surplus interconnection processes that identify and allow for the construction of interconnection facilities where necessary to facilitate surplus interconnection service.

55 181 FERC ¶ 61,269, at P 15. Under the independent entity variation standard, FERC takes a more lenient approach to evaluating proposed RTO interconnection procedures than for non-RTO transmission providers. While non-RTOs must demonstrate that any deviations from *pro forma* tariff language are consistent with or superior to the *pro forma* language, RTOs need only demonstrate that proposed deviations are "just and reasonable, and not unduly discriminatory or preferential, and accomplish[] the purposes of the [relevant Commission] rulemaking." *Id.* at P 3.

56 *Id.* at P 17. The Commission drew the same conclusion with regard to CAISO's proposal that allows for surplus interconnection even where it triggers certain "new reliability network upgrades." *California Independent System Operator*, 170 FERC ¶ 61,112, at P 74 (2020).

57 *California Independent System Operator*, 170 FERC ¶ 61,112, at P 74 (2020). While the CAISO approach is workable insofar as it allows for limited infrastructure upgrades associated with surplus interconnection service, the RTO's surplus interconnection rules are not a model for other regions because CAISO also employs a restrictive "electrical independence" test that limits surplus interconnection opportunities. See *Id.* at P 82 (describing the electrical independence requirement); see also *Improvements to Generator Interconnection Procedures*, Docket No. RM22-14, Reply Comments of the Solar Energy Industries Ass'n, at 23-25 (Dec. 14, 2022) (identifying various shortcomings in CAISO's surplus interconnection process that render it ineffective at adding new capacity).

58 *Louisville Gas and Electric Co.*, 170 FERC ¶ 61,116, at P 60 (2020); see also *PJM Interconnection, LLC*, 190 FERC ¶ 61,083, at P 32 (2025) ("Unlike new network upgrades, the construction of additional interconnection facilities does not impact other interconnection queue customers.").

59 *Id.* In doing so, the Commission explained that "surplus interconnection service will likely require new directly assignable interconnection facilities to connect the surplus interconnection service customer to the original interconnection customer's interconnection facilities." Consequently, limiting it in this circumstance would render surplus interconnection service unworkable. *Id.* Next, the Commission explained that "since interconnection facilities are the sole cost responsibility of the relevant interconnection customer, requiring interconnection facilities for a surplus interconnection request will not impact others in the interconnection queue." *Id.*

Transmission providers should consider following the example set by SPP, and now PJM, by adopting workable surplus interconnection rules that allow for limited system upgrades. These rules should also enable surplus interconnection across a broad range of use cases, provided they do not require network upgrades to maintain system reliability. MISO and SPP have demonstrated that surplus interconnection can be leveraged not only to access the energy value of resources, but also to harness their capacity contributions to resource adequacy.

FERC should consider further promoting or mandating the best practices established in SPP and PJM’s tariffs. It could encourage these practices through a policy statement on surplus interconnection, or require them by issuing a follow-on order with additional *pro forma* tariff language outlining how surplus interconnection study results should be used in determining whether an applicant will be granted surplus interconnection service.

If transmission providers continue to restrict surplus interconnection by using screening measures that disqualify requests due to minimal system impacts or inhibit the use of surplus for capacity interconnection, these processes will undermine the goals of FERC Order No. 845, which include using allocated interconnection capacity more efficiently, improving wholesale competition, and “remov[ing] economic barriers to the development of complementary technologies.”⁶⁰ In these cases, where appropriate, developers seeking Surplus Interconnection Service may consider filing a complaint with FERC, highlighting how the relevant study and evaluation process conflicts with Order No. 845.

60 Order No. 845, at P 467.

Surplus Interconnection Is Not Applicable in All Regions

While Surplus Interconnection Service is required for nearly all grid operators in the Continental U.S., it does not apply to the Electric Reliability Council of Texas (ERCOT) or the New York Independent System Operator (NYISO). ERCOT is not subject to FERC's regulation of transmission tariffs, and its market design makes surplus interconnection less compelling. Unlike other market regions, ERCOT does not study the need to deliver electricity from connected resources to load, which may limit the ability to connect new ones. Instead, ERCOT uses a "Connect & Manage" system for all interconnections, which involves a more limited study of new resources, similar to surplus interconnection studies in other regions.⁶¹ Under Connect & Manage, ERCOT evaluates whether interconnecting a new resource creates safety or reliability issues caused by interconnecting the new resource to the grid, but it does not require a deliverability analysis to confirm that the new resource's power can reach consumers.⁶² Consequently, generators only pay for any immediate necessary facilities, not for Network Upgrades needed to deliver power to load—unlike the "invest and connect" system used in FERC-jurisdictional markets.⁶³ As a result, surplus interconnection requests in ERCOT offer little advantage in terms of speed or cost savings compared to a standard interconnection request.

ERCOT's approach allows for resource connections following relatively simple studies, with grid congestion then managed through price-based generator dispatch. Deliverability upgrades are typically made later—often years later—with the costs socialized across all ratepayers. While ERCOT's connect-and-manage has been successful in terms of quickly bringing new generation online, it remains uncertain whether this model can be applied to other regions, given their formal rules around deliverability and capacity markets. However, Surplus Interconnection Service offers these regions a way to capture some of the speed benefits of connect-and-manage, while still ensuring that accredited capacity is deliverable.

61 For a deeper review of connect and manage, see Tyler Norris, *Beyond FERC Order 2023: Considerations on Deep Interconnection Reform* (2023), available at: <https://nicholasinstitute.duke.edu/publications/beyond-ferc-order-2023-considerations-deep-interconnection-reform> (last accessed February 2025).

62 While ERCOT's interconnection process does model resources at "full output," and thus shares the core characteristic of Energy Resource Interconnection Service (ERIS) modeling under FERC's *pro forma* tariff that enables surplus interconnection capacity, ERCOT's threshold for determining network upgrades is narrower than most other grid operators, making surplus interconnection a less compelling proposition. See ERCOT Planning Guide, at § 5.3.2.4.1 (2023) ("The study shall identify any system limitations that would prevent the generator from achieving full output."), available at <https://www.ercot.com/files/docs/2022/12/30/January%20,%202023%20Planning%20Guide.pdf>; see also Tyler Norris, *Beyond FERC Order 2023*, at 9 (2023) (discussing variation in ways that different grid operators model redispatch of generators in the interconnection process).

63 See *id.* at 3 (describing how interconnection requests are evaluated under the invest and connect approach).

Surplus interconnection is also not used in NYISO. While NYISO is subject to FERC’s jurisdiction over transmission and wholesale electricity rates, it obtained a waiver from Order No. 845’s surplus interconnection requirements.⁶⁴ NYISO successfully argued that its unique interconnection study process renders surplus interconnection inapplicable. Specifically, when a resource applies for Energy Resource Interconnection Service (ERIS), NYISO “does not necessarily assume that a generating facility is operating at its full output under various system conditions and, instead, permits the re-dispatch of the facility and/or other facilities to the extent possible.”⁶⁵ As a result, NYISO explained, “there is no specified output in connection with the facility ... that could provide the ‘surplus’ contemplated in Order No. 845,” and therefore, “the underlying premise of the surplus interconnection service requirement ... is inconsistent with NYISO’s interconnection process.”⁶⁶ NYISO also argued that Surplus Interconnection Service was incompatible with its capacity market design, which requires separately modeling each resource behind the same point of interconnection, and mandates resources to offer their capacity into the day-ahead energy market.⁶⁷

The Commission granted NYISO’s request for waiver, agreeing that “the premise that a facility’s interconnection service is based on an evaluation of the facility at full capacity” is “not applicable to NYISO’s interconnection process.”⁶⁸ However, even if FERC was correct in stating that “NYISO’s ERIS interconnection process already reduces the cost burdens for interconnection customers by making the need for network upgrades less likely,”⁶⁹ a significant drawback of the waiver is that no process exists to access the capacity value that use of surplus interconnection service can provide. Moreover, NYISO’s study process for resources with Capacity Resource Interconnection Service does require a deliverability study, which means that, to the extent resources operate below their capacity rights, the system still has surplus capacity.⁷⁰ NYISO made it clear that any process to share capacity rights would require innovation that they were unwilling to explore in compliance with Order No. 845. This remains a significant deficiency in NYISO’s process, leaving valuable surplus interconnection opportunities untapped. NYISO should consider revising its tariff to facilitate capacity surplus as a mechanism to address the region’s resource adequacy challenges.⁷¹

64 See *New York Independent System Operator*, 170 FERC ¶ 61,117 (2020).

65 *Id.* at P 84.

66 *Id.*

67 See *id.* at PP 85–87.

68 *Id.* at P 98.

69 *Id.*

70 See NYISO OATT, § 25.7 (describing NYISO’s deliverability study requirements).

71 Similarly, ISO-NE’s approach to surplus interconnection for Capacity Network Interconnection Service largely prevents surplus interconnection from being used to add capacity to the system. See 170 FERC ¶ 61,209, at PP 86–112 (2020). Tariff improvements would be required in order to enable surplus interconnection to contribute meaningfully to the region’s resource adequacy needs.

3. Comparison of Surplus Interconnection Frameworks Across RTOs/ISOs

RTO/ISO	SURPLUS INTERCONNECTION APPROACH	PRIMARY FERC ORDER AND TARIFF PROVISIONS
CAISO	Allows for surplus interconnection service even where it triggers certain reliability network upgrades or local delivery network upgrades. However, the CAISO process requires the applicant to “demonstrate electrical independence,” ⁷² a strict test which may limit the use of surplus interconnection service.	170 FERC ¶ 61,112 (2020); OATT Appendix DD, § 3.4
SPP	Allows for surplus interconnection service wherever the study demonstrates no network upgrades are required. Where the study identifies network upgrades, service must still be granted where: (a) those additional Network Upgrades are either: (1) located at the Point of Interconnection substation and at the same voltage level as the Generating Facility with an effective [generator interconnection agreement (GIA)], or (2) are System Protection Facilities; and (b) there are no material adverse impacts on the cost or timing of any Interconnection Requests pending at the time the Surplus Interconnection Service request is submitted.	181 FERC ¶ 61,269 (2022); OATT Attachment V, § 3.3
MISO	Surplus interconnection service is available where it would not “result in a material adverse impact to the Transmission System and/or Affected Systems” such that it “amounts to a Material Modification.”	169 FERC ¶ 61,221 (2019); OATT Attachment X, § 3.2.3
ERCOT	None	N/A
PJM	Available where studies find no new Network Upgrades are required, not inclusive of additional Interconnection Facilities necessary to accommodate the surplus interconnection service (which are permitted).	190 FERC ¶ 61,083 (2025); OATT, § 36.4
NYISO	None (obtained waiver from Order No. 845).	170 FERC ¶ 61,117 (2020)
ISO-NE	The Tariff states that “Surplus Interconnection Service is not applicable when a new Interconnection Request for Interconnection Service or Network Upgrades would be required to implement the proposed change to the Original Interconnection Customer’s Generating Facility.”⁷³ Unlike most other regions, ISO-NE limits surplus interconnection service for Capacity Network Resource Interconnection Service only to the level of service that is continuously available. Surplus interconnection is not allowed for “periodic service,” which would allow for use of the interconnection capacity during specific periods when the existing generator is not making use of its interconnection rights.⁷⁴ However, this limitation does not apply to resources using Network Resource Interconnection Service.⁷⁵	170 FERC ¶ 61,209 (2020); OATT, Schedule 22, § 3.3

⁷² California Independent System Operator, 170 FERC ¶ 61,112, at P 82 (2020).

⁷³ ISO-NE OATT, Schedule 22, § 3.3.

B. Commercial Barriers and Opportunities

One key limitation on surplus interconnection is that the surplus unit is entirely dependent on the interconnection rights owned by the legacy “host” generator. This relationship creates financial and operational interdependence between the two resources, which can be difficult to manage, and introduces significant transaction costs. These barriers may limit the use of surplus interconnection in locations where it would otherwise be beneficial. This section discusses how the need to coordinate service with an existing resource creates various commercial barriers that must be addressed for successful interconnection via this pathway.

First, surplus interconnection service relies on the interconnection capacity of an existing resource, meaning the new project must either be developed by the existing resource’s owner or require close collaboration between the two developers. Second, because surplus interconnection service is linked to the existing resource’s service, the new resource must align with the existing resource’s operating horizon or have a pathway to gain interconnection rights after the existing resource’s retirement. Third, the operation and dispatch of both resources must be coordinated, which involves managing shared interconnection rights and compensating the existing resource if ownership is separate. Fourth, the full value of resources using surplus interconnection is often difficult to monetize, as the complex operation and dispatch of hybrid resources may not be adequately captured in the grid operator’s capacity accreditation framework. Fifth, the existing resource is often bound by agreements—such as equity and financing arrangements and PPAs—which may need to be amended in order to provide for surplus interconnection service.

Sorting through these issues can be challenging, especially where ownership of the existing and new resources is separate. For example, the host and surplus projects may have investors or financing parties with conflicting investment priorities, operational incentives, or long-term commercial expectations. These challenges vary between vertically integrated versus restructured states, as well as between projects inside and outside ISOs/ RTOs.

However, as developers, existing resource owners, and financing parties gain experience with surplus interconnection, business models and contractual structures are emerging to streamline the process. Owners of existing resources are becoming more aware of surplus interconnection opportunities. In vertically integrated states where the incumbent utility owns existing resources, state regulators can facilitate this process by encouraging utilities to capitalize on these opportunities, through measures such as

issuing targeted Requests for Proposals (RFPs) for surplus interconnection projects, or allowing such proposals to compete in broader RFPs.

While further efforts are needed to lower transaction costs associated with surplus interconnection service, precedents for agreements to coordinate operations between existing and new resources have been developed. Grid operators should explore ways to build on these models by developing pro forma contractual structures to barriers to entry for new participants in the surplus market. For example, MISO's pro forma "Energy Displacement Agreement"⁷⁶ includes standardized provisions on default, termination, and other commercial terms, while also clarifying responsibility for compliance with MISO dispatch and generation control requirements.

Surplus interconnection opportunities will continue to expand as financing and offtake agreements expire, and as equity, financing, and offtake partners become more aware of the revenue potential. Looking ahead, project developers may increasingly be able to incorporate surplus interconnection service into these agreements, enabling a smoother and more efficient deployment of surplus interconnection.

1. Reliance on the Interconnection Rights of an Existing Resource

As FERC observed in Order No. 845, access to surplus interconnection service is inherently controlled by the owner of the existing resource. While an owner can allocate surplus interconnection service to itself or an affiliate, "Surplus interconnection service is not available to third parties absent some process for allowing the use or transfer of the surplus interconnection service to another interconnection customer."⁷⁷ Accordingly, for surplus interconnection service to be utilized, the existing resource owner must recognize the value proposition to the host resource.

In restructured markets, developers specializing in optimizing interconnection capacity may acquire existing resources that are under-utilizing their interconnection. In vertically integrated markets, however, the incumbent utility's participation is essential. **Utilities in vertically integrated service territories are well-positioned to advance surplus service by explicitly including it as an option in future RFPs.** PacifiCorp, for example, expressly

⁷⁶ See Energy Displacement Agreement, MISO Open Access Transmission Tariff, Attachment X, Appendix 12.

⁷⁷ Order No. 845, at P 480.

invited requests from surplus customers in its 2022 RFP.⁷⁸ Oklahoma Gas & Electric Company (“OGE”) took a more targeted approach in its 2024 All-Source RFP, identifying surplus opportunities at a variety of fossil resources with capacity factors below 30 percent, including the 1,700 MW coal and natural gas Muskogee facility in Fort Gibson, OK;⁷⁹ the 1,700 MW natural gas fired Seminole facility in Konawa, OK;⁸⁰ and the 1,100 MW Sooner coal facility⁸¹ in Red Rock, OK.⁸² OG&E specified that “[b]ids using OG&E Surplus Interconnection will be evaluated alongside and against the same evaluation criteria as all other Bids”⁸³ and signaled openness to surplus bids associated with non-OG&E facilities—an important safeguard against affiliate abuse.⁸⁴ Similarly, Xcel Energy has leveraged a blended surplus interconnection-PPA model for over a decade, as documented in the Prairie Wind and Agnus Anson peaking plant case study above.⁸⁵

Southwestern Electric Power Company (“SWEPCO”) similarly invited energy storage systems to use SPP’s surplus interconnection process in its 2024 RFP.⁸⁶ The RFP allowed for energy storage bids that would interconnect at the site of SWEPCO’s existing 350 MW simple-cycle peaking plant in Arkansas, on land owned by SWEPCO, providing a rapid path to commercial deployment of energy storage at a low-capacity factor gas facility.

State regulators play a critical role in advancing surplus interconnection markets. For example, **a state commission could formally encourage—or mandate—consideration of surplus additions in utility RFPs or re-contracting with an existing facility. Regulatory staff could also submit data requests asking whether utilities evaluated surplus interconnection as a lower-cost means of meeting demand.** Focusing on surplus additions may be particularly attractive as a short- to medium-term strategy for addressing load growth or for regulators who need more time to assess whether projected data center and manufacturing load growth will materialize. **A mandate could be implemented through a requirement for**

78 See PacifiCorp’s 2022 All-Source RFP Interconnection and Transmission Workshop, at 14, available at https://www.pacificorp.com/content/dam/pcorp/documents/en/pacificorp/suppliers/rfps/pacificorps-2022-all-source-request-for-proposals/PacifiCorp_2022_All-Source_RFP_-_Interconnection_and_Transmission_Workshop_05-04-2022.pdf (last accessed Feb. 11, 2025).

79 EIA Data indicates a 28% capacity factor for the coal unit and 6% capacity factor for the oil/gas unit in 2024.

80 EIA data indicates a capacity factor between 19% and 23% for these units in 2024.

81 EIA data indicates approximately 11% capacity factor for both units in 2024.

82 See Oklahoma Gas & Electric, 2024 All Source Request for Offers, available at: <https://www.oge.com/wps/wcm/connect/6aede2cd-7ff8-4831-a4d6-23d2ebab0d5b/OG%26E+2024+All+Source+RFP+rev+1.pdf?MOD=AJPERES&CVID=o.vWTI-> (last accessed Feb. 11, 2025).

83 *Id.* at Appendix H – Overview of OG&E Surplus Interconnection.

84 *Id.* at 12.

85 See *supra* section II.C.

86 American Electric Power Service Corporation as agent for Southwestern Electric Power Company, Request for Proposals Purchase and Sale Agreements (PSAs) from Qualified Bidders for New and Operational Resources (2024), available at <https://lpscpubvalence.lpsc.louisiana.gov/portal/PSC/ViewFile?fileId=0Ywdy%2FJ3hzo%3D> (last accessed Feb. 11, 2025).

utilities to evaluate surplus options in all integrated resource plan filings. State regulators could further encourage surplus interconnection by conducting formal or informal inquiries into whether it offers a more cost-effective and expedient solution than conventional new builds.

For existing facilities already under contract, state regulators may also be able to further promote additional use of surplus capacity by formalizing their approach to contractual modifications necessary to encourage adoption of surplus interconnections. This could include requiring utilities to evaluate surplus additions to existing projects as an alternative to new builds or new contracts. **Additionally, regulators could establish a formal policy allowing for a “blend and extend” approach, adjusting existing contracts to reflect new economic benefits of the surplus resource.**

In both vertically integrated and restructured markets, greater transparency on surplus interconnection potential could encourage market actors to fully leverage these opportunities. **Congress or FERC could mandate that grid operators publish information on surplus interconnection potential in their region or service territories. Similarly, in vertically integrated markets, state regulators could require utilities to report on surplus capacity availability.**

2. Life Expectancy Alignment

One of the major challenges in deploying surplus interconnection at scale is managing the risk associated with the differing economic lifespans of the host unit and the surplus resource. Order No. 845 states that “surplus interconnection service shall not be available when the original interconnection customer retires and permanently ceases commercial operation,” with the limited exception that where certain conditions are met, “the transmission provider must permit the surplus interconnection service customer to continue the surplus interconnection service for a limited period not to exceed one year.”⁸⁷ This means that to develop a project using surplus interconnection service, the developer must plan for securing interconnection rights when the existing unit retires—particularly if that retirement is expected before the facility using the surplus interconnection reaches the end of its operational life. The life expectancy mismatch is particularly relevant for surplus units co-locating with aging infrastructure: while a new surplus project may plan to operate for 20+ years, its host resource likely has a shorter remaining economic life.

Potential development pathways include (1) using the standard interconnection process to secure interconnection rights once the existing resource retires; and (2) using a generator replacement or capacity transfer

87 Order No. 845, at PP 504–05.

process to retain all or part of the existing resource's interconnection rights.⁸⁸

While the standard interconnection queue exposes the surplus resource to timeline and cost risk, it may still be an attractive tradeoff, for example, in cases where adding energy resources to the grid without queue delay is highly valuable. This is particularly true in areas facing significant resource adequacy challenges, where even a modest increase in generation could improve reliability challenge or put downward pressure on high market prices. It may also be appealing where renewable energy credits carry a premium. If grid operators succeed in reforming interconnection queue processes to provide greater certainty and faster processing times, this pathway may become viable for a greater range of resources. Currently, however, the current delays and uncertainties in the standard interconnection queue, generator replacement, where available, remains the more appealing option for prospective surplus interconnection resources.

Generator replacement generally offers a more viable pathway for resources using surplus interconnection service, where available. Although historically challenging for developers to navigate, recent rule changes have sought to increase predictability, opening up commercial opportunities for new resources to first deploy as surplus interconnection service units and later transition to full interconnection status.

Grid operators vary in their rules on capacity transfer and generator replacement. Some RTO and non-RTO grid operators have tariff provisions allowing interconnection rights to be transferred to a new resource without requiring it to go through the standard interconnection queue. However, these processes have been implemented through individual section 205 filings rather than a broader FERC rule.

SPP,⁸⁹ MISO,⁹⁰ Dominion Energy South Carolina,⁹¹ Public Service Company of Colorado,⁹² Arizona Public Service Company,⁹³ PacifiCorp,⁹⁴ and Duke⁹⁵ all have generator replacement processes that allow for an existing generator's interconnection rights to be used by a replacement generator under certain

88 Another related potential pathway for surplus interconnection resources may be to align the addition of new surplus megawatts until the underlying resource is scheduled for repowering or refurbishment, where the grid operator exempts these processes from the standard interconnection queue. Significant investment in the underlying resource will generally only be undertaken if there is an expectation that the resource will continue to operate for a number of years into the future. This can help manage the risk of life expectancy misalignment.

89 *Southwest Power Pool*, 171 FERC ¶ 61,270 (2020).

90 See *Midcontinent Independent System Operator*, 167 FERC ¶ 61,146 (2019), later modified in *Midcontinent Independent System Operator*, 186 FERC ¶ 61,225 (2024).

91 *Dominion Energy South Carolina*, 173 FERC ¶ 61,171 (2020).

92 *Public Service Company of Colorado*, 175 FERC ¶ 61,100 (2021).

93 *Arizona Public Service Company*, 184 FERC ¶ 61,011 (2023).

94 *PacifiCorp.*, 182 FERC ¶ 61,003 (2023).

95 *Duke Energy Carolinas, LLC*, 180 FERC ¶ 61,156 (2022).

conditions.⁹⁶ These processes facilitate surplus interconnection by providing a pathway for surplus resources to secure interconnection rights once the original interconnected facility retires. However, a key barrier to their use—for both surplus interconnection and more generally—is the restricted transferability. These rules prohibit the interconnection customer from selling or transferring the relevant facility from a set period before retirement (e.g., one year ahead) until the replacement facility achieves commercial operation.⁹⁷ The scope of transferability varies between RTOs, with MISO’s process being more flexible than SPP’s, for example.⁹⁸ Synapse Energy Economics has recommended that SPP adopt MISO’s transfer provisions.⁹⁹

PJM has recently proposed tariff provisions¹⁰⁰ to address commercial feasibility barriers for investors seeking to deploy surplus interconnection resources at an existing facility but concerned about the lack of a clear operational path if the host facility retires. The proposed reforms to the capacity injection rights (CIR) transfer process are designed to “facilitate an expedited interconnection process for a replacement resource seeking to utilize the CIRs of a deactivating resource” and “better [align] the timing of de-energizing deactivating resources and the energizing of their replacements.”¹⁰¹ These new rules are modeled after FERC-approved rules for MISO and SPP that enable expedited generator replacement processes.¹⁰²

PJM’s previous generation of CIR transfer rules were commercially challenging for retiring generators, with strict limitations on the applicability of transfers, including between different types of technology. The new rules remove these restrictions, allowing, for example, CIR transfers between different generation technologies—such as thermal resources transferring their rights to storage or renewable resources—“thereby increasing the amount of Capacity on the system at a time when more Capacity is needed.”¹⁰³ Under the old rules, a CIR transferee had to navigate the existing stalled interconnection,

96 See Chelsea Mattioda et al., Synapse Energy Economics, Inc., No Regrets Solutions for Accelerating Grid Interconnection: How Fast-Track Interconnection Processes Cut Costs in SPP and MISO (Aug. 2024) (providing a broad discussion of the benefits of generator replacement processes in MISO and SPP).

97 See *Xcel Energy Services*, 187 FERC ¶ 61,158, at P 3 (2024) (discussing MISO’s transfer restrictions for its generator replacement process).

98 See Chelsea Mattioda et al., No Regrets Solutions, at 18–19 (Aug. 2024) (discussing the difference in transfer restrictions between SPP and MISO).

99 *Id.*

100 See PJM Open Access Transmission Tariff, Part VIII, Subpart E, section 426(C)(4), currently pending before FERC in Docket No. ER25-1125, *PJM Interconnection, L.L.C.*, Transmittal Letter (Jan. 31, 2025) (“CIR Transfer Rules”).

101 Letter from the PJM Board of Managers, to Stakeholders (“Letter from the PJM Board”), at 2 (December 9, 2024) (summarizing a number of capacity market reforms), available at <https://www.pjm.com/-/media/DotCom/about-pjm/who-we-are/public-disclosures/2024/20241209-board-letter-outlining-action-on-capacity-market-adjustments-rrr-and-sis.pdf> (last accessed Feb. 11, 2025).

102 See *Southwest Power Pool*, 171 FERC ¶ 61,270, at PP 13–15 (2020) and *Midcontinent Independent System Operator*, 167 FERC ¶ 61,146, at PP 61–62 (2019) (accepting MISO proposal to establish expedited generator replacement procedures).

103 See CIR Transfer Rules, at 7–8 (citing PJM OATT, Part VIII, Subpart E, § 437(A)(2)).

subjecting the surplus resource to the same interconnection delays that the CIR transfer process was intended to mitigate. The new rules clarify that the new generator replacement process is “separate from but parallel to PJM’s three-phase, clustered cycle process, much as the Surplus Interconnection Service process operates, and applies ‘first ready, first served’ principles to Replacement Generation Interconnection Requests in a transparent and nondiscriminatory manner.”¹⁰⁴ PJM notes that the “expedited timing allows replacement resources to execute an interconnection agreement sooner and also allows for their inclusion in RTEP models sooner to support reliability studies.”¹⁰⁵ This is critical to ensuring that surplus interconnection resources are able to contribute to PJM reliability as quickly as possible.

While a drawback of these rules is that they reduce the rate of CIR turnover that can be leveraged by new projects, they offer several key benefits, including unlocking significant technical potential for surplus interconnection. Generator replacement processes, like surplus interconnection, alleviate the study burden on grid operators. They also help resolve the “chicken-or-the-egg” problem that can arise with potential resource retirements, where an existing generator may be found necessary for reliability (thus delaying retirement), but new resources cannot replace the capacity because they are stuck in the interconnection queue, and skipping ahead would constitute “queue jumping”.

Overall, while generator replacement and interconnection rights transfer provisions involve a complex set of tradeoffs, one **strong argument for grid operators to adopt workable generator transfer provisions** is their potential to maximize the use of surplus interconnection. These provisions are especially important when grid operators face resource adequacy shortfalls, and where standard interconnection queue processes are overburdened—two conditions that are present across much of the country’s electricity system. **Where pursued, generator replacement and interconnection rights transfer provisions should be designed as flexibly as possible so as to facilitate their broadest possible application, in an open and non-discriminatory manner.**¹⁰⁶

104 See CIR Transfer Rules, at 7 (“This separate but parallel process will provide an efficient and timely process for studying Replacement Generation Interconnection Requests while minimizing the diversion of PJM staff resources away from the clustered Cycle process.”)

105 Letter from the PJM Board, at 2.

106 See *Xcel Energy Services*, 187 FERC ¶ 61,158 (2024) (Clements, Comm’r, concurring, at P 2) (arguing that transferability restrictions in generator replacement processes should be reconsidered because “at best,” they “appear to impede beneficial commercial transactions and, “at worst, may unduly discriminate against non-incumbent generation owners”).

3. Operational and Dispatch Considerations

Another challenge to surplus interconnection is developing frameworks that govern how the interconnection rights are coordinated between the host and surplus resources. Under Order No. 845, these arrangements must be formalized through agreements between the existing and new resources, which are then filed with FERC. Other aspects of resource coordination, such as compensation of the existing resource (where ownership is separate) are handled through purely commercial arrangements between the parties.

Order No. 845 states:

Agreements between the original interconnection customer, the surplus interconnection service customer (whether affiliated or not), and the transmission provider are necessary to establish conditions such as the term of operation, the interconnection service limit, and the mode of operation for energy production (i.e., common or singular operation) and to establish the roles and responsibilities of the parties for maintaining the operation of the facility within the parameters of the surplus interconnection service agreement.¹⁰⁷

However, the Order “decline[s] to establish these agreements as part of the pro forma LGIA or prescribe their terms and conditions,”¹⁰⁸ allowing grid operators flexibility to address them on a region-specific basis. Grid operators may “either file pro forma versions of these agreements with the Commission, as was done in MISO, or execute them as needed and file them with the Commission on an ad hoc basis.”¹⁰⁹

While executing these contractual arrangements is most straightforward when ownership of the host facility and surplus interconnection resource is unified, unity of ownership is not a requirement—as demonstrated by the numerous utility solicitation programs offering surplus interconnection rights to winners of an RFP.¹¹⁰

MISO’s Energy Displacement Agreement, incorporated into its interconnection rules, is one example of an ISO/RTO adopting pro forma tariff rules to simplify the administration of surplus agreements and clarify which entity is responsible for meeting dispatch instructions from the market operator.¹¹¹

¹⁰⁷ Order No. 845, at P 499.

¹⁰⁸ *Id.* at P 500.

¹⁰⁹ *Id.*

¹¹⁰ Even the appearance of unity of ownership within a single corporate parent may often be a mirage, given the complex financing agreements and debt covenants that underlie power plant ownership. Fractional shares and joint venture agreements are particularly common in large central station generating units.

¹¹¹ See MISO OATT, Attachment X, *Appendix 12*, which requests that the parties agree which “shall be solely responsible for the coordinated automatic generation control of the combined output of Interconnection Customer’s Generating Facility and existing generating facility.”

It remains fairly unique among grid operators in providing pro forma arrangements. However, a number of “shared services agreements” have now been filed with FERC, facilitating the shared use of interconnection rights and providing a foundation on which future surplus interconnection arrangements can be based.¹¹² We recommend that grid operators and FERC continue developing pro forma or default standardized agreements to reduce transaction costs for developers and ensure that grid operators are comfortable with the contractual and dispatch rights of the parties involved.

Other operational details are typically resolved through contracts between the host and surplus resource owners and are not subject to market rules or FERC oversight. In addressing these operational and dispatch considerations, it is important to recognize that surplus interconnection does not allow the combined facility to inject more power onto the grid than the injection rights held by the original host facility. Thus, the contractual arrangement between the parties must govern what happens when both resources wish to inject power into the grid at the same time —such as in response to high energy prices. These contractual mechanisms must be paired with power plant control settings and operational procedures that prevent inadvertent export of power beyond the authorized limits.

Given the many aspects of coordinated operation that must be addressed between the existing and new resources, surplus interconnection may be easiest to implement when a single entity owns both resources. In restructured markets, companies have emerged that specialize in purchasing existing assets and subsequently maximizing use of the surplus interconnection rights. In vertically integrated markets, build-and-transfer arrangements may offer a suitable pathway to integrating the shared operation of both resources with the incumbent utility. However, more competitive pathways have also proven to be feasible. Vertically integrated utilities can combine the use of surplus capacity at existing utility-owned generation with PPAs, as demonstrated by the case study of Prairie Wind above. There, Xcel’s South Dakota affiliate awarded a PPA to an unaffiliated wind farm developer and included the rights to interconnect with a peaking power plant owned by Xcel. While assigning surplus interconnection rights as part of a PPA negotiation could lead to affiliate abuse issues if the utility were self-building the generation, in this case, the agreement to maximize the existing plant’s interconnection by adding the wind resource was struck with an unaffiliated third party.

¹¹² See, e.g., MISO’s Shared Facilities Consent Agreement Energy, designed to create a template for interconnection customers seeking to share interconnection facilities, available at <https://cdn.misoenergy.org/Shared%20Facilities%20Consent%20Agreement%20Template625081.docx> (last accessed Feb. 11, 2025); *Earthrise Crete Interconnection*, 184 FERC ¶ 61,102 (2023) (accepting a Shared Facilities and Use Agreement).

4. Challenges in Monetizing the Full Capacity Value of Surplus Interconnection

Surplus interconnection involves connecting at least two resources behind the same point of interconnection. Hybrid resources, such as storage-intermittent or storage-thermal pairings, can provide system value that is greater than the sum of their individual components.¹¹³ However, accurately modeling the behavior of these resources to fairly accredit their value presents challenges. As grid operators have shifted to Effective Load Carrying Capability approaches, their assumptions about the coordinated dispatch of hybrid resources sometimes do not match their operations. PJM, for example, initially modeled these resources in a way that inaccurately assumed inefficient allocation of interconnection rights to the energy storage component of the resource—curtailing the variable wind or solar component even when it could have been used to charge storage.¹¹⁴ PJM has since updated its model approach to reflect more efficient operation of hybrid resources,¹¹⁵ but there is still room for further improvement.

In ISO/RTO regions where a resource's revenue partly depends on the underlying capacity accreditation models, inaccuracies in the modeling of hybrid resources can result in lower compensation for the surplus resource.¹¹⁶ As grid operator rules around hybrid resources continue to evolve, this uncertainty creates risk for commercial investors, dampening interest in surplus interconnection and hindering its optimal deployment.

While rules for hybrid resources vary across markets, one key to making surplus service commercially viable is for market rules to recognize that a wind or solar + storage facility has energy and reliability attributes that exceed either type of project on a stand-alone basis. The differentiated resource adequacy value of hybrid storage/renewable facilities was explicitly included by Marin Clean Energy, a Community Choice Aggregator operating in California in its

¹¹³ For example, a project in Fresno, California “converted a natural gas-fired peaker plant” by adding “16 MW of battery energy storage to the existing 48-MW gas-fired plant [allowing it] to burn significantly less fuel than a standard gas-fired site, and it has improved local air quality by reducing particulate emissions from the facility by as much as 78%,” while cutting greenhouse gas emissions by up to 60% and water usage by up to 80%, and substantially reducing run hours, number of starts, and gas usage. Darrell Proctor, *Hybrid Plant Provides a Cleaner Power Solution* (Oct. 2, 2023), available at <https://www.powermag.com/hybrid-plant-provides-a-cleaner-power-solution/>. The Wheatridge Renewable Energy Facility in Oregon was billed as “the first in the U.S. to combine integrated wind, solar and battery storage at such a large scale in one location, giving it even more flexibility to generate continuous output without relying on fossil fuels to fill in the gaps.” Gillian Flaccus, *North America's first wind-solar-battery 'hybrid' power plant Commissioned in Oregon* (Sept. 28, 2022), available at <https://www.oregonlive.com/environment/2022/09/north-americas-first-wind-solar-battery-hybrid-power-plant-commissioned-in-oregon.html#:~:text=The%20Wheatridge%20Renewable%20Energy%20Facility,to%20fill%20in%20the%20gaps> (last accessed Feb. 11, 2025).

¹¹⁴ See *PJM Interconnection, LLC*, 187 FERC ¶ 61,208 (2024) (Clements, Comm'r, dissenting, at PP 14–23) (explaining how PJM's approach undercounted the value of hybrid resources, but was subsequently improved).

¹¹⁵ See *id.*

¹¹⁶ A resource's revenue most directly depends on accreditation assumptions in regions such as PJM that operate capacity markets. But even in regions without capacity markets, the underlying framework for resource adequacy accreditation may determine a resource's potential revenues in the bilateral market.

resource adequacy showing to the California Public Utility Commission.¹¹⁷ **State mechanisms for incentivizing or procuring resources can be designed to help mitigate this uncertainty, and/or replace revenue lost from the resource adequacy value that is not currently captured in the market.**

In non-RTO regions, the framework for crediting the resource adequacy contributions of hybrid resources may be less critical to its commercial outlook, but the ability to conduct “apples-to-apples” comparisons between hybrid and non-hybrid resources will enhance the ability of the incumbent utility to conduct all source procurements that draw from all potential resources, including those relying on the use of surplus interconnection.

State incentive and procurement programs hold the potential to close gaps left by inadequate wholesale market structures that do not fully compensate surplus interconnection resources for their value, including non-FERC jurisdictional local economic benefits that they bring.¹¹⁸ In designing incentive and procurement programs, state regulators should consider the unique value of surplus interconnection in making greater use of existing infrastructure and existing brownfield sites. At minimum, state regulators should ensure that resources using surplus interconnection are eligible for broader incentive and procurement programs.¹¹⁹

5. Financing, Tax Equity, and Offtake Considerations

Another challenge of using surplus interconnection is the mismatch in corporate ownership structures between the host facility and the surplus interconnection project—including differences in debt/equity financing and tax equity. The financial parties and investors involved in the host facility often have a specific risk tolerance, tenor of investment, and other considerations that drove their interest in the facility. The risk profile, capital requirements, and long-term outlook of a surplus facility may differ significantly. This issue can arise even if the same equity investor is involved in both the host and surplus projects, due to differing tax equity and debt arrangements commonly used in the financing of facilities.

117 See Order Instituting Rulemaking to Continue Electric Integrated Resource Planning and Related Procurement Processes, Rulemaking 20-05-003, Marin Clean Energy Resource Plan (Public Version), available at https://www.mcec cleanenergy.org/wp-content/uploads/2022/11/MCE-2022-Integrated-Resource-Plan_11012022.pdf (last accessed Feb. 11, 2025).

118 See *supra* section II.B.5.

119 For example, a recent bill in New Jersey proposes incentives for “transmission-scale energy storage systems with a reasonable likelihood of successful and timely completion,” but limits eligibility for its initial procurement to projects with signed Generator Interconnection Agreements. See New Jersey Assembly Bill 5267, § 2 (Feb. 10, 2025), available at https://pub.njleg.state.nj.us/Bills/2024/A5500/5267_11.PDF. Resources planning to use surplus interconnection may have an equally fast or faster path to market than resources that have obtained signed interconnection agreements through the standard interconnection queue process, given the streamlined permitting that may be associated with development at the same site as an existing resource. Accordingly, regulators should consider adding an eligibility pathway to any incentive program targeting “shovel-ready” resources that allows projects planning to use surplus interconnection to participate.

A similar barrier to surplus investment can occur when the host facility is under a unit-contingent PPA or a tolling arrangement, where the facility's output is contractually committed to a third party. In these cases, the financial value of additional energy injections attributable to the surplus facility may be credited to the purchaser. For entities under a tolling arrangement, the surplus project may interfere with the economic value of the toll, creating a significant mismatch with the existing contractual obligations. **Addressing these concerns likely requires a cooperative approach from both parties to renegotiate the underlying agreement to accommodate the addition of the surplus resource.**

Several of the entities we interviewed generally consider the addition of surplus capacity only as part of a repowering or when the underlying agreement is nearing expiration and the facility is about to undergo re-contracting or repowering. This suggests that **policymakers may want to prioritize evaluating surplus service additions at facilities approaching the end of their contractual arrangements. Requiring utilities to actively seek the addition of surplus capacity before re-contracting with a resource could be a particularly effective tool for regulators in vertically integrated service territories.**

While challenges exist, there are also notable opportunities. In many cases, adding a surplus project can reduce the operational and market risks of the underlying facility, leading to improved economics. Additionally, surplus facilities may result in a decreased capacity factor for the underlying facility. This can offer significant benefits for thermal generators, because it results in fewer starts, longer intervals between major maintenance cycles, reduced operations and maintenance costs, and lower emissions compliance costs in relevant areas.

For renewable generation projects that incorporate storage using surplus interconnection, there are also significant advantages for the underlying host facility owners. For example, adding storage can insulate the variable resource from penalties (for non-performance, etc.) and provide the facility with a more consistent output, which may enhance the commercial value to offtakers.



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gridlab.org
admin@gridlab.org

