No-Regrets Solutions for Accelerating Grid Interconnection

How Fast-Track Interconnection Processes Cut Costs in SPP and MISO

Prepared for Sun2o

August 19, 2024

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EXECUTIVE SUMMARY

Surplus Interconnection and Generator Replacement interconnection processes present quick, low-cost solutions to the current interconnection bottlenecks hindering new power plant deployment. While regulators and policymakers across the United States strive to reliably, and cost effectively serve customers and prepare for anticipated electricity demand growth, new generators sit in interconnection queue backlogs for years. Moreover, these generators face increasingly expensive interconnection costs that often cause them to drop out of their queues altogether. Resources using the standard interconnection queue process cannot come online fast enough to satisfy the reliability needs of the electricity grid and its customers. Grid operators across the country have the potential to address these challenges by taking advantage of faster, quicker, and lower-cost interconnection pathways through Surplus Interconnection and Generator Replacement Interconnection. While this report focuses on the electric grid regions operated by two regional transmission operators (RTO) that together span most of the central United States, the Midcontinent System Operator (MISO) and Southwest Power Pool (SPP), the opportunities and conclusions are largely applicable to other U.S. power markets.

Generator Replacement (adding new generation at the site of a retiring plant) and ***Surplus Interconnection*** (adding new generation at the site of an existing plant) are cheaper and quicker ways to interconnect new resources, and thereby increase energy and capacity on the grid. There is incredible potential for solar, wind, and battery storage to come online using these processes while avoiding the challenges associated with the standard interconnection process. The potential for clean energy deployment through these two interconnection solutions exceeds the current solar and wind capacity in SPP and MISO. More than 40 GW of coal capacity are scheduled to retire in the next several years, which creates an opportunity for replacement with clean, low-cost resources. Additionally, there are more than 30 GW of gas turbines in MISO and SPP whose low levels of utilization make them potential locations to co-locate clean resources.

These alternative interconnection processes offer several benefits:

- **Cheaper Interconnection.** Interconnection costs are soaring for projects in the standard interconnection queue due to the expensive transmission network upgrades involved, regularly reaching over $100/kW.[1] Surplus Interconnection and Generator Replacement avoid network upgrades and allow resources to come online at a lower cost than standard interconnection projects.

- **Faster Interconnection.** Surplus Interconnection and Generator Replacement allow new resources to come online within a year or less, compared to backlogged standard interconnection queues in MISO and SPP where some projects have stalled for over seven years.

[1] LBNL. 2022. "Data from MISO Show Rapidly Growing Interconnection Costs." https://emp.lbl.gov/news/data-miso-show-rapidly-growing.

Faster interconnection can shore up system reliability as electric demand continues to grow across the United States.

- **Lower Risk.** Projects in the standard interconnection queue face greater risks as high upgrade costs and lengthy wait times cause many interconnection customers to withdraw before coming online. Interconnecting as surplus or replacement generation mitigates these risks and provides regulators and utilities greater certainty in resource planning.

- **Bonus Tax Credit Eligibility.** Solar and wind generators using surplus and generator replacement to interconnect at retiring coal plants can qualify for a 10% Energy Community bonus tax credit under the *Inflation Reduction Act* (IRA), lowering the cost to deploy new clean energy.[2]

- **Tax Revenue Replacement for Communities.** Fossil plants, especially coal plants, are increasingly retiring due to age or non-competitive operational costs, which leaves gaps in tax revenues for communities that hosted these plants. Placing new generation at sites of retiring plants will help keep tax revenues in communities that rely on those funds.

Key Takeaways:

These benefits help increase much-needed low-cost energy and capacity on the electricity grid. Utilities, commissions, and other regulators should seek opportunities to include these types of projects in Integrated Resource Plans (IRPs), Requests for Proposals (RFPs), and other planning processes for developing and deploying new energy and capacity assets. Taking advantage of these opportunities will bring low-cost projects online and help ensure system reliability.

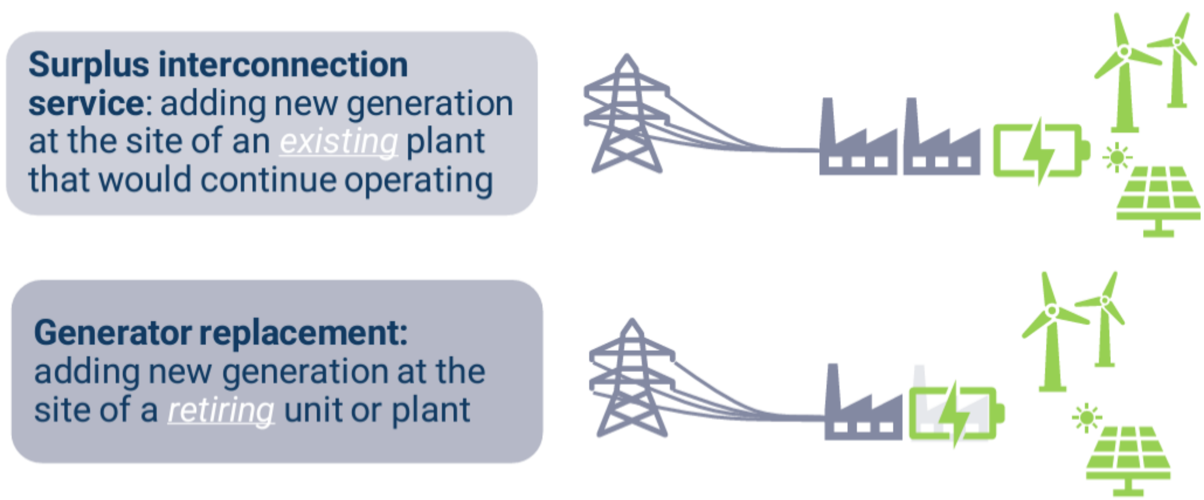
[2] Bonuses for energy communities are in addition to the increased investment tax credits and production tax credits available through the IRA.

BACKGROUND

The standard interconnection process is expensive, slow, and complex. Across the country, regional transmission operators report that future projects will take two to four years to interconnect. However, one cluster of SPP resources that entered the queue in 2017 are still waiting to achieve commercial operation nearly seven years later.[3] MISO and SPP currently see a substantial backlog of resources in their interconnection queues, leaving considerable potential untapped; MISO has over 247 GW of solar and wind resources currently waiting in its queue, and SPP has about 87 GW.[4]

Surplus Interconnection and Generator Replacement provide new resources alternative pathways to interconnect to the electric grid that are quicker, lower risk, and more cost-effective than moving through standard interconnection processes. Figure 1 provides a high-level overview of Surplus Interconnection and Generator Replacement interconnection, both discussed further below.

Figure 1. Surplus Interconnection and Generator Replacement overview



Source: Rocky Mountain Institute. 2024. "Clean Repowering: How to Capitalize on Fossil Grid Connections to Unlock Clean Energy Growth," slide 7, https://rmi.org/insight/clean-repowering/.

[3] Advanced Energy United. 2024. "MISO's Interconnection Process Evaluation." From the Advanced Energy United Scorecard series. https://advancedenergyunited.org/hubfs/2024%20Folders/2024%20-%20Fact%20Sheets/MISO%E2%80%99s%20Interconnection%20Process%20Evaluation.pdf.

[4] Lawrence Berkeley National Laboratory (LBNL). 2024. "Queued Up: 2024 Edition—Characteristics of Power Plants Seeking Transmission Interconnection as of the End of 2023." Interconnection Innovation e-Xchange presentation for the U.S. Department of Energy. https://emp.lbl.gov/sites/default/files/2024-04/Queued%20Up%202024%20Edition_R2.pdf.

Surplus Interconnection

Surplus Interconnection allows new generators to interconnect using the spare interconnection capacity available at existing generators that do not fully use their interconnection rights. Some of the greatest opportunities for Surplus Interconnection exist at natural gas peaking units, which usually only run when the grid is experiencing high demand and increasingly when renewable energy resources are not operating. This means their interconnection rights remain underutilized during the majority of hours of the year, resulting in spare capacity at their points of interconnection. For instance, a peaker plant may have interconnection rights of 100 MW but only use up to 100 MW during a handful of hours throughout the year. Clean resources, when paired with the existing generator, can effectively and efficiently make use of the existing interconnection rights and infrastructure.[5]

Generator Replacement Interconnection

Generator Replacement allows new generators to interconnect where existing generators retire, taking advantage of the previous generator's interconnection rights and infrastructure. The replacement resource must use the same point of interconnection as the retiring resource, and requests are reviewed first-come, first-served outside of the standard interconnection queue.

SUCCESS STORIES

Utilities across SPP and MISO are advancing Surplus and Replacement generation projects, identifying existing plants with additional interconnection opportunities in their IRPs, and issuing requests for proposals (RFPs) specifically procuring projects that can leverage these fast-track interconnection processes. By replacing generators outright or adding surplus capacity at these sites, utilities are adding clean, low-cost, lower-risk energy by taking advantage of existing infrastructure in their communities. Figure 2 maps several solar, wind, and battery projects that have used or plan to use Surplus or Replacement interconnection in SPP and MISO. These projects are at various stages of completion.

Table 1 provides information on these projects, and Appendix A explores some of these projects in additional detail.

[5] While some regulatory challenges remain (see the Challenges section below), there is national regulatory support for this interconnection pathway. The Federal Energy Regulatory Commission (FERC) required RTOs to establish processes to allow interconnection customers to use Surplus Interconnection at appropriate points of interconnection when it issued Order 845 in 2018. The FERC found that it would be "unjust and unreasonable" to not require transmission providers to utilize Surplus Interconnection opportunities to reduce interconnection costs, increase the utilization of existing facilities, and increase competition in wholesale markets by increasing the number of resources in the market. Federal Energy Regulatory Commission (FERC). 2018. *Reform of Generator Interconnection Procedures and Agreements,* Docket No. RM17-8-000, Order No. 845. https://www.ferc.gov/sites/default/files/2020-06/Order-845.pdf.

Figure 2. Map of select surplus and replacement projects in MISO and SPP

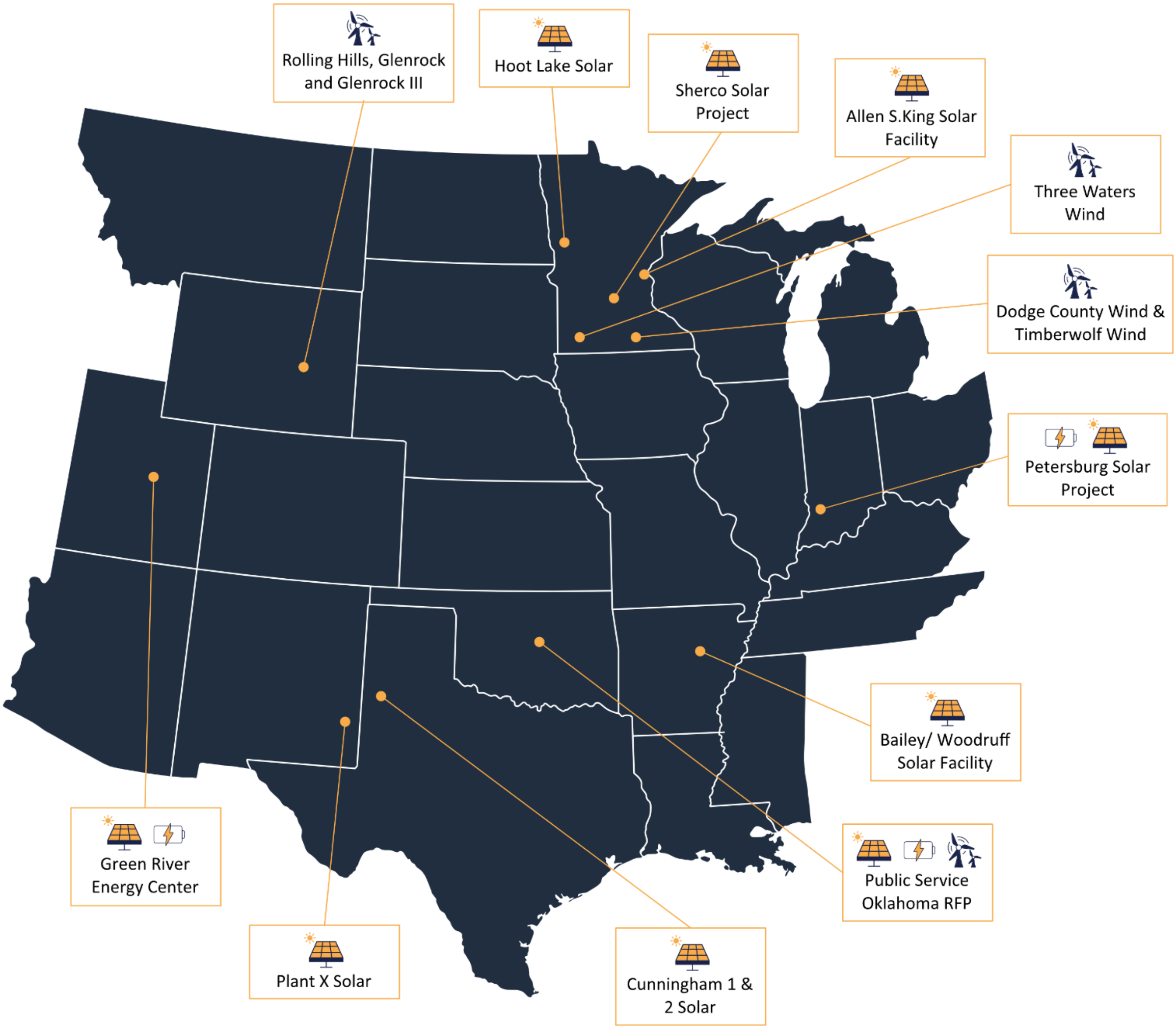


Table 1. Selection of surplus and replacement projects in SPP and MISO

Utility	Project	Capacity	Interconnection	COD
Xcel, MN	Sherco Solar Project	710 MW	Replacing Sherco Coal Plant	2025 & 2028
	Solar facility	650 MW	Replacing Allen S. King coal plant	2027-2029; proposed in RFP
Great River Energy, MN	Timberwolf Wind & Dodge County Wind	150 MW & 170 MW	Surplus at Pleasant Valley Station gas plant	2023 & 2026
	Three Waters Wind	280 MW	Surplus at Lakefield Junction gas plant	2023
Otter Tail, MN	Hoot Lake Solar	49 MW	Replacing Hoot Lake coal plant	2023
AES Indiana, IN	Petersburg Solar & Storage Project	250 MW & 180 MWh	Replacing Petersburg coal plant Units 1 & 2	2024
Rocky Mountain Power, UT	Green River Energy Center solar & storage facility	400 MW & 200 MWh	Replacing Hunter and Huntington coal plants	TBD; construction commencing in 2023
Rocky Mountain Power, WY	Rolling Hills, Glenrock, & Glenrock III wind facilities	238 MW	Replacing Dave Johnston coal plant	2009
Arkansas Electric Cooperative Corporation, AK	Bailey/Woodruff Solar Facility	122 MW	Replacing Carl Bailey Generation Station gas plant	2023
Southwestern Public Service, TX	Cunningham 1 & 2 Solar Projects	268 MW	Replacing Cunningham Generation Station	2026 & 2027; pending final approval
Southwestern Public Service, NM	Plant X Solar	150 MW	Replacing Plant X Generation Station	2027; pending final approval
Public Service Oklahoma, OK	Wind, solar, or battery storage	1,500 MW	TBD	2028; proposed in RFP

BENEFITS

The electricity system in North America is undergoing a major transition. As older fossil fuel generators such as aging coal power plants retire across SPP and MISO, the system needs affordable, and rapidly interconnected alternatives to take their place. Generating resources cannot come online fast enough to meet demand, especially through standard interconnection processes. Surplus Interconnection and Generator Replacement interconnection provide several benefits: cheaper interconnection, faster interconnection, lower risk for owners and investors, maximization of federal tax incentives, and replacement of property tax revenues for local communities. Each of these will be discussed in turn below.

"The ability for AES Indiana to use the remaining Petersburg Unit 2 MISO injection rights reduces the cost and risk of interconnection. This in turn facilitates AES Indiana's ability to meet its capacity need and in doing so safeguards system reliability and avoids the need to purchase capacity." – IRUC, approving AES Indiana's 2023 IRP

Cheaper Interconnection

"Due to the current congestion in the MISO interconnection queue, transmission interconnection costs for new resources are very high and impact the economic feasibility of adding new generation units of all types."-Otter Tail Power

Interconnection costs have risen considerably for generator owners and developers in recent years, driven primarily by increasing network upgrade costs.[6] For many resources in the standard interconnection process, system impact studies reveal costly transmission network upgrades that are required before the resource can come online.

In MISO, active projects in the queue from 2019 to 2021 had an average overall interconnection cost of $156/kW. These estimated costs have more than tripled since 2018 when average costs were $48/kW.[7] In SPP, active projects had an average cost of $106/kW in 2020–2023.[8] Interconnection costs for solar and wind are higher than the average interconnection costs for all resources at $157/kW and $154/kW, respectively.[9] When projects can interconnect through Surplus

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[6] LBNL.2023. "SPP Data Showing Rising Network Upgrade Costs, Especially Withdrawn Projects." https://emp.lbl.gov/news/spp-data-show-rising-network-upgrade | LBNL. 2022."Data from MISO Show Rapidly Growing Interconnection Costs." https://emp.lbl.gov/news/data-miso-show-rapidly-growing.

[7] LBNL. 2022. "Data from MISO Show Rapidly Growing Interconnection Costs." https://emp.lbl.gov/news/data-miso-show-rapidly-growing.

[8] LBNL. 2023. "SPP Data Showing Rising Network Upgrade Costs, Especially Withdrawn Projects." https://emp.lbl.gov/news/spp-data-show-rising-network-upgrade.

[9] LBNL. 2023. "SPP Data Showing Rising Network Upgrade Costs, Especially Withdrawn Projects." https://emp.lbl.gov/news/spp-data-show-rising-network-upgrade.

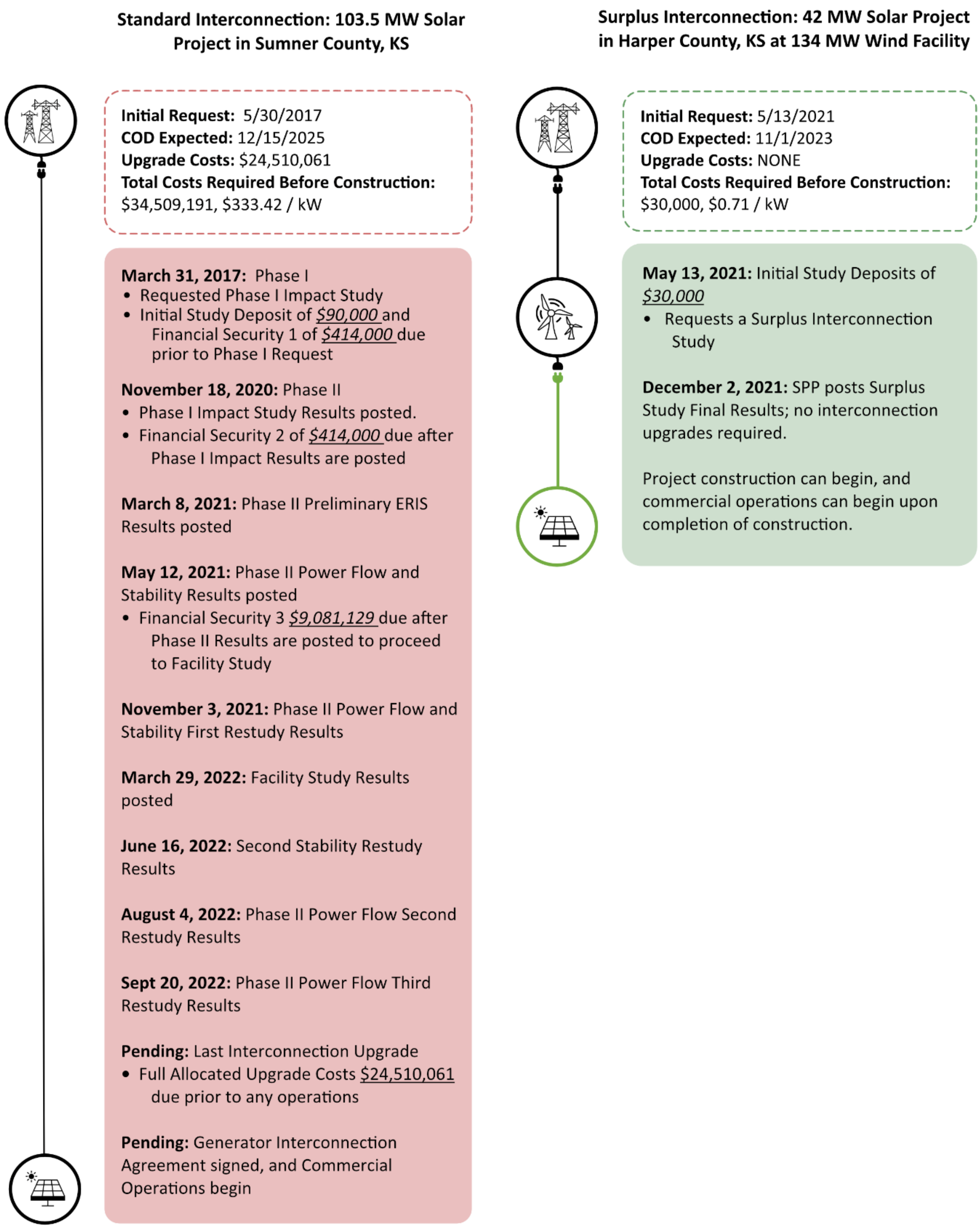
Interconnection or Generator Replacement, there are usually no transmission network upgrade costs, which greatly reduces overall interconnection costs.

Figure 3 provides an example of two projects in SPP's queue, one of which went through the standard interconnection process and a second which went through Surplus Interconnection. The solar project in Sumner County, Kansas had total interconnection costs before construction of approximately $333/kW, of which roughly 70 percent were for transmission network upgrades alone. This project will ultimately wait over eight years to interconnect.[10] In contrast, the solar project nearby in Harper County, Kansas used Surplus Interconnection, and there were no transmission network upgrades associated with this project, resulting in less that $1/kW total interconnection costs before construction.[11] As can be seen in Figure 3, surplus and replacement interconnection pathways substantially reduce interconnection costs for new generators.

[10] OASIS Apps, GI Active Requests, (last updated April 24, 2024) https://opsportal.spp.org/Studies/GIActive.

[11] OASIS Apps, GI Active Requests, (last updated April 24, 2024) https://opsportal.spp.org/Studies/GIActive.

Figure 3. Comparison of two real-world example projects going through standard and Surplus Interconnection processes



Source: SPP Interconnection Queue Website.

Faster Interconnection

RTOs across the country currently face lengthy interconnection queue backlogs, which prevent new resources, predominantly renewable resources, from coming online. Although RTOs are currently reforming their interconnection processes, many resources across different regions have spent over seven years waiting in the queue.[12]

Resources pursuing the Surplus Interconnection or Generator Replacement interconnection processes can be brought online much quicker, with interconnection studies often getting completed within a year of filing interconnection requests.[13] These interconnection processes do not require resources to wait for specific queue windows within MISO or SPP, engage in studies on a timeline with a cluster of other resources, or face potential delays from restudies or other complications. Because their level of capacity is already approved for the point of interconnection they will use, projects in these fast-track interconnection processes can skip power flow studies and move forward to facilities studies and other shorter studies that may be required. These processes have the benefit of bringing clean resources online much more quickly, and in a less complicated, streamlined way.

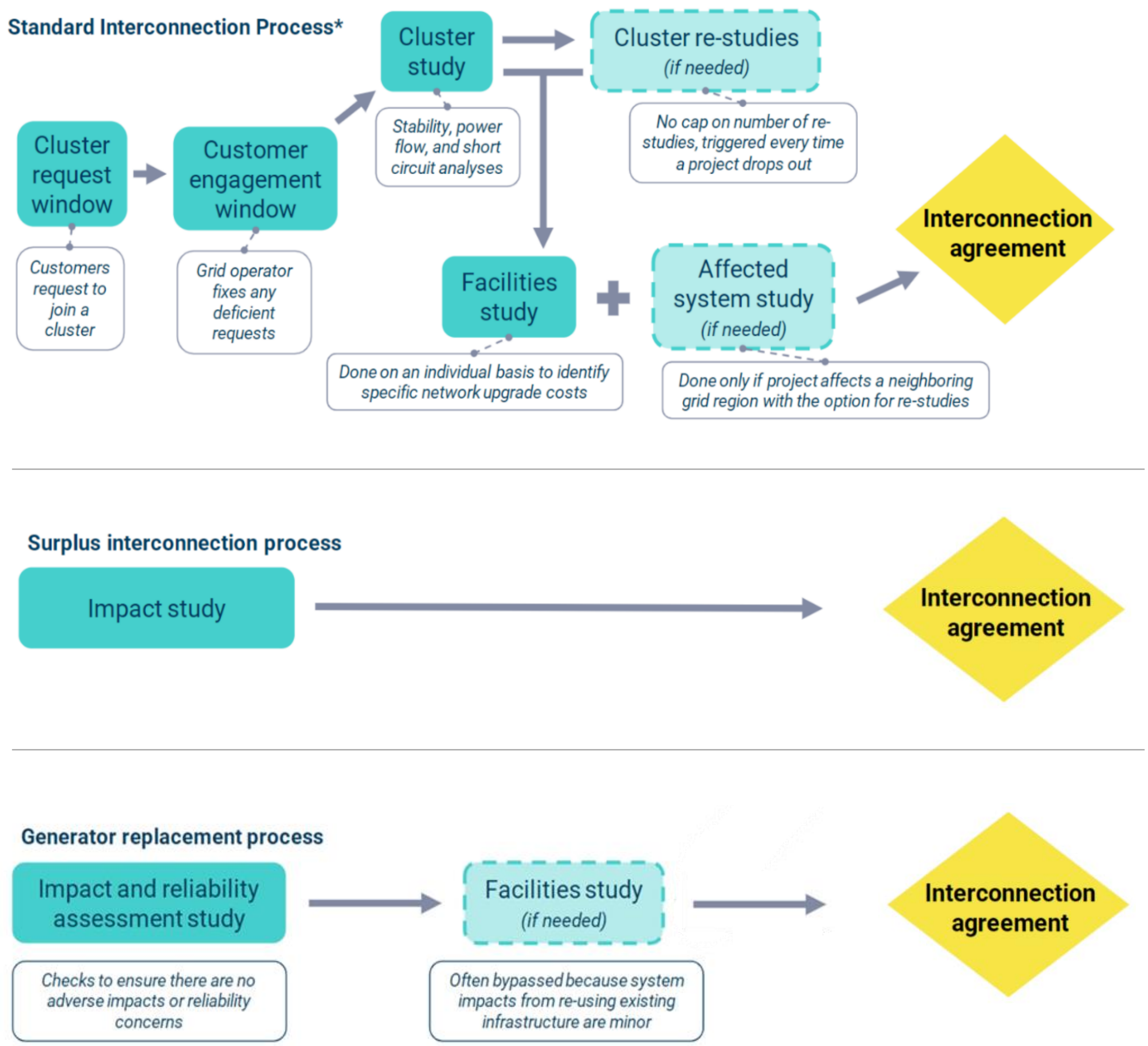
> *"The benefits of utilizing the Generation Facility Replacement Process or the Surplus Interconnection process are they are faster to complete and the resulting additional generation will likely be lower cost. These two processes only take approximately six months to complete, while the DISIS [Definitive Interconnection System Impact Study] is currently backlogged and is finally completing studies for generators that were submitted in 2017. Additionally, since both of these studies utilize existing interconnection rights, the requesting generators will not be assigned transmission network upgrade costs like the DISIS generators, thus lowering their overall cost."*
>
> *-Xcel, 2023 IRP*

Figure 4 compares the complicated, lengthy steps involved in the standard interconnection process with a generalized version of both the Surplus Interconnection process and the Generator Replacement process.

[12] Advanced Energy United. 2024. "MISO's Interconnection Process Evaluation," https://advancedenergyunited.org/hubfs/2024%20Folders/2024%20-%20Fact%20Sheets/MISO%E2%80%99s%20Interconnection%20Process%20Evaluation.pdf.

[13] Rocky Mountain Institute. 2024. "Clean Repowering: How to Capitalize on Fossil Grid Connections to Unlock Clean Energy Growth," slide 16, https://rmi.org/insight/clean-repowering/.

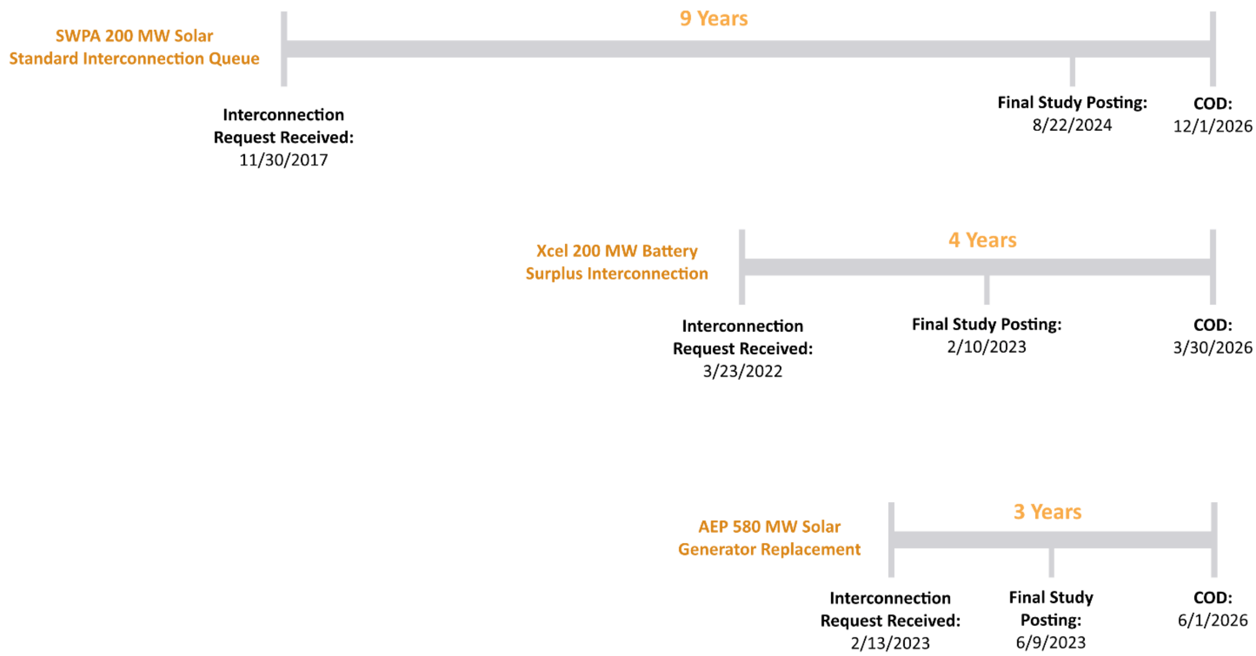
Figure 4. Comparison of a standard interconnection process to a Surplus Interconnection and a Generator Replacement process



Source: Adapted from Rocky Mountain Institute. 2024. "Clean Repowering: How to Capitalize on Fossil Grid Connections to Unlock Clean Energy Growth," slides 12-13, https://rmi.org/insight/clean-repowering/*. Different regions use varied terms for the different stages. This figure presents a general overview of the steps.*

Figure 5 compares the runway required to bring three example resources online by 2026 using the standard interconnection process, Surplus Interconnection, and Generator Replacement. In this example, the interconnection study process for the project in the standard interconnection queue will take twice as long as the Surplus Interconnection and Generator Replacement projects.

Figure 5. Interconnection timeline for three real-world example projects using the standard interconnection, Surplus Interconnection, and Generator Replacement processes



Source: SPP Interconnection Queue.

Lower Interconnection Risk

Load growth and aging generation retirement make certainty of new project execution more important than ever. Surplus Interconnection and Generator Replacement help provide that certainty by avoiding the high costs and lengthy interconnection timelines (discussed above) that cause high levels of attrition for new projects.

The often-unanticipated network upgrade costs can cause project costs to skyrocket if they don't render them infeasible altogether. The studies, restudies, and lead time for required network upgrades cause significant delays that derail project progress. SPP's 2017 cluster saw only 39 of 76 projects reach the final facilities studies stage of the interconnection process; 37 of those projects dropped out during the impact study process. This pattern of withdrawals is becoming common as costs increase over lengthy study timelines, increasing project risk and ultimately deterring investments. Results for these 2017 cluster studies were not released until 2020 and 2021, and project costs reached $934/kW. Willingness to invest in renewable energy generation will fall if interconnection results continue to become more uncertain or delayed.

Tenaska Clear Creek wind project's network upgrade costs nearly tripled from $33.5M to $99M following a re-study in SPP.

In one example from 2017, Tenaska Clear Creek, a 242 MW wind project in Missouri that interconnects through Associated Electric Cooperative Initiative (AECI). SPP conducted an affected system study and initially identified $33.5 million of required network upgrades. Then after the project achieved an interconnection agreement and began commercial operation, SPP identified the need to conduct a restudy and increased that network upgrade costs to approximately $99 million.[14] This re-study decision that increased project costs *after* a project reached commercial operation is a stark example of the risk faced by new generators. These projects cannot often control or anticipate when and what level of costs will arise.

Using existing interconnection rights gives projects "control over the timing of the interconnection to AES Indiana…and…results in lower cost, avoiding the prospect of network upgrades that can drive up interconnection costs and contribute to potential delays."- IURC

Using fast-track interconnection instead of the standard queue will enable projects, utilities, and regulators to proceed with greater confidence that projects will be completed on time and on budget. In its order on AES's integrated resource plan (IRP), the Indiana Utility Regulatory Commission (IURC) considered testimony that the ability to use existing injection rights "lowers a [p]roject interconnection risk because the [p]roject is not reliant on the [MISO] queue process and does not require execution by third-party transmission owners to complete the interconnection, both of which create the possibility for delay."[15] The IURC then noted that this gives projects "control over the timing of the interconnection to AES Indiana…and…results in lower cost, avoiding the prospect of network upgrades that can drive up interconnection costs and contribute to potential delays."[16]

The standard interconnection process presents a serious risk to new generation owners, investors, and regulators. Grid planners cannot count on new generation waiting in the queue to provide new energy capacity quickly, if at all. As high transmission upgrade costs and delays impede resource deployment, regulators should support the utilization of Surplus Interconnection and Generation Replacement opportunities for more effective resource planning.

Federal Tax Incentives and Lower Ratepayer Costs

Federal incentives squarely support clean generation looking to interconnect at retiring coal plants, or existing fossil infrastructure and most will be available until 2032. Regulators should urgently support

[14] Clark Hill. 2022. "New FERC Order Highlights Interconnection Customer Risks for Increased Transmission Upgrade Costs." https://www.clarkhill.com/news-events/news/new-ferc-order-highlights-interconnection-customer-risks-for-increased-transmission-upgrade-costs/.

[15] *Order of the Commission on Cause No. 45920*, Indiana Utility Regulatory Commission, (January 17, 2024) https://www.in.gov/iurc/files/ord_45920_011724.pdf.

[16] Ibid.

these projects so that they can start construction and take advantage of federal tax incentives before they expire.

Tax incentives through the *Inflation Reduction Act* (IRA) offer support for new generators, particularly solar and wind generators, that seek to come online where coal is retiring. For these types of developers, the IRA's Energy Community Tax Credit (ECTC) creates a 10 percent adder on top of the Investment Tax Credit or Production Tax Credit, and other tax credits for projects in energy communities. Energy communities include areas with substantial historical levels of employment or tax revenue derived from coal, oil, gas extraction, or census tracts where a coal power station closed after 2009.[17] These areas are located throughout SPP and MISO,[18] and as more coal units retire, more communities will be considered energy communities and create additional opportunities for projects to obtain the ECTC.

The U.S. Department of Energy's Loan Program Office's Energy Infrastructure Reinvestment Program also supports projects that retool, repower, repurpose, or replace energy infrastructure that has ceased operations; it further supports projects that enable operating energy infrastructure to avoid, reduce, utilize or sequester air pollutants or greenhouse gas emissions. Generators that are retiring, and thus present potential sites for replacement interconnection, could potentially benefit from these types of funding opportunities. See Table 2 for additional information on the tax benefits and funding available to solar and wind resources under the IRA.

Table 2. IRA incentives and funding opportunities potentially available to sites using replacement interconnection

Tax Credits	
Investment Tax Credit (ITC)	Solar: 30% credit through 2032
	Wind: 30% credit through 2032
Production Tax Credit (PTC)	Solar: $26/MWh credit through 2032
	Wind: $26/MWh credit through 2032
Energy Community Tax Credit (ECTC)	10% adder to the ITC and PTC for projects in energy communities
Funding for refinancing undepreciated assets and reinvesting in renewables	

[17] Energy communities are defined as brownfield sites, areas with substantial historical levels of employment or tax revenue derived from coal, oil, gas extraction, or census tracts where a coal power station closed after 2009 or a coal mine closed after 1999, among other criteria. Congress.gov. "Text - H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022," (August 16, 2022) https://www.congress.gov/bill/117th-congress/house-bill/5376/text.

[18] U.S. Department of Energy, "EJScreen: Environmental Justice Screening and Mapping Tool," (last updated April 2, 2024) https://www.epa.gov/ejscreen.

Sec. 50141. Funding for DOE Loan Programs Office	Loans to retool, repower, repurpose, or replace energy infrastructure that has retired or to improve efficiency and reliability of existing resources ($40 billion through FY2026)
Sec. 50144. Energy Infrastructure Reinvestment Financing	Loans to retool, repower, repurpose, or replace energy infrastructure no longer in operation or enable operating energy infrastructure to avoid greenhouse gas emissions ($5 billion to guarantee up to $250 billion in loans through FY2026) Sec. 60103. Greenhouse Gas Reduction Fund Financial assistance for projects that reduce greenhouse gas emissions or deploy zero-emission technology ($27 billion available through FY2024)
Sec. 50144. Energy Infrastructure Reinvestment Financing Loans	Sec. 50144. Energy Infrastructure Reinvestment Financing Loans to retool, repower, repurpose, or replace energy infrastructure no longer in operation or enable operating energy infrastructure to avoid greenhouse gas emissions ($5 billion to guarantee up to $250 billion in loans through FY2026) Sec. 60103. Greenhouse Gas Reduction Fund Financial assistance for projects that reduce greenhouse gas emissions or deploy zero-emission technology ($27 billion available through FY2024)

Source: Congress.gov. "Text - H.R.5376 - 117th Congress (2021-2022): Inflation Reduction Act of 2022." August 16, 2022. Available at: https://www.congress.gov/bill/117th-congress/house-bill/5376/text.

Replacement of Property Tax Revenues for Local Communities

The increasingly rapid retirement of fossil plants will not only require new sources of energy and capacity but also new sources of tax revenue to support the communities that hosted them. Generator replacement by new resources can mitigate the high risk of tax revenue shortfall in communities with fossil plants, which often provide substantial portions of their local communities' tax base.

For example, in Minnesota, the Sherburne County Generating Station provided 77 percent of its local city's tax base, which is equivalent to 54 percent of the school district's tax base. Another 923 MW coal plant in Cohasset provided similar quantities of tax revenue—69 percent of the city's tax base, and 19 percent of the school district's tax base.[19] As more coal plants retire, some states have identified the need to fill this revenue gap, with the Minnesota legislature specifically mandating that the tax base impacts of generator retirements be reviewed for every facility considering retirement.[20] Quickly redeveloping these plant sites is becoming a high priority in many communities across the country, and

[19] Center for Energy and Environment. 2020. "Minnesota's Power Plant Communities: An Uncertain Future." https://www.mncee.org/sites/default/files/report-files/Host-Communities-Study-Report-FINAL_2-24-20_updated%20%281%29.pdf.

[20] Coalition of Utility Cities. 2023. "What Happens to a Host Community When a Power Plant Retires?" https://www.senate.mn/committees/2023-2024/1019_Committee_on_Taxes/SF%201172%20-%202023%20Local%20Tax%20Impact%20of%20Power%20Plant%20Retirement%20(CUC).pdf.

Minnesota has even proposed a state-sponsored aid to communities that will cushion lost tax revenue from retiring plants for 21 years following a plant's retirement.[21]

Allowing new resources to interconnect where a fossil plant is retiring will ensure that the tax revenues from new generators can flow to communities facing significant gaps, across MISO and SPP states. For example, when Otter Tail Power retired its coal plant in Fergus Falls, MN, it replaced the retiring plant with enough solar panels to provide sufficient power for 9,000 homes and over $120,000 annual tax revenue to the town. The Fergus Falls mayor celebrated the continued local support saying, "Our relationship with Otter Tail Power has been essential to the history of our community. Their investments over more than 110 years have been critical to the success of Fergus Falls. This historic addition of clean energy demonstrates their continued vision for generations to come."[22]

"Our relationship with Otter Tail Power has been essential to the history of our community. Their investments over more than 110 years have been critical to the success of Fergus Falls. This historic addition of clean energy demonstrates their continued vision for generations to come."
-Fergus Falls Mayor, Ben Schierer

In 2019, economic modeling showed that a 450 MW solar plant at or near the retiring San Juan coal plant in New Mexico could replace all lost property tax revenue, support thousands of jobs during construction, and increase state and local tax revenue by $67 million.[23] When replacement generation is not local, communities will have to find other ways to manage this revenue loss and risk of tax shortfall. The cost-effectiveness of solar and energy community incentives from the IRA align these community investment needs with least-cost resource planning.[24]

[21] *Ibid.*

[22] Otter Tail Company. 2023. "We've Completed Hoot Lake Solar." https://www.otpco.com/newsroom/posts/weve-completed-hoot-lake-solar/.

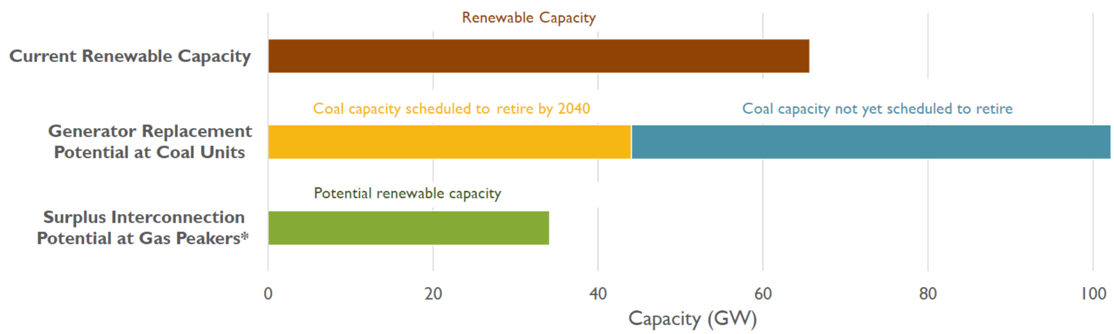
[23] O'Donnell, K. 2019. *Tax and Jobs Analysis of San Juan Generating Station Closure*. https://www.nmvoices.org/wp-content/uploads/2019/01/San-Juan-Tax-Study-report.pdf.

[24] Solomon, M., O'Boyle, M. 2023. "Renewable Would Provide Cheaper Energy Than 99% of US Coal Plants and Catalyze a Just Energy Transition." *Utility Dive*, (February 9) https://www.utilitydive.com/news/renewables-cheaper-energy-than-99-percent-of-us-coal-plants-just-energy-transition/642393/.

Deployment Potential

In the MISO and SPP footprints, which span twenty central states, clean energy deployment potential exceeds current clean capacity (Figure 6). Over 30 GW of standalone natural gas turbines in MISO and SPP create opportunities for clean resources to be interconnected through Surplus Interconnection.[25] More than 40 GW of coal capacity are scheduled to retire by 2040, presenting opportunities for Generator Replacement with clean energy resources. Taking advantage of this vast potential will efficiently increase reliability in the regions in a cost-effective way.

Figure 6. Deployment potential in SPP and MISO compared to currently deployed clean capacity



Source: Deployment data from EIA Form 860, 2022. Gas Peakers are defined as stand-alone gas/oil gas turbines and internal combustion units >10 MW listed as operable in EIA Form 860 2022. Capacity presented is nameplate capacity, not accredited capacity.

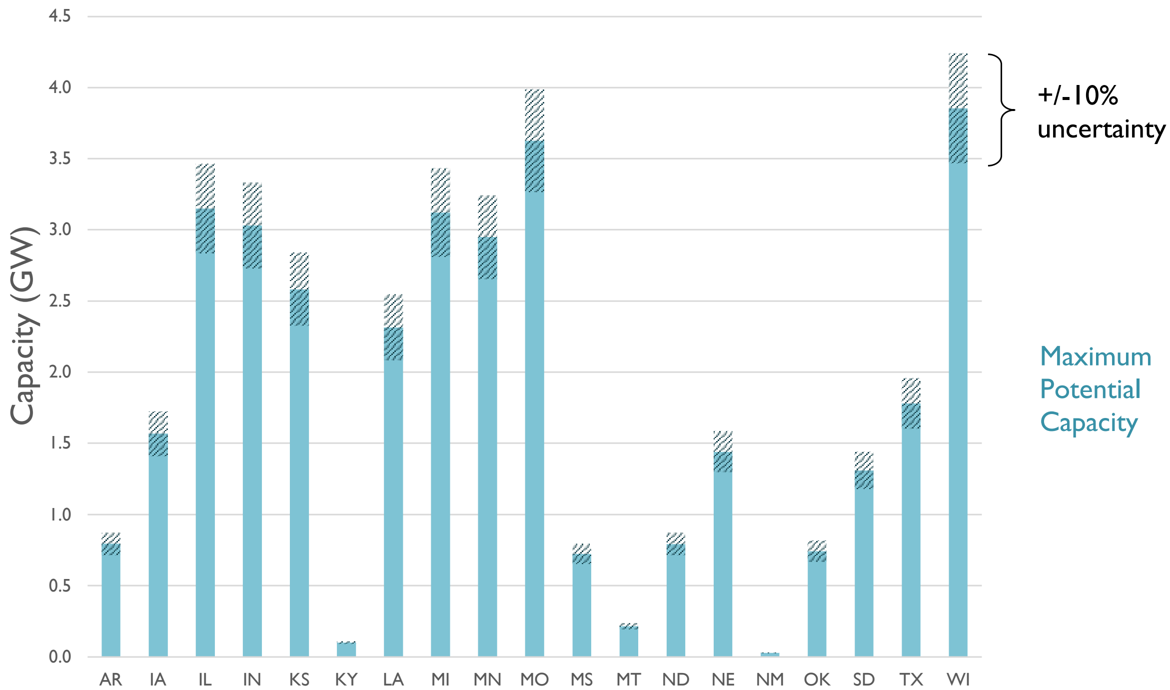
Surplus Interconnection Deployment Potential

Figure 7 shows the potential Surplus Interconnection capacity that could be captured using renewables throughout the two RTO territories. The total potential capacity across all states in MISO and SPP amounts to roughly 34 GW. Some states such as New Mexico and Kentucky have low surplus capacity represented here because only a small portion of those states are within SPP or MISO.

***34+ GW** of Surplus Interconnection capacity potential exists across all states in MISO and SPP*

[25] The data used to identify standalone gas turbines is from 2022.

Figure 7. Renewable potential from Surplus Interconnection



Note: This analysis only included oil and gas turbines and internal combustion units greater than 10 MW. The analysis excluded steam plants because they require a more case-by-case review to determine if they are good candidates for Surplus Interconnection. We also do not consider siting restrictions and feasibility of solar and wind at all sites.

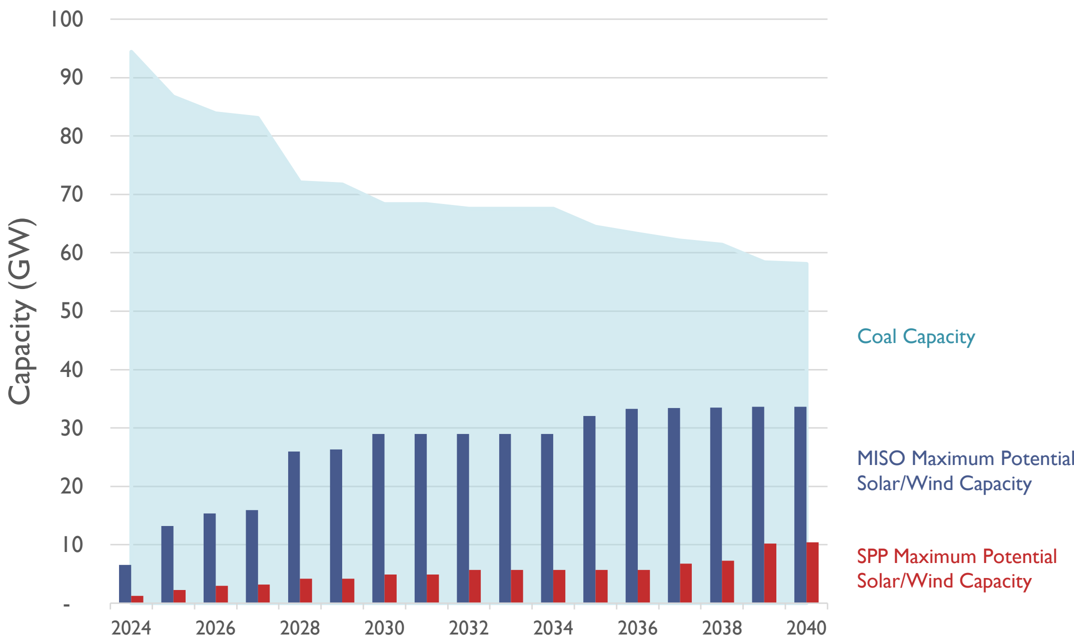
The analysis only looks at surplus capacity at peaker plants with a combined unit size larger than 10 MW; the surplus potential could be much larger if it included steam and combined-cycle plants. Although steam and combined-cycle plants are excluded here, utilities and commissions should still work collaboratively to assess the potential at these types of sites, because many will likely be a good fit for Surplus Interconnection. In addition, the analysis assumes that either wind *or* solar will get built at the point of interconnection. The analysis does not optimize wind and solar combinations, nor does it consider battery storage, which would likely increase the total amount of clean generation at the majority of sites. On the other hand, the analysis assumes that all sites can accommodate solar or wind generators of any size, though realistically, certain sites may have specific factors that make these resources more challenging to build, such as permitting constraints, insufficient buildable land adjacent to the existing plant, or low wind conditions.

Generator Replacement Interconnection Deployment Potential

Figure 8 shows the cumulative renewable capacity potential in SPP and MISO through Generator Replacement of coal plant retirements, through to 2040. There is currently 100 GW of coal capacity connected to the grid across SPP and MISO, and 44 GW of that coal capacity is scheduled to retire by

2040. Those retirements create the opportunity to add 44 GW of solar or wind capacity through Generator Replacement (34 GW in MISO and 10 GW in SPP).

Figure 8. Maximum renewable potential from Generator Replacement



It is likely that more coal plants will retire in coming years than have been reported. Projections of economical retirement (the point at which a plant becomes more expensive to operate than it is lucrative) indicate that the majority of coal plants in the country will retire by 2035.[26] As with Surplus Interconnection, our calculation of Generator Replacement does not consider the co-location of solar and wind, opportunities for battery storage, or construction limitations to optimize generation.

There is a high deployment potential in SPP and MISO for resources to interconnect as Surplus or Replacement generation. Regulators and utilities should seize these opportunities to interconnect more clean energy resources and help serve load growth.

[26] National Renewable Energy Laboratory (NREL). 2023. *2023 Standard Scenarios Report: A U.S. Electricity Sector Outlook*. https://www.nrel.gov/docs/fy24osti/87724.pdf.

CHALLENGES

Although Surplus Interconnection and Generator Replacement hold tremendous potential to deliver more energy, capacity, and reliability through cheaper, faster, and lower risk interconnection, there are still some challenges that may limit that potential. First, not all sites currently used by fossil plants will be conducive to building out renewable energy. Some sites will lack sufficient land space or wind or solar potential, or they may face other limitations that render clean replacements or additions infeasible, such as permitting delays.

Regulatory barriers also remain, despite some recent advancements. MISO previously maintained transferability restrictions that prevented existing generators from transferring interconnection rights to entities they do not own. This was originally designed so that projects in the normal queue could not skip ahead of the queue by buying the rights from existing generators. However, these requirements ultimately excluded unaffiliated developers from being able to redevelop retired power plant sites. Stakeholders made it clear that being able to transfer a generator's capacity rights to a replacement facility would increase their ability to attract investment. In November 2022 when FERC granted a waiver of these restrictions, Commissioner Clements spoke out against MISO's transferability restrictions, stating that, "No part of those [generator replacement] rules is more in need of reconsideration than these transferability restrictions, which, at best, appear to impede beneficial commercial transactions and, at worst, may unduly discriminate against non-incumbent generation owners."[27] In response, MISO created some exceptions to the transferability restriction to allow existing generators to sell or otherwise transfer their existing facility, their existing generator interconnection agreement (GIA) or a replacement generating facility to any entity so long as the transaction meets additional requirements set by MISO related to the transfer process.[28]

SPP's Generator Replacement process still does not provide for such exceptions but would benefit from following MISO's lead to increase transfer flexibility.[29] Currently, SPP cancels the retiring generator's interconnection agreement and creates a brand new agreement for the new generator. This process must be initiated by the owner of the retiring generator, who must also own the replacement generator, with no exceptions. Although the owner can ultimately sell either facility, it is prohibited from doing so from the moment it submits a replacement generator request until the replacement facility achieves commercial operation. This restriction was created to mitigate concerns that new generators would use

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[27] Federal Energy Regulatory Commission, Order Granting Waiver, Docket No. ER22-2632-000 (November 8, 2022) https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20221108-3063&optimized=false.

[28] Midcontinent Independent System Operator. 2023. "MISO Tariff, Attachment X – Generator Interconnection Procedures." (November 6) https://www.misoenergy.org/legal/tariff/.

[29] Southwest Power Pool. 2020. "Submission of Tariff Revisions to Implement a Generator Replacement Process, Docket No. ER20-1536-000." (April 10). https://spp.org/documents/61990/20200410_revisions%20to%20implement%20generator%20replacement%20process_er20-1536-000.pdf.

facility replacement as a vehicle to skip the interconnection queue.[30] However, as discussed above, these concerns about queue skipping and discriminatory treatment were unfounded; Generator Replacement may even prevent discriminatory patterns impacting non-incumbent generation owners. Both RTOs should continue to explore impediments to these faster pathways to maximize their potential benefits and enhance grid reliability.

KEY TAKEAWAYS

Surplus Interconnection and Generator Replacement have incredible potential to bring wind and solar online more cheaply and quickly. Standard interconnection methods are not fast enough to bring the required amount of clean energy online to help lower electricity cost or satisfy reliability needs.

Utilities and commissions throughout MISO and SPP should incorporate these fast-track interconnection pathways into their standard planning processes, and they should look for opportunities to quickly interconnect low-cost, clean energy throughout their territories:

- For instance, commissions could require utilities to explore Surplus and Generator Replacement interconnection as part of their IRP processes. Similarly, commissions could require utilities to issue targeted RFPs for fast-track interconnection options at specifically evaluated generation facilities.
- Commissioners should consider the advantages Replacement and Surplus Interconnection bring in terms of tax revenue to communities, their ability to leverage financial incentives, and reduced risk compared to the standard queue process. They should evaluate projects based on their ability to demonstrate these benefits, while providing the most cost-effective options.
- Utilities should be encouraged, or even mandated, to investigate opportunities for Surplus Interconnection and Generator Replacement at their power plants.

RTOs should also work to support these processes in their jurisdictions:

- All RTOs can continue to break down barriers to these pathways, and utilities should advocate for these changes.
- SPP would benefit from following MISO's lead to create more flexibility around the ownership of a replacement facility. This type of change will encourage more resources to take advantage of this opportunity to replace both energy and revenues in what are likely energy communities eligible for additional incentives.

[30] *Ibid.*

- MISO is currently considering changes to its Generator Replacement process that would allow new generators to interconnect one substation away from the retiring plant. This change will make it easier to take advantage of opportunities from retiring plants and should be implemented by MISO.

Regulators should act quickly to establish support so that new generators can take advantage of federal incentives that will only be available until 2032. If regulators do not support these opportunities, be it through IRPs, RFPs, or other processes, their communities and customers will miss out on receiving the multiple benefits that Surplus Interconnection and generator replacement can offer.

Appendix A. SUCCESS STORIES

This Appendix provides additional detail on a selection of successful surplus and replacement projects in MISO and SPP.

Xcel Energy Coal Plant Replacement in the Upper Midwest

Xcel Energy plans to construct 710 MW of solar generation at the retiring Sherco Coal Plant in Sherburne County, Minnesota. The first 460 MW of the solar project are scheduled to begin operating in 2025, and the 250 MW expansion is scheduled to come online in 2028; in total the solar plant will use the entire 710 MW of capacity injection rights. At the time of Sherco Solar's groundbreaking, Xcel highlighted that the project would provide, "the lowest-cost solar on Xcel Energy's system in Minnesota, South Dakota, North Dakota, Wisconsin and Michigan," and that federal tax credits would reduce impacts to customers by upwards of 30 percent.[31]

This project is part of Xcel's Upper Midwest Integrated Resource Plan 2020–2034, which outlines the company's plan for retiring all the coal plants in its service territory by 2030. In its initial 2019 IRP filing, Xcel proposed to install new gas-powered combined-cycle plants at the retiring Sherco Coal Plant, but the Commission rejected that proposal and instead approved Xcel's amended plan to install approximately 720 MW of company-owned solar-powered generators to interconnect at the retiring Sherco Coal Plant.[32] The Sherburne County Generating Station provided 77 percent of its local city's tax base, which is equivalent to 54 percent of the school district's tax base.[33]

Great River Energy Wind Farms' Use of Surplus Interconnection

Great River Energy plans to use Surplus Interconnection to bring three wind farms online at the sites of Pleasant Valley and Lakefield Junction gas facilities in Minnesota. The company will work with NextEra to bring online a combined 600 MW capacity of Dodge County Wind, Three Waters Wind, and Timberwolf

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[31] Xcel Energy. 2023. "Xcel Energy Breaks Ground on Upper Midwest's Largest Solar Project." (May 22) https://mn.my.xcelenergy.com/s/about/newsroom/press-release/xcel-energy-breaks-ground-on-upper-midwest-s-largest-solar-project-MCQQIXB3EFQND5JD5HGLAFRBFXBE.

[32] Minnesota Public Utilities Commission, *Order Approving Plan with Modifications and Establishing Requirements for Future Filings, In the Matter of the 2020-2034 Upper Midwest Integrated Resource Plan of Northern States Power Company d/b/a Xcel Energy*, Docket No. E-002/RP-19-368 (April 15, 2022) E-docket: 20224-184828-01.

[33] Center for Energy and Environment. 2020. *Minnesota's Power Plant Communities: An Uncertain Future*. https://www.mncee.org/sites/default/files/report-files/Host-Communities-Study-Report-FINAL_2-24-20_updated%20%281%29.pdf.

Wind, capitalizing on existing GIAs at peaking units.[34] NextEra had previously withdrawn Dodge County Wind from the standard MISO process in 2020 "because of exceedingly uneconomic costs."[35]

In its 2021 IRP, Great River Energy emphasized its strategy to use existing GIAs to incorporate "advantageously priced wind in [its] portfolio as a valuable hedge while avoiding significant costs."[36] Overall, Great River Energy plans to match all of its remaining peaker plants with wind farms to bring up to 1,400 MW of clean energy to the grid while avoiding the challenges of the MISO queue.[37]

AES Indiana Replacement of Last Coal Plant with Solar

AES Indiana is replacing two of four retiring coal units at the Petersburg Station with 250 MW of solar and 180 MWh of battery storage, which are scheduled to start operating in the second quarter of 2024.[38] In its 2019 IRP, AES Indiana determined that connecting renewables to the existing point of interconnection at the Petersburg Station was the most cost-effective way to replace the retiring capacity.[39]

In its order approving the plan, the IRUC noted, "The ability for AES Indiana to use the remaining Petersburg Unit 2 MISO injection rights reduces the cost and risk of interconnection. This in turn facilitates AES Indiana's ability to meet its capacity need and in doing so safeguards system reliability and avoids the need to purchase capacity."[40] The Indiana commission considered testimony that using existing injection rights "lowers a Project interconnection risk because the [p]roject is not reliant on the [MISO] queue process and does not require execution by third-party transmission owners to complete the interconnection, both of which create the possibility for delay."[41] The commission then noted that this gives projects "control over the timing of the interconnection to AES Indiana…and…results in lower

[34] Great River Energy. 2021. *2021 Integrated Resource Plan Update*, (April 1) page 1, https://greatriverenergy.com/wp-content/uploads/2022/04/2021-Integrated-Resource-Plan-040121.pdf.

[35] Jossi, Frank. 2021. "In Minnesota, old power plants could be the on-ramp for new wind and solar." *Energy News Network* (October 21). Accessed: https://energynews.us/2021/10/21/in-minnesota-old-power-plants-could-be-the-on-ramp-for-new-wind-and-solar/.

[36] Great River Energy, *2021 Integrated Resource Plan Update*, (April 1, 2021) page 1, https://greatriverenergy.com/wp-content/uploads/2022/04/2021-Integrated-Resource-Plan-040121.pdf.

[37] In its 2021 IRP, Great River Energy emphasized its strategy to use existing GIAs to incorporate "advantageously priced wind in [its] portfolio as a valuable hedge while avoiding significant costs."

[38] *Order of the Commission on Cause No. 45591*, Indiana Utility Regulatory Commission, (November 24, 2021).

[39] Indianapolis Power & Light Company (AES Indiana). 2019. *2019 Integrated Resource Plan Volume 1 of 3*. https://www.aesindiana.com/sites/default/files/2021-02/2019%20IPL%20IRP%20Public%20Volume%201.pdf.

[40] *Order of the Commission on Cause No. 45920*, Indiana Utility Regulatory Commission, (January 17, 2024) https://www.in.gov/iurc/files/ord_45920_011724.pdf.

[41] *Order of the Commission on Cause No. 45920*, Indiana Utility Regulatory Commission, (January 17, 2024) https://www.in.gov/iurc/files/ord_45920_011724.pdf.

cost, avoiding the prospect of network upgrades that can drive up interconnection costs and contribute to potential delays."[42]

Petersburg Station is AES Indiana's only existing coal plant—with the replacement of Petersburg units with solar, battery, and natural gas, the company will have phased out all its coal generation by 2025.

Southwestern Public Service Awaiting Approval for 400 MW of Solar Replacement

Southwestern Public Service (SPS) is awaiting commission approval to build over 400 MW of solar capacity and 36 MW of battery storage capacity at the site of three retiring gas plants in Texas and New Mexico. In filings related to the company's application to construct new generation facilities, SPS noted that reusing existing interconnections "will save SPS' s customers between approximately $146 million and $439 million (total company), which reduces SPS' s revenue requirement over the lifetimes of the SPS Self-Build Projects."[43]

This project is in line with SPS's strategy presented in its 2023 IRP. In that docket the company discussed the benefits of Generator Replacement and Surplus Interconnection, stating that, "These two processes only take approximately six months to complete, while the DISIS (Definitive Interconnection System Impact Study) is currently backlogged and is finally completing studies for generators that were submitted in 2017."[44]

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[42] *Ibid*.

[43] Southwestern Public Service Company. 2024. *Proposed Findings of Fact, Conclusions of Law, and Ordering Paragraphs*, SOAH Docket No. 473-24-02691, Texas PUC Docket No. 55255, (March 20) https://interchange.puc.texas.gov/Documents/55255_289_1377398.PDF.

[44] Xcel Energy, *In the Matter of Southwestern Public Service Company's 2023 Integrated Resource Plan for New Mexico*, Case No. 23-00073-UT, (October 13, 2023), page 46, https://www.xcelenergy.com/staticfiles/xe-responsive/Company/Rates%20&%20Regulations/Resource%20Plans/2023%20SPS-IRP%20Plan.pdf.

Appendix B. DEPLOYMENT POTENTIAL: ANALYSIS OVERVIEW

Surplus Interconnection

Synapse calculated the Surplus Interconnection potential by determining the amount of additional generation possible at existing generator sites, up to the plant's nameplate capacity (assumed to be equal to a plant's capacity injection rights). The analysis focused on surplus capacity at gas peaker plants, which run less frequently than baseload plants or intermediate plants, providing more opportunity for Surplus Interconnection. The analysis only included stand-alone[45] gas and oil peaker plants (gas turbine and internal combustion) whose combined units have a nameplate capacity greater than 10 MW located in SPP and MISO territories. Using data from the U.S. Energy Information Administration (EIA) and the Environmental Protection Agency (EPA),[46] Synapse identified 200 of these plant types, which have a combined plant capacity of 34 GW.

To calculate the amount of available surplus capacity at each plant, Synapse used the EPA's Clean Air Markets Program Data (CAMPD) from 2022 to find hourly generation at each peaker plant in SPP and MISO over the course of the year.[47] Each plant's actual generation was subtracted from its nameplate capacity to find the hourly surplus, or the available generation potential, at each plant. The maximum possible surplus at each plant determines how much renewable capacity could be built at the respective plant using the same point of interconnection.

Generator Replacement

To find the Generator Replacement capacity, Synapse used EIA data[48] to calculate the total capacity of retiring coal plants in SPP and MISO. Coal plant scheduled retirement dates are reported by EIA and the National Database (NDB)[49] —the analysis prioritized EIA's scheduled retirement dates and filled in the gaps with data from the NDB. Next, Synapse summed the nameplate capacity of all coal plants scheduled to retire in SPP and MISO each year and assumed a 1:1 ratio between coal retirement and clean energy replacement via this interconnection process. By 2040, 44 GW of solar or wind could be built to replace retiring coal plants.

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[45] Stand-alone means that the units are not connected to a combined-cycle plant or any other steam unit.

[46] U.S. Energy Information Administration. 2023. Form 860, (September 19) https://www.eia.gov/electricity/data/eia860/.

[47] U.S. Environmental Protection Agency. 2023. "Clean Air Markets Program Data." https://campd.epa.gov/.

[48] U.S. Energy Information Administration. 2023. Form 860, (September 19) https://www.eia.gov/electricity/data/eia860/.

[49] Data purchased by Synapse from Anchor Power Solutions for 2022.