AES' Energy Innovation Challenge



2026 Prompt Packet

Accelerating interconnection through innovation

The Problem

After decades of stable growth, energy demand has begun increasing exponentially across the residential, commercial, and industrial sectors. An ICF International analysis projects overall U.S. electricity demand to increase by 25% by 2030 and 78% by 2050 compared to 2025 levels mainly due to new AI and cloud infrastructure, manufacturing facilities, and building and transportation electrification. While a wide variety of energy resources have been entering interconnection queues to power the grid, an increased number of large loads have also submitted applications to connect to the grid. Because of the increased backlog in the queues compared to historical precedence, generation and load interconnection have become an increasingly relevant topic in the energy industry. Now, interconnection is one of the main bottlenecks for deploying new energy generation and data center projects. Projects can be permitted but could still wait in the interconnection queue for years, with costs and delays eroding project viability. High interconnection fees, uncertain cost allocation, and unpredictable schedules are making many projects unprofitable, even when land, financing, and equipment are secured.

The transmission grid was not designed for the current pace of energy deployment, AI infrastructure growth, and electrification. Utilities and grid operators are prioritizing flexible resources like energy storage, which can reduce the need for additional transmission infrastructure and generation capacity. This is shifting interconnection priorities toward projects that enhance grid reliability and flexibility versus only loads and generators looking for firm connections.



Interconnection is a key issue due to:

- → **Energy security**: Delays threaten the pace of adding resources required to sustain growth onto the grid
- → **Economic strain**: Billions in lost investment and consumer costs
- → **Data center and AI growth**: Constrains the build out of AI to meet consumer demand
- → **Policy urgency**: Federal Energy Regulatory Commission (FERC) and regulators are pushing reforms to avoid systemic grid bottlenecks

Interconnection is no longer just a procedural hurdle — it is a structural impediment to the U.S. energy system's ability to deliver new capacity and connect loads driving economic growth on time, at affordable costs, and in a way that supports both climate goals and commercial milestones.

Interconnection process

Currently, U.S. grid interconnection is regulated by the Federal Energy Regulatory Commission (FERC) and the interconnection project queues are managed by regional transmission operators (RTOs) and independent system operators (ISOs) who each have their own rules and procedures governing who can interconnect.

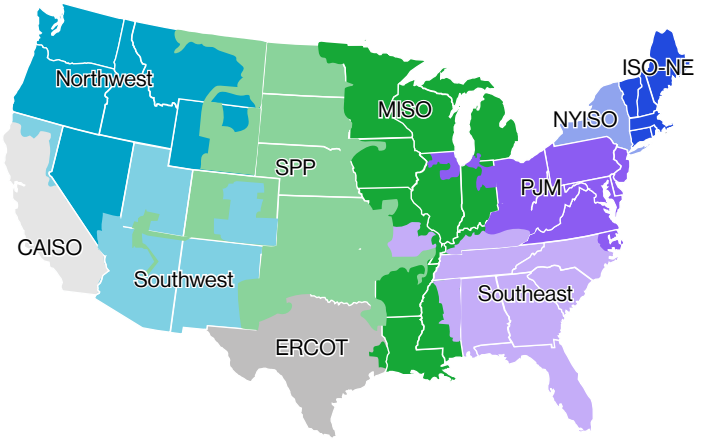


Figure 1: Map of North American ISOs and RTOs.
Source: FERC

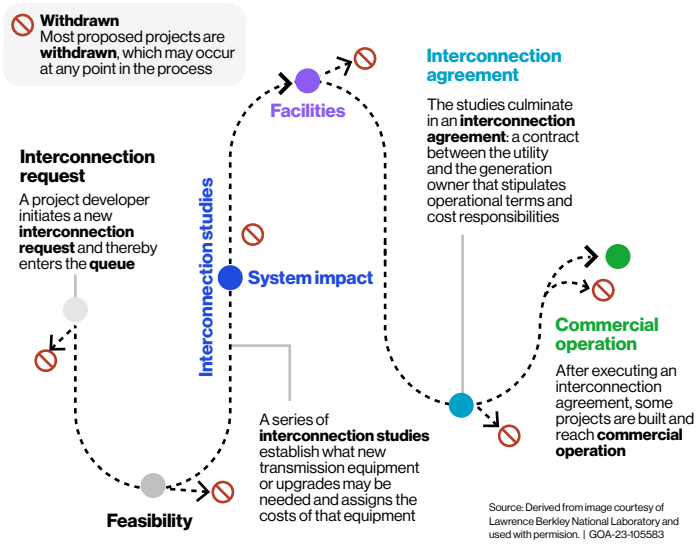


Figure 2: Diagram of generator interconnection process.
Source: Lawrence Berkeley National Lab

To initiate an interconnection, an Interconnection Customer must submit an Interconnection Request (IR) for the generator, which typically includes:

- → Application form and fee
- → Proof of site control
- → Technical appendices (power or load flow models, generation or load specifications, etc.)
- → Generator Models (PSSE, PSLF, ASPEN, PSCAD)
- → Electrical single-line diagrams
- → Preliminary site plan with coordinates

From there, the Transmission Provider (TP), such as the utility and/or ISO, analyzes and processes the request. The interconnection study process organizes interconnection requests in clusters (as of FERC Order 2023). The clusters are typically organized annually, or they can be organized by date and geographic area depending on the Transmission Provider's rules listed in their open access transmission tariff. Large load interconnection follows a similar process but is currently less structured and is governed more by the transmission provider or utility in the region.

Interconnection challenges

Each Transmission Provider is allowed to create their own study methodology governing how they administer the technical aspects of each study.

This lack of standardization leads to variations in how each Transmission Provider runs their studies, making it more complex for applicants to assess project feasibility across regions.

Another challenge for improving the interconnection process is interconnection queue data accessibility. The types and frequency of data sharing are not standardized across the U.S., aside from requirements for adoption and compliance with IEEE 1547-2018. Publicly available data is based on state requirements for data sharing and standardization. While interconnection queues in some states look larger than others, it may be due to available data rather than indicative of higher levels of Distributed Energy Resource (DER) deployment.

Major barriers to data sharing and data collection include:

- → Labor and resources needed to collect, aggregate, clean and standardize the data
- → Computing requirements for data collection and sharing
- → Privacy and security of the data (i.e. CEII clearance)
- → NERC reliability requirements are interpreted at a regional level, resulting in different reliability studies and modeling requirements, changing data needs for projects regionally
- → Lack of transparency between transmission providers for standardized study definitions and data

The pace of reforms needed to mitigate interconnection challenges varies depending on the market, regulations, and resource availability.

Interconnection is a crucial bottleneck in the energy space, holding up billions of dollars of investment and stifling the energy transition due to a disconnection between technological advances, policy measures, and effective implementation across the U.S.'s diverse regions. However, interconnection challenges also provide ample opportunity for innovation and new creative solutions for a safer, cleaner, more cost-effective, and efficient grid. The best interconnection solutions, as illustrated in the next section, are grounded in strong technical understanding of the issues at play and can integrate efficiencies with policy and strategic stakeholder engagement.

For additional resources on Interconnection, see the attached resources below:

- → Electricity demand growth: How will the grid keep pace? | ICF
- → Learn More About Interconnections | Department of Energy
- → With U.S. Electricity Demand Set to Skyrocket, the Call for Solutions Accelerates | The Pew Charitable Trusts
- → Interconnection Processes for Large Loads: Current Practices and Recommendations | ESIG
- → Interconnection 101 – Fact Sheet | ACP
- → Transmission Basics | Lawrence Berkeley National Laboratory
- → Energy Primer: A Handbook on Energy Market Basics | FERC
- → Distributed Energy Resource Interconnection Roadmap - For Exec Sec | DOE
- → Department of Energy, Federal Energy Regulatory Commission: Building for the Future Through Electric Regional Transmission Planning and Cost Allocation | U.S. GAO.
- → FERC's "Building for the Future Through Electric Regional Transmission Planning and Cost Allocation" (Docket RM21-17-000) issued in June 2024 (effective Aug. 12, 2024)
- → Generator Interconnection | Federal Energy Regulatory Commission
- → Distributed Energy Resources Interconnection: Overview of Process, Data and Queue Management | Lawrence Berekeley National Laboratory
- → Heatmap | Advanced Energy United Whitepaper: Generator Interconnection Interim Progress Report
- → DER Interconnection Roadmap | DOE
- → Connecting to the Grid - Interstate Renewable Energy Council (IREC)

Supporting examples

The following examples highlight reforms and innovations occurring across the energy value chain, including policy and market reforms, performance incentive mechanisms, grid-enhancing technologies (GETs), and emerging operational frameworks to address interconnection challenges. While these solutions vary in maturity, they illustrate how the industry is working to unlock additional grid capacity, improve infrastructure utilization, and reduce barriers to connecting new resources to the grid.



Policy and market reforms

An important example of innovative thinking within the energy industry was FERC Order 2222, which challenged the traditional assumption that only large, centralized generation resources could meaningfully participate in wholesale electricity markets. Prior to Order 2222, many distributed resources such as battery storage, rooftop solar, EVs, and demand response assets were considered too small in generation to meet market participation requirements individually. However, this order required RTOs and ISOs to allow aggregated Distributed Energy Resources (DERs) to participate alongside traditional generation in regional electricity markets. This policy laid the groundwork for Virtual Power Plants (VPPs), enabling DERs to operate as a single dispatchable asset, increasing grid flexibility, and reducing dependence on large, centralized generation. **Importantly, Order 2222 serves as an example of how challenging long-standing assumptions and reframing existing constraints can unlock new value from resources that were previously underutilized.**

Today, similar thinking is being applied to large-load interconnections. ISOs/RTOs are developing Flexible Load Integration Programs that shift away from the traditional model of reserving fixed capacity for each customer. Instead, they are finding ways to leverage inefficiencies in the current power transmission network. Examples of these initiatives include:

- → Southwest Power Pool's (SPP) Conditional High Impact Large Loads (CHILLS)
- → PJM's Interim Resource Adequacy Service (IRAS)
- → ERCOT Provisional Controllable Load Resource (PCLR)

These **flexible service models** offer accelerated interconnection, which might otherwise require years in queue, by allowing large loads to connect under curtailment obligations during periods of system stress. In parallel, grid operators and utilities are exploring **real-time capacity allocation**, which leverages operational data, flexible operating agreements, energy storage systems, and digital coordination platforms to allocate available grid capacity based on actual system conditions. Together, these approaches challenge the traditional assumption that every customer requires firm service, allowing operators to conditionally connect large loads based on real-time system conditions.

While promising, adoption remains limited by reliability concerns, communication and control system requirements, market design challenges, and the willingness of customers, particularly data centers, to accept potential curtailments.

Supporting examples



Performance Incentive Mechanisms (PIMs)

Performance Incentive Mechanisms (PIMs) tie a portion of a utility's earnings to specific regulatory outcomes. In the DER interconnection context, utilities often face throughput bias that favors centralized generation and can result in slow, opaque interconnection processes. PIMs address these challenges by rewarding improvements in interconnection timelines, data transparency, and process efficiency. By creating financial incentives for better performance, this encourages investments in automation, data sharing, and hosting capacity analysis while better aligning utility incentives with goals such as grid resilience and renewable energy integration.

In some states, PIMs for DER interconnection are part of a Performance-Based Regulation (PBR) framework. For example, the Hawaiian Electric PBR Framework includes PIMs that reward utilities for meeting targets on renewable energy integration, cost containment, and customer service, with interconnection efficiency as a potential performance area.

Supporting examples



Grid-Enhancing Technologies (GETs)

The U.S. Department of Energy (DOE) defines Grid-Enhancing Technologies (GETs) as technologies that "maximize the electricity transmission across the existing system". These technologies can range from complex digital control solutions to redefining how engineers map power flows. Because electric grids must continuously balance supply and demand while operating within transmission constraints, GETs help maximize the utilization of existing infrastructure. This improves reliability, reduces congestion, and accelerates interconnections by unlocking additional capacity from assets already deployed on the grid. As a result, utilities can defer costly transmission upgrades and avoid the long timelines associated with building new infrastructure, helping address one of the key barriers to connecting new generation and large loads.

One example of a GET currently being implemented is Dynamic Line Ratings (DLR). Dynamic Line Ratings use real-time measurements and weather conditions to calculate the real time thermal capacity of a transmission line rather than relying on worst case scenario conditions. These highly accurate ratings unlock unused transmission capacity, allowing more power to flow across existing lines while reducing the need for costly upgrades and new transmission projects that can take a decade or more to develop.

In collaboration with LineVision, AES deployed DLR sensors across transmission and sub-transmission lines in Indiana and Ohio to evaluate the systems' carrying capacity. AES found that real-time line ratings frequently exceeded traditional static ratings, with one 345 kV line exhibiting an average capacity increase of more than 60%. Beyond this, DLR helped identify local weak points in the system, allowing targeted upgrades of bottlenecks in the system. While this solution is actively being implemented, broader application is held back by regulatory, operational, and market barriers. Nevertheless, its success illustrates the potential for GETs to improve grid reliability, increase transmission capacity, and accelerate interconnections without requiring extensive transmission expansion. Beyond DLR, other examples of GETs, less mature in their development, include:

- → Power-Flow Control Devices: Enable operators to reroute electricity to underutilized lines, alleviating congestion and optimizing the flow of power across the network. Modern advancements have improved both the economics and capabilities of these devices.
- → Analytical Tools and Sensors: Include smart meters, monitoring devices, and data analytics platforms that provide real-time information on grid conditions. These tools help operators make informed decisions and respond quickly to changes in supply or demand.
- → Advanced Conductors and Transmission Switching: Technologies like tower lifting and advanced conductors allow existing lines to operate closer to their design limits, further increasing capacity without new construction.

Supporting examples



Operational frameworks

Specific operational frameworks such as Grid 2.0 have been proposed to assist in automating and scaling programs such as SPP CHILLS, PJM IRAS, and ERCOT PCLR. While these programs demonstrate the value of flexible service models, they are currently fragmented, regional, and heavily dependent on manual implementation. Grid 2.0 seeks to provide a common framework that integrates flexible loads, distributed energy resources, storage systems, and grid-enhancing technologies into a unified operating model. Grid 2.0 seeks to transform transmission capacity into a dynamically managed resource rather than a fixed system allocating available capacity based on real-time system conditions.

While still largely conceptual, Grid 2.0 represents a potential evolution of the power system that could significantly reduce interconnection delays, increase infrastructure utilization, accelerate load growth, and support the continued integration of renewable energy resources.

Your task and relevant context

As electricity demand increases and new generation, storage, and large loads seek to connect to the grid, the existing U.S. interconnection process is struggling to keep pace. While certain interconnection reforms have been implemented, including cluster studies, readiness requirements, stricter study timelines, and increased transparency, many challenges remain.

Interconnection decisions are influenced by regulators, customers, government agencies, utilities, developers, and grid operators. Companies like AES work across the energy value chain, creating a unique opportunity to rethink traditional interconnection relationships. However, many of the people making policy and investment decisions must evaluate highly technical issues involving transmission constraints, queue backlogs, reliability, and cost allocation.

Recognizing the importance of collaboration, FERC has convened a technical conference on interconnection innovation, bringing together representatives from across the energy industry to develop tangible recommendations for the future of the grid. Solutions must address four key areas:



Efficiency

The interconnection process must enable projects to reach commercial operation in a timely manner. Increasing efficiency will reduce delays, lower costs, and allow the industry to respond faster to rising electricity demand.



Transparency

Stakeholders need clear, consistent, and accessible information throughout the interconnection process. Greater transparency will improve decision-making and strengthen trust among participants.



Reliability

The grid must remain dependable as new generation and load are added. Any proposed reforms must maintain and improve reliability for all customers.



Affordability

Costs associated with interconnection solutions should be managed responsibly and allocated fairly while balancing the needs of all stakeholders.

Your Task

Your team has been invited to participate in the conference as a cross-industry working group. Your team should consider different stakeholder perspectives, such as developers, utilities, grid operators, regulators, customers, industry associations, communities, environmental organizations, or other key participants in the interconnection process. Your team may choose to focus your solutions on a specific RTO/ISO or propose broader reforms applicable at the federal level.

Propose and build a new or enhanced tool, technology, or policy that can further enable a more efficient interconnection process. Make sure to include how it emphasizes transparency, reliability, and affordability for all stakeholders.

First Round

To inform the discussions, FERC has asked each working group to prepare a brief presentation outlining its proposed solution ahead of the conference. In the first round of the competition, teams will submit a 5-minute video presentation highlighting the key aspects of the solution. The review panel will assess the strength of your group's idea and determine whether you will present at the conference. Your team may choose to focus your solutions on a specific RTO/ISO or propose broader reforms applicable at the federal level. Be sure to clearly identify the organization or governing body your proposed reforms are intended to address. This round is critical to developing the foundations of your idea. During your presentation, please begin by introducing your team and providing an overview of the key components of your proposed solution.

First Round Deliverable

Prepare a 5-minute video presentation (or preferred virtual presentation-building tool) detailing your solution to the proposed task at hand. All team members must be present and actively participate.

Your team must submit your video presentation via the competition portal no later than October 14 at 11:59 pm EST. Please save the presentation in an .mp4 format with the following naming convention "Team Name_FirstRoundPresentation."

Second and Final Rounds

Additional details regarding the second and final rounds will be provided to advancing teams at each stage of the competition. These rounds will build upon the solutions developed in Round 1. All team members are expected to attend and actively participate in both presentations.

AI use and best practices

The use of AI is permitted throughout this competition and is encouraged as a tool to support creativity and research. However, participants remain accountable for all submitted work and should apply AI in a responsible, ethical, and transparent manner. Please adhere to the following best practices when using AI throughout the competition:

Accountability: AI outputs may not always be accurate or reliable. Users should maintain clear ownership, exercise appropriate oversight, and remain accountable for decisions and recommendations informed by AI.

Integrity: AI should be used to support collaboration, ethical behavior, and informed, productive decision-making.

Fairness: AI should be used responsibly to minimize bias and promote objective, equitable, and non-discriminatory outcomes.

Privacy & Confidentiality: Protect sensitive, personal, and proprietary information. Do not share confidential AES data with unauthorized third-party AI systems or tools.

Traceability & Explainability: AI-generated recommendations should be traceable to their underlying data and logic. Users should be able to understand, validate, and explain how conclusions were reached.

Safety & Security: AI systems should be used in a manner that protects people, data, and assets, while adhering to cybersecurity requirements and minimizing operational risk.

Transparency: Be transparent about when and how AI has been used, including its role in decision-making, limitations, and key assumptions.

Second Round

Congratulations! Your group has been selected to present at the conference to a subset of industry experts. During this round, your group should think through the different impacts of your solution, including positive and negative externalities. Please consider the following:

Technical effectiveness

How effectively does the proposed solution address a real interconnection challenge? Explain how the solution works and why it was selected over alternative approaches.

Policy and regulatory considerations

What regulatory, market, or governance changes are required to implement the solution?

Reliability and grid impact

How will the solution support a reliable electric grid? Identify potential risks and mitigation strategies.

Financial feasibility and affordability

Is the solution economically viable? Discuss who bears the cost and who receives the benefits. Evaluate affordability impacts for all stakeholders.

Stakeholder and social impact

How does the solution impact the broader interconnection ecosystem? Consider impacts on communities, customers, and industry participants. Explain how transparency and stakeholder engagement are improved.



Second round deliverable

Prepare a PowerPoint presentation (or preferred virtual presentation-building tool) detailing your solution to the proposed task at hand. On **either October 29 or 30**, you will have 20 minutes to present as a team to a panel of AES judges followed by a 10-minute Q&A session. All team members must be present and actively participating. Up to 5 teams will be selected to move on to the final round which will take place on **November 13**.

Your team must submit your presentation via the competition portal no later than **October 28 at 11:59 pm PT**. The presentation should be in PDF format with the following naming convention "Team Name_SecondRoundPresentation."

Final Round

Congratulations! Your stakeholder working group has been selected to present its recommendations to the full conference and review panel as one of the most promising solutions for industry implementation. While your proposal has demonstrated strong potential, success in the industry requires more than a compelling idea. Decisionmakers must understand how a solution will be implemented, how its impacts will be measured, and how challenges to adoption will be addressed. For this round, your team will prepare a formal proposal that brings your solution to life. Building on your previous work, you should demonstrate how your recommendation would move from concept to implementation within the real-world interconnection ecosystem. Teams should evaluate both the opportunities and risks associated with their proposal and develop a practical roadmap for execution. In your deliverable, please consider the following:

Implementation, Risks, and Opportunities

Describe how your solution would be implemented. Identify barriers to adoption and how they would be mitigated.

Metrics of Success

Define how the success of your solution would be measured. Identify clear quantitative and qualitative metrics that demonstrate improvements in interconnection efficiency, transparency, reliability, and affordability.



Final round deliverable

Prepare a PowerPoint presentation (or preferred virtual presentation-building tool) detailing your solution to the proposed task at hand. On **November 13**, you will have 25 minutes to present to a new panel of AES executives followed by a 10-minute Q&A session. A winner and runner-up will be selected based on these presentations.

Your team must submit your presentation via the competition portal no later than **November 12 at 11:59 pm PT**. The presentation should be in PDF format with the following naming convention "TEAMNAME_Round_3."