Improving Distributed Energy Resources Interconnection:
Automation, Timelines, Studies, Cost Allocation and Standards

DOE Energy Innovator Fellows Informational Webinar

Grace Relf, Lawrence Berkeley National Laboratory

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INTERCONNECTION INNOVATION e-XCHANGE
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Agenda

- Strategic use of automation
- Interconnection timelines
- Interconnection studies
- Cost allocation
- Standards
- Wrap Up
  - i2X Connect
  - Additional resources

Strategic Use of Automation

Automation for Increased Data Access, Transparency, and Security

Goal 1: Increase data access, transparency, and security for interconnection
- Data sharing guidelines
- **Strategic use of automation**
- **Broaden use of hosting capacity analysis**

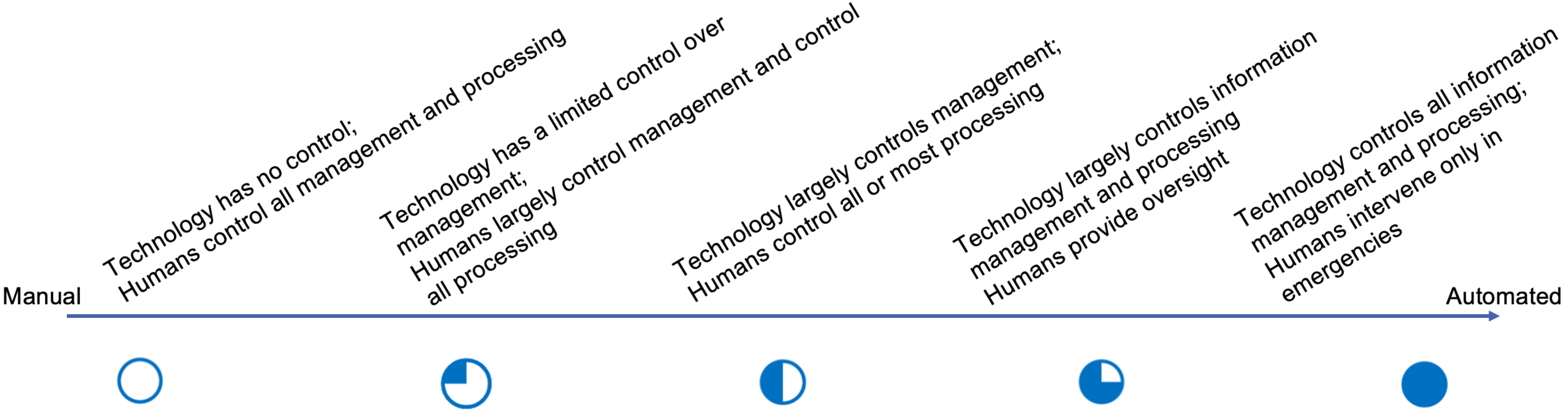
Goal 2: Improve interconnection process and timeline
- Queue management
- Inclusive and fair processes
- Workforce development

Goal 3: Promote economic efficiency in interconnection
- Cost allocation
- Coordination between interconnection and grid planning
- Interconnection studies

Goal 4: Maintain a reliable, resilient, and secure grid
- Interconnection models and tools
- Interconnection standards

Defining Automation for DER Interconnection

- Automation refers to using technology to perform work previously done by humans, or not previously able to be done.
- Technology may only perform some elements of a task or process. Degrees of automation capture the level of control over a task or process by technology including:
  - *Information management* – Collecting and organizing information
  - *Information processing* – Reviewing or performing operations to understand information for decision-making



Opportunities for Automation for DER Interconnection

- Automation opportunities vary by utility.
  - Higher levels of automation are correlated with higher volumes of interconnection requests.
  - The ability to automate depends on multiple dimensions of feasibility.
- There are significant opportunities to automate interconnection processes for some types of DERs from start to finish, particularly for small project sizes.
  - Automation tools are available today for each step in the interconnection process, ranging from simple tools that require limited utility expense to advanced and more costly software tools.
  - Many simpler solutions, such as workflow management tools, provide very high value for utilities.
- Complementary practices and processes are foundational for automation and improving its effectiveness (e.g., better quality data and integrating data into modeling tools).

Dimensions of Feasibility

Technological	• Can technology reliably perform the task?
Economic & value creation	• Is the cost of automation reasonable and worth the benefits?
Change management & implementation	• Will users accept automation and be able to integrate it into workflows?
Regulatory & compliance	• Does automation meet cybersecurity, legal, and regulatory requirements?

Drivers for Automation

Increasing transaction volume: A high volume of DER interconnection applications makes manual processes unsustainable, leading to backlogs and efficiency challenges. Utilities are faced with increasing transactions and limited resources.

Improving efficiency and streamlining processes: Stakeholders frequently seek reduced total cycle time from application submission to permission to operate. Automating workflows, notifications, and communications can eliminate "busywork” and manual handoffs.

Enhancing customer experience and transparency: Automation aims to provide greater transparency for interconnection customers, allowing them to track application status and receive quicker feedback. That can reduce delays and improve customer satisfaction.

Ensuring safety and reliability: As DER penetration grows, automation helps standardize reviews and catches more potential grid issues, improving engineering review and contributing to system safety and reliability.

Resource optimization: Utilities seek to manage growing workload without hiring additional full-time employees (FTEs) and allow existing staff to keep up with daily tasks rather than working overtime.

Tools for Automation

Process and Workflow Management Tools

These tools automate workflow aspects such as application submission, completeness check, document uploads, and signature collection. They can integrate with, but do not specialize in, technical reviews.

Examples:

- PowerClerk
- GridUnity
- Salesforce
- eTRACK+

Technical Analysis and Screening Tools

These tools use inputs provided by the applicant or a utility engineer to perform screening analysis and evaluate an application. They rely on high quality data.

Examples:

- NREL PRECISE
- Envelio
- Camus

Related Process Tools

These tools address and automate specific aspects of the process and may be needed to integrate with the tools in the other two categories. For example, the tools may enhance screening tools through automation.

Examples:

- EPRI DRIVE
- PSS/E
- Synergi
- CYME

Benefits of Automation

- Substantial reduction in interconnection processing time
- Reduction in interconnection costs
- Reduction in human effort and ability to direct staff resources more effectively
- Ability to provide a real-time, accurate grid picture across utility departments
- Improved customer and utility employee satisfaction
- Reduced human error and improved accuracy in interconnection processing
- Improved forecasting and proactive identification of potential grid constraints
- Reduced need for conservative planning assumptions leading to increased available hosting capacity
- Ability to assess multiple future scenarios

Quantifying the Benefits of Automation

Pacific Gas and Electric California (2016)

- Reduced cost to process net energy metering applications by 68%
- Cycle times fell to ~3 days for review even as application quantities increased
- **$28.5M saved in 4 years**, recouping the utility's investment 16-fold

ComEd Illinois (2021)

- Reduced processing time from 2 weeks to 2 days
- **78% of applications passed with no manual review**

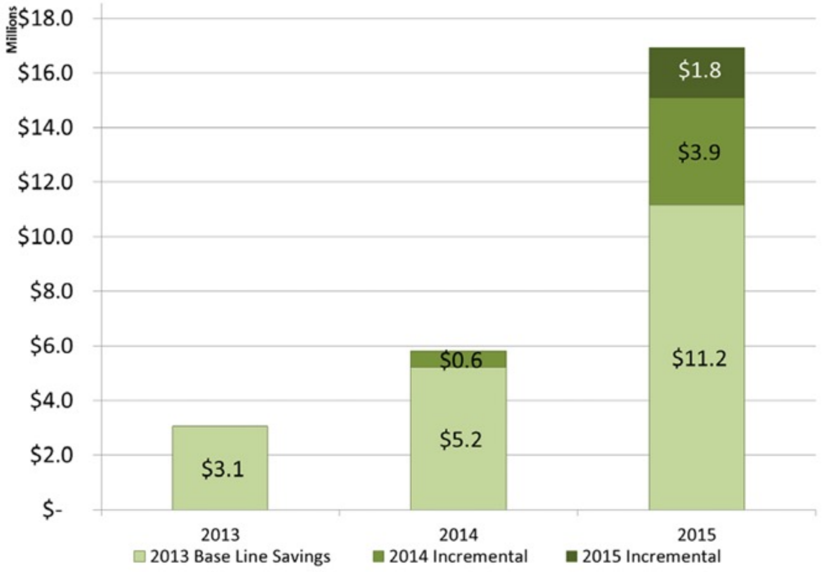
Alliant Energy Wisconsin (2025)

- Reduced time to review level 1 applications by 68%
- 450 data fields removed or consolidated (35% reduction), 63% reduction in review form content
- Improved situational awareness and **reduced non-compliance risk**
- Enabled multi-jurisdictional reporting
- Improved customer experience

PG&E Unit Cost Reductions and Cost Savings

Year	Q4 Avg. Unit Cost** ($)
2012	195
2013	92
2014	62
2015	39*

*Targeted Q4 2015 Average Unit Cost ($)
**Unit cost represents the administrative cost to process an application. This cost excludes installation, commission, or inspection of the meter; required interconnection facility; or distribution upgrades or costs associated to set up billing. August 2015 average unit cost is at $42



Source: NREL, 2015

Challenges to Automation

Need for robust and accurate data sets

- GIS and other systems may have missing or incorrect data
- Utility may not have the data needed to accurately model the secondary distribution system

Complexity of integrating data and automation tools across utility and external systems (e.g., for permitting)

Utility may not be able or willing to invest in automated systems (financial and staff time investments)

Lack of uniform, updated, and clear interconnection requirements

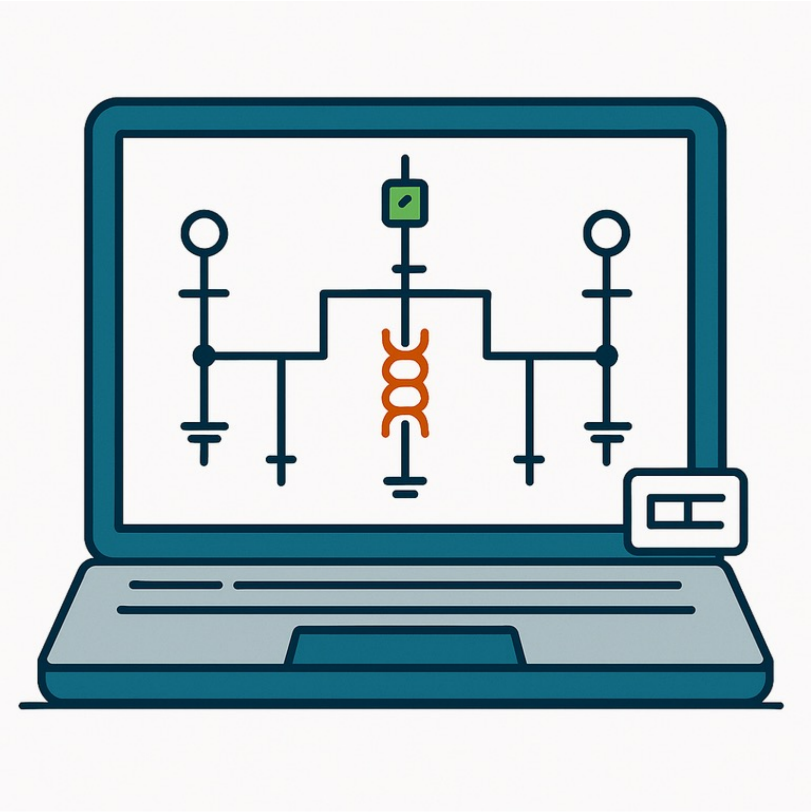
- Inconsistent interconnection requirements across jurisdictions
- Free-form interconnection application questions
- Tariffs that are not machine readable

Utilities must seek approval from regulators to change interconnection processes in some jurisdictions

Potential introduction of new cybersecurity risks

Artificial Intelligence (AI) and Machine Learning (ML) for Interconnection

- Software companies are using AI and ML to begin to automate portions of the interconnection process that have generally been viewed as requiring human intervention.
- AI and ML have the potential to:
  - Accelerate study cycles through automated initial review, validation of unstructured information screening, and clustering of projects
  - Support decision-making through improved forecasting, long-range scenario analysis, proactive problem identification, and identification of land use constraints and policy changes
- If users develop trust in these tools over time, they could be transformative by automating portions of the interconnection process that are currently the most complex, costly, and time consuming.
  - This also can support proactive and scenario-based planning that are increasingly needed to support rapid load growth.



Source: Image created with Berkeley Lab AI

Poll

Do you think artificial intelligence will radically change the DER interconnection process?

- Yes
- No
- Only some change
- Unsure

Timeline Requirements and Workforce Development

Queue Management and Workforce Development for Improved Processes and Timelines

Goal 1: Increase data access, transparency, and security for interconnection
- Data sharing guidelines
- Strategic use of automation
- Broaden use of hosting capacity analysis

Goal 2: Improve interconnection process and timeline
- **Queue management**
- Inclusive and fair processes
- **Workforce development**

Goal 3: Promote economic efficiency in interconnection
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Goal 4: Maintain a reliable, resilient, and secure grid
- Interconnection models and tools
- Interconnection standards

Manage Queues with Timeline Requirements

- Regulators can set limits on the total interconnection timeline or steps within the interconnection process.
  - Timelines can differentiate between interconnection types (e.g., solar PV, storage, by size, fast-track).
  - Requirements can be formalized in tariff updates.
  - Enforcement of timelines is important.
- State agencies and stakeholders can participate in working groups to determine where to cut time in the process.

ConEdison Interconnection Queue Data and Example Timelines

Applying for Private Generation Interconnection

Review eligibility requirements and fill out the interconnection application before starting your project.

	APPLICATION REVIEW				PRELIMINARY REVIEW		
	10 business days				15 business days		
Protective Equipment	Start Date	End Date	Calculated Duration	Application Approved Date (Utility)	Start Date (Must Match Application Approved Date)	End Date	Calculated Duration
Inverter	12/31/24						
Inverter	12/31/24						
Inverter	12/31/24						
Inverter	12/31/24						
Inverter	12/31/24						

Source: New York Department of Public Service, ConEdison

Workforce Development

- Interconnection activities require diverse skillsets and expertise (e.g., engineering, regulatory).
- Utilities and public utility commissions need skilled workers to process and provide oversight for an increasing number of applications to interconnect local resources.
- Actions include:
  - Assess interconnection workforce needs.
  - Provide continuing workforce education.
  - Conduct targeted outreach to recruit skilled workers for interconnection-related jobs and retain skilled workers.

Slides and recordings here

Interconnection Studies and Cost Allocation

Interconnection Studies and Cost Allocation for Economic Efficiency

- **Goal 1: Increase data access, transparency, and security for interconnection**
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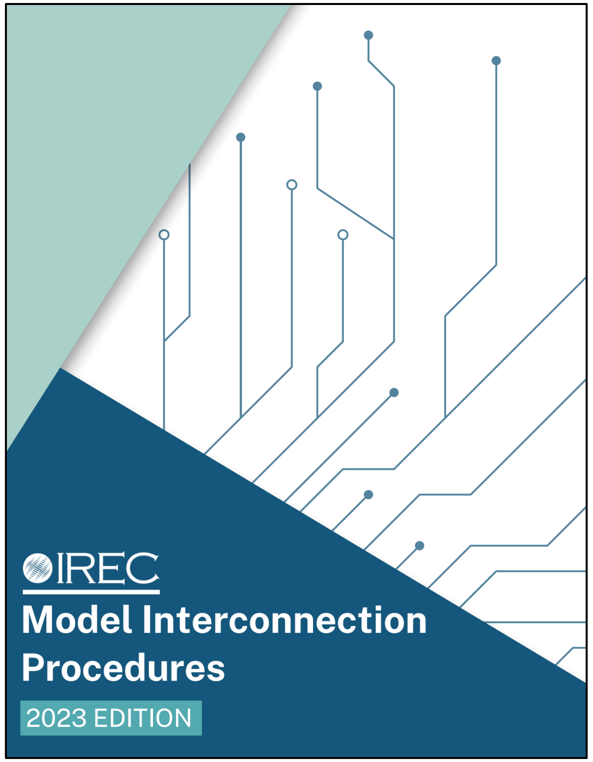
Interconnection Studies

- Types of screens and studies
  - **Simplified Process or Fast Track Screens** – For systems unlikely to cause adverse grid impacts, utilities screen for contribution to minimum load, inadvertent export impacts, fault current and short circuit contributions, and other impacts.
  - **Supplemental Review** – If a system fails initial screens, utilities can review additional issues based on why the system failed.
  - **System Impact Study** – Analyzes load flow, short-circuit, circuit protection and coordination, stability, and voltage-collapse.
  - **Facilities Study** – Provides a list of equipment and costs for necessary delivery system upgrades.
- Based on study findings, utilities identify necessary mitigations
  - Equipment replacement or reconductoring
  - DER reactive power modifications, such as through advanced inverter settings
  - Voltage regulating equipment



Source: IREC Model Procedures

Process and Study Differences by DER Size

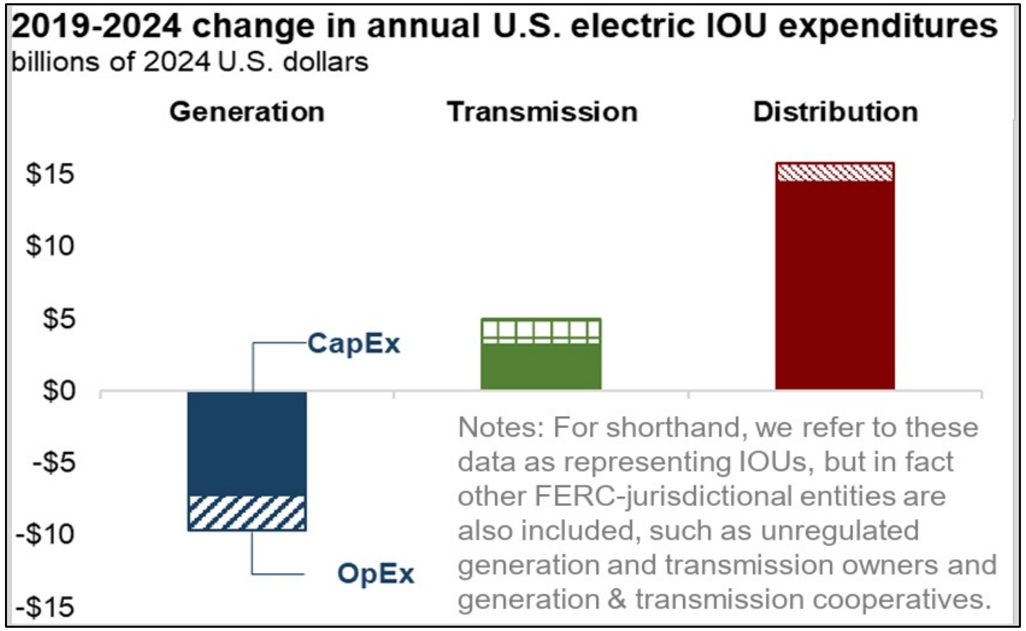
	Small	Medium	Large
DER Size Range	0–25 kW	25–500 kW	500+ kW
Process Terminology	• Level 1 • Fast Track • Simplified Review	• Level 2 and 3 • Fast Track • Supplemental Review	• Level 4 • Supplemental Review • Feasibility and System Impact Study
Application Screening	Site-level screening criteria, may include elements for known circuit limitations (e.g., minimum load)	Screening criteria may be similar to smaller systems but with additional criteria or more extensive review	Screening generally requires applications be modeled in power flow software
Interconnection Costs	Typically minimal, may require service transformer upgrade	Vary significantly, ranging from minimal to $100k+ or larger	Range from minimal to very high (can reach millions of dollars)

*Values/statements are illustrative. Specific thresholds and processes vary by state.

Source: Cody Davis, Electric Power Engineers

Cost Allocation for DER Interconnection

- The interconnection application review process determines whether the utility needs to upgrade its distribution equipment to accommodate the DER.
- Utilities commonly select distribution system equipment that is oversized compared to immediate needs.
  - Equipment may only be available in certain sizes.
  - Utilities may wish to create additional headroom for future load or DER interconnections.
  - Utilities may wish to add capacity for operational needs.
- Cost allocation for DER interconnection assigns cost responsibility for these upgrades.
- The interconnection customer that first triggers an upgrade typically is responsible for the full cost under the traditional ***cost-causer pays*** model.



Source: Wiser et al., 2025

Drivers for Improving DER Interconnection Cost Allocation

- States are facing increasing grid constraints from high DER penetration in some locales, resulting in interconnection costs that hinder additional DER adoption.
- Distribution system spending is increasing across the country to meet growing pressures associated with aging infrastructure, grid hardening needs, rapid load growth, and bi-directional power flow.
  - New cost allocation approaches tied to improved distribution system planning can help reduce long-term overall distribution system costs.
- The cost-causer pays model can create free-riders. DERs that trigger upgrades pay 100% of the costs, allowing other interconnecting DERs to benefit from that equipment without paying.

Connecticut

"…[S]everal substations already have little to no hosting capacity and the Authority expects that DER saturation will be a growing problem"

-CT PURA, 2025

Source: EEI, 2025

Cost Allocation Approaches (1)

Approach	Who pays and how?	Example
Fixed Fee	Charge the same fee to interconnecting customers who share, or whose DERs share, a common characteristic(s)	The utility charges a fixed fee for interconnection of all small DER systems to fund shared upgrades that cost more than an established level.
Direct cost assignment	Allocate costs entirely to one interconnection customer	The utility may directly assign the triggering DER project specific or all costs incurred to accommodate the resource, such as in the traditional cost-causer pays model.
Pro-rata assignment	Charge costs proportionally based on use of shared distribution upgrades	Group studies typically allocate costs to participating interconnection customers on a proportional, $/kW basis based on the cost of the upgrades (either individual upgrades or a collection of upgrades).

Cost Allocation Approaches (2)

Approach	Who pays and how?	Example
Use established rate case allocators	Rate-base costs following traditional revenue requirement and cost allocator processes	Proactive approaches may allocate a percentage of upgrade costs to all ratepayers using established cost allocation processes (e.g., division among customer classes).
Grid usage charges	Allocation of costs based on how the interconnected DER actually uses the grid	Export tariffs for customers that send excess energy to the distribution system use cost-of-service analysis to determine ongoing charges for shared distribution upgrades.
Locational Pricing	Allocation of costs based on the availability of distribution system hosting capacity	Interconnection customers not requiring a distribution upgrade pay a pro-rata $/kW fee based on available hosting capacity. The fee is lower in areas with ample available capacity and higher in areas with lower available capacity.

Cost Allocation and Recovery Frameworks

Additional factors to consider in cost allocation and recovery frameworks:

- **Trigger for initiating upgrades** – How is the need for an upgrade determined?
- **Determination of beneficiaries** – What is causing costs to be incurred and who is benefiting from investments?
- **Which costs will be included** – What specific equipment is the utility installing or upgrading to accommodate DERs?
- **How and when to recover costs** – Will costs be recovered through interconnection customer fees, base rates, riders, or deferred accounting, and over what time period?
- **Other considerations that may impact cost allocation and cost recovery** – Is the approach feasible and aligned with state objectives and established ratemaking principles?

Common Cost Allocation and Recovery Frameworks (1)

Common Cost Allocation and Recovery Frameworks	Description
Cost-causer pays	**Directly assign all interconnection-related costs to the project that initially triggers distribution system upgrades**
Reimburse initial interconnection customer over time	**Directly assign all upgrade costs to the triggering project, then require subsequent interconnection customers to pay back the initial paying customer for use of shared equipment**
Create a reserve fund	**Collect a fee from all interconnecting customers to fund upgrades**
Conduct group interconnection studies	**Study multiple, related applicants as a group and allocate upgrade costs proportionally by project**
Reactive cost sharing	**Assign an initial triggering project a pro-rata share of costs and establish a window of time in which subsequent interconnection customers also pay a pro-rata share of costs**

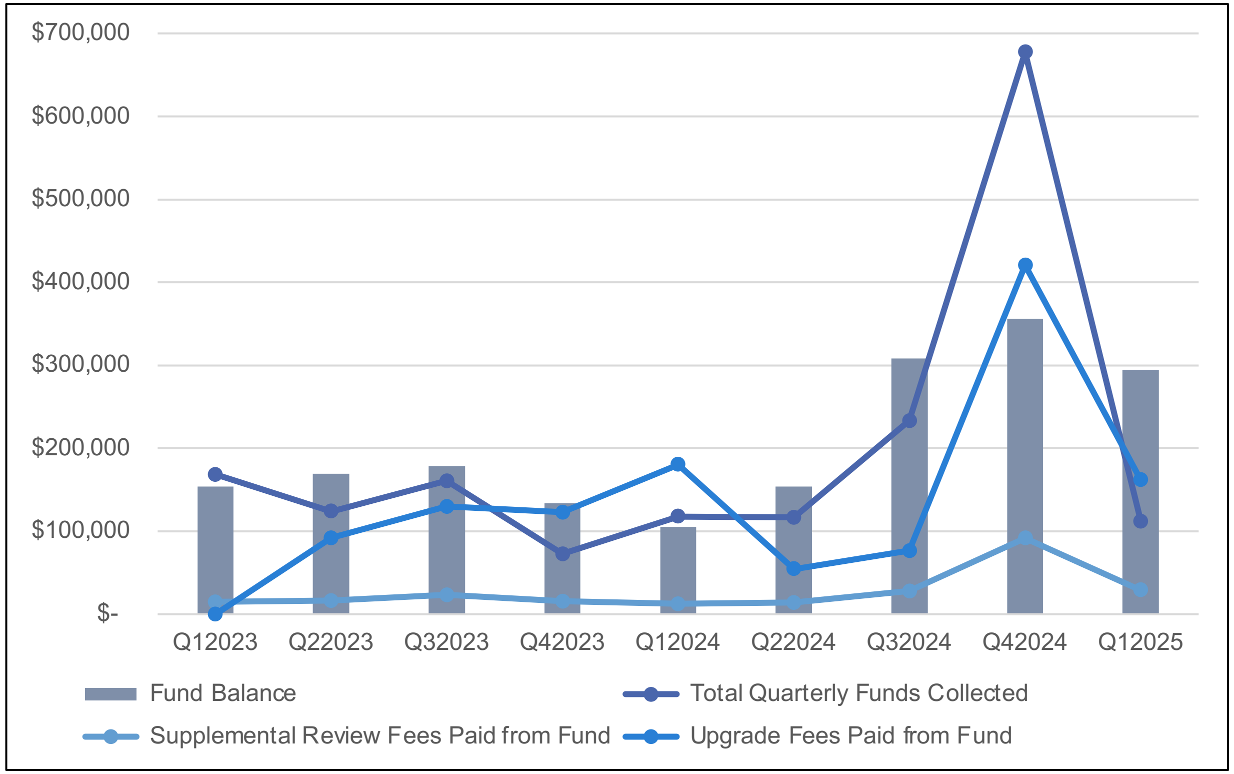
Common Cost Allocation and Recovery Frameworks (2)

Common Cost Allocation and Recovery Frameworks	Description
Proactively upgrade grid infrastructure	**Forecast and construct necessary upgrades that are reimbursed by interconnecting customers over time**
Establish cost caps	**Establish maximum cost responsibilities (e.g., $/DER system) and recover remaining costs from ratepayers**
Incorporate grid usage costs into tariffs	**Apply ongoing charges for interconnected DERs that export energy to the distribution system**
Follow line extension cost allocation practices	**Utilities cover a portion of distribution construction costs as an "allowance," and DER customers pay for costs over the allowance**
Implement scarcity pricing	**Interconnection customers that do not trigger upgrades pay a proportional or fixed share of location-based prices that reflect hosting capacity availability**

Example: Minnesota – Small DER Cost Sharing Fund

- Established in 2023, the fund supports distribution system upgrades ≤$15,000 for DER systems ≤40 kW.
- Customers with small DERs pay a flat fee: $200/system.
  - Cost of upgrades in recent years ÷ number of interconnection applications
- ~9,700 customers paid into the fund; about $1.9M in collections
  - The fund has paid for ~1,300 supplemental reviews and ~150 distribution upgrade projects.
  - The average cost for a distribution upgrade would have been about $9,000/application if paid only by the ~150 applicants that triggered upgrades.

Xcel Minnesota's Small DER Cost Sharing Fund Collections and Payments



Sources: Xcel Energy, Quarterly and Annual MN DIP Reports, Docket No. M-18-714

Example: Massachusetts – Capital Investment Project Program

- The provisional Capital Investment Project (CIP) program addresses near-term grid needs for group study projects affected by high-cost upgrades.
- Ratepayers and interconnecting customers share costs based on benefits accrued.
  - Interconnection customers pay a pro-rata $/kW fee, calculated based on each project’s use of the portion of the upgrade that serves larger DER projects.
  - The utility recovers the full upgrade costs from all distribution customers using customer class allocators over a specified time period and reimburses customers over time with CIP interconnection fees.
  - The DPU order approved a 20-year rate recovery period for CIP projects to reduce the risk to ratepayers. The extended rate recovery period allows more time for CIP fees to offset ratepayer charges.

Eversource CIP Capacity Enablement

Group	# Substations	Existing DER (MW)	Study DER (MW)	Additional Enabled DG (MW)
Plainfield-Blandford	1	38	13	29
Plymouth	7	237	123	279
Cape	8	149	71	274
Marion-Fairhaven	4	69	49	102
Dartmouth-Westport	2	72	16	55
Total	22	565	272	739

Eversource Marion-Fairhaven CIP Fee

Project Type	DER Customer Benefit	Distribution Customer Reliability Benefit	Distribution Customer Capacity Benefit	Upgrade Cost
Distribution Substation	$38 M	$37 M	$17 M	$92 M
Distribution Line	$16 M	$5 M	$7 M	$27 M
Total:	$54 M			
CIP Fee:	**$385 /KW**			

Sources: Martinez, 2025; Eversource, 2022; MA DPU 2022

Example: Australia – Export Tariffs

- Australia has high and growing DER penetration.
  - In response, stakeholders called for changes to the regulatory framework to better support utilities' provision of services for DER customer exports, require DER customers to pay their share for required infrastructure, reduce the need for DER export limits and moratoriums, and optimize existing and future hosting capacity.
- Utilities are implementing export tariffs with ongoing charges on customer bills to pay for the cost of exporting energy from DERs to the utility's distribution grid.

Illustrative Two-Way (Consumption and Export) Tariff

Residential two-way tariff	Time period	Charge per unit	Price per unit (cents)
Fixed charge	Daily	c/day	50.0
Peak consumption charge	4 pm – 9 pm	c/kWh	20.0
Shoulder consumption charge	9 pm – 10 am	c/kWh	5.0
Off-peak consumption charge (solar sponge)	10 am – 4 pm	c/kWh	1.5
Export peak rebate	4 pm – 9 pm	c/kWh	20.0
Export charge* applies to exports > 2 kWh/day (that is, the basic export level is 2 kWh/day).	10 am – 4 pm	c/kWh	1.5

Source: Australian Energy Regulator, 2024

Poll

Has your jurisdiction implemented any cost allocation methodologies other than cost-causer pays?

- Yes
- No
- No, but other methodologies under consideration
- Unsure

Interconnection Standards

Technical Standards

- IEEE 1547 – Standard Covering DER Interconnection
- UL 1741 – Hardware Testing and Safety Standard to Ensure Compliance with IEEE 1547 Requirements

IEEE 1547 – 2003 Basic Inverters

- Requires unity power factor
- No voltage regulation
- Required to trip immediately for voltage/frequency issues
- Hardware Certification
  - **UL 1741 (2005)**

IEEE 1547a – 2014 Early Smart Inverters

- Developed in response to voltage regulation and bulk system stability challenges
- Includes Volt/Var and Volt/Watt curves for voltage regulation
- Includes Voltage and Frequency Ride-Through for Bulk Power Stability
- Hardware Certification
  - **UL 1741 SA**

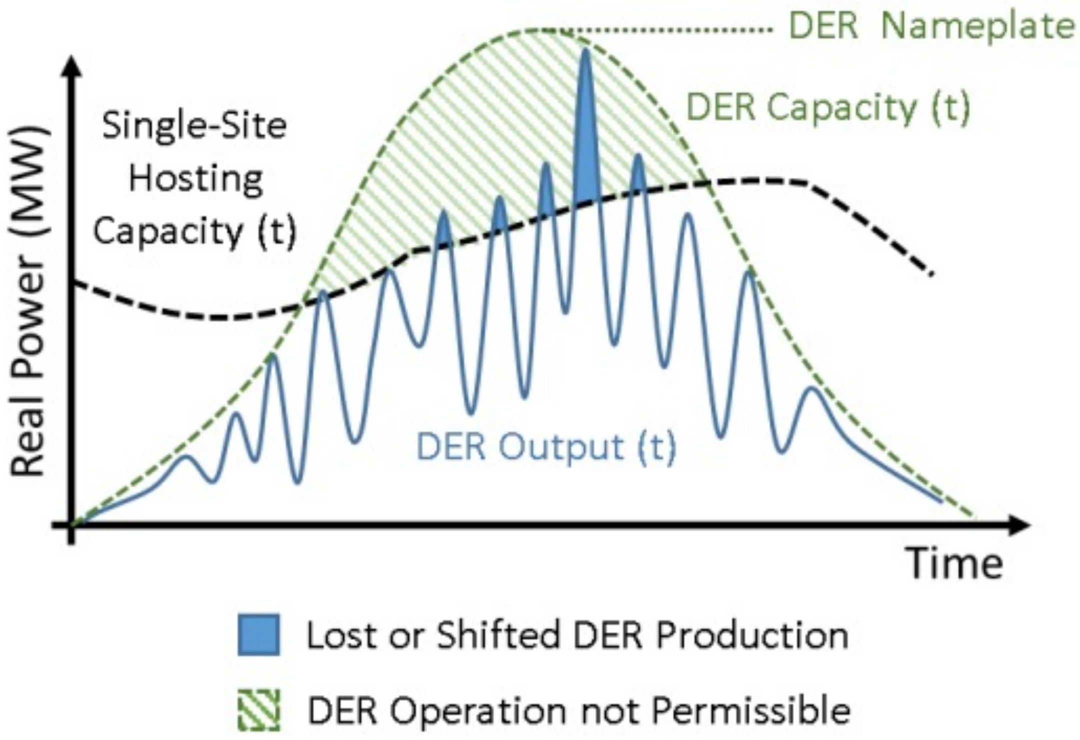
IEEE 1547 – 2018 Full Interoperability

- Expands and formalizes 1547-2014a into full interoperability standard
- Includes roles and decisions for various parties within interconnection Process
  - Utilities
  - Manufacturers
  - PUCs
- Hardware Certification
  - **UL 1741 SB**

Source: Cody Davis, Electric Power Engineers

Enable Flexible Interconnection (1)

- Flexible interconnection is an emerging practice that uses control systems and other techniques to reduce interconnection costs or improve interconnection timelines.
  - **Static:** Performance limits and characteristics are set at the time of interconnection.
  - **Dynamic:** Performance limits are set dynamically based on actual grid conditions.
- Flexible interconnection protects the electric grid, helps with grid balancing, and can allow customers to interconnect while waiting for distribution system upgrades for their project or until more significant upgrades are triggered by additional DER interconnection requests.
- Stakeholders can encourage flexible interconnection pilots.



Sources: EPRI, Cody Davis, Electric Power Engineers

Enable Flexible Interconnection (2)

Type	Benefits	Challenges and Drawbacks
Static	• Allows for more accurate, less conservative assumptions during the interconnection study • Enables more DER to be interconnected at a lower cost	• Implementations and hardware are more site-specific for large installations, as standards and equipment are still relatively nascent • Reliance on customer equipment to prevent utility safety and reliability issues creates accountability challenges • Customer hardware requirements and utility redundant mechanisms to ensure performance may create additional costs
Dynamic	• Reduces DER interconnection costs • Increases utilization of existing infrastructure	• Requires significant distribution operations infrastructure to support at-scale (ADMS/DERMS/Communications) • Interconnection study process is significantly more complex • Curtailment of real power can impact project economics, create uncertainty • Can be difficult to predict future curtailment, especially due to distribution system changes

*ADMS – Advanced Distribution Management System / DERMS – DER Management System

Source: Cody Davis, Electric Power Engineers

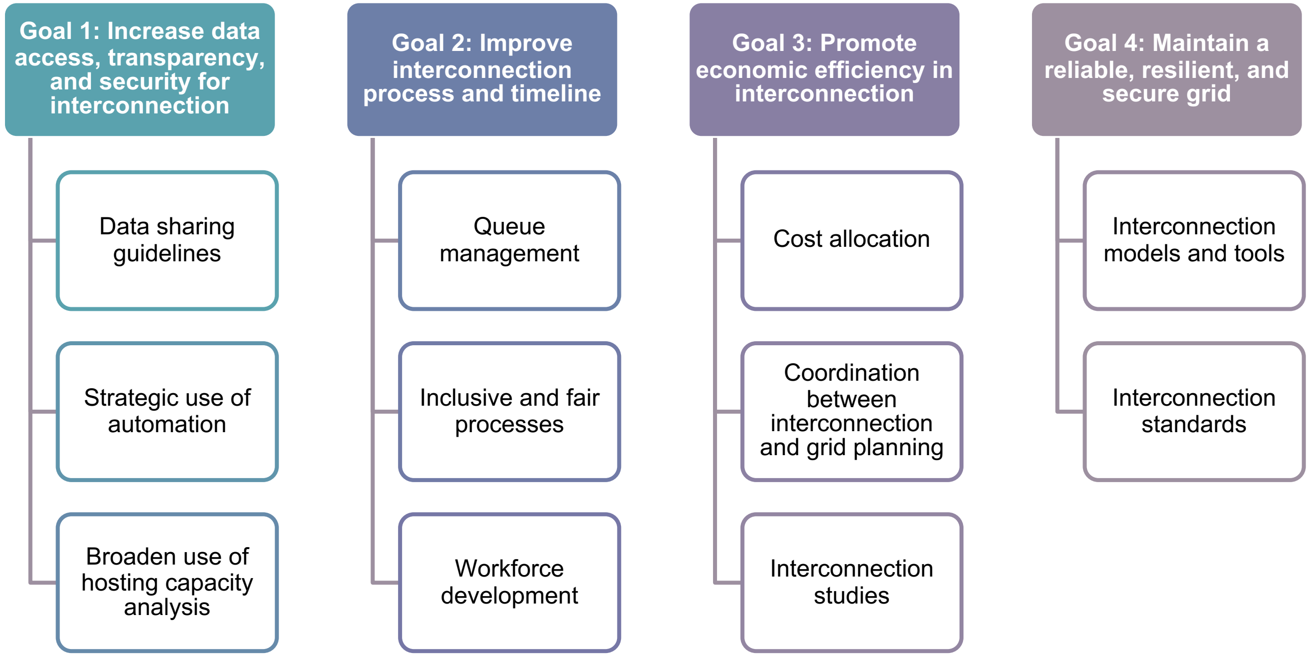
Wrap Up

Additional Activities to Support Interconnection

Many of the solutions in DOE's DER Interconnection Roadmap are complementary.

Applying multiple solutions compounds benefits.

- Consider how to tailor these practices to suit the jurisdiction's specific needs and unique goals and objectives.
- Draw on leading practices in areas such as:
  - Improving hosting capacity analysis
  - Coordinating interconnection with grid planning
  - Adopting recent standards, modeling tools, and study approaches
  - Exploring emerging interconnection approaches like group studies, proactive planning, and streamlined requirements for new buildings



Source: DOE DER Interconnection Roadmap

Example Actions (1)

Regulators can:

- Evaluate how automating steps in the interconnection process may reduce interconnection queues and timelines
- Consider differentiated DER interconnection study tracks based on potential grid impacts
- Examine the jurisdiction's approaches for interconnection cost allocation in relation to its energy-related objectives
- Pilot new cost allocation approaches
- Adopt the IEEE 1547-2018 standard
- Facilitate updates to DER interconnection rules to incorporate new technology capabilities, such as flexible interconnection and limited import/export

Example Actions (2)

Other state agencies and stakeholders can:

- Provide feedback on interconnection timelines and potential rule revisions to encourage adoption of automation techniques, study tracks, and new technology capabilities
- Participate in forums considering updates to interconnection standards and processes and cost allocation approaches
- Encourage utilities to pursue or pilot leading and emerging best practices and share information from other states

Utilities can:

- Assess data quality, integration, security, and streamlining for interconnection processes to enable use of automation
- Consider and adopt automation tools
- Share data and other information with stakeholders to facilitate regulatory consideration of updates to technical standards, processes, and cost allocation
- Propose pilots for new cost allocation and flexible interconnection approaches

Join i2X Connect at:
https://groups.energy.gov/i2xconnect/

Resources for More Information

- Forthcoming LBNL technical documents on cost allocation, automation, and queues, timelines and costs — plus a dashboard with national data
- DOE, *Distributed Energy Resource Interconnection Roadmap*, 2025
- DOE Interconnection Innovation e-Xchange, *Interconnection Resources*
- LBNL's Interconnection Innovation e-Xchange website
- Interstate Renewable Energy Council (IREC), *IREC Model Interconnection Procedures 2023*
- Building a Technically Reliable Interconnection Evolution for Storage (BATRIES), *Solutions to Improve Energy Storage Interconnection*
- IREC, *IEEE 1547-2016 Adoption Tracker*, 2024
- LBNL, Interactive Decision Framework for Distribution System Planning (2025) — *see "Interconnection" in "Distribution System Analyses" box*
- Online catalog of state distribution planning requirements — 2025 update, by G. Pereira, G. Relf, M. Whiting, N. Mims Frick, and L. Schwartz
- LBNL, *Unlocking Load Growth at the Grid Edge: Practices for Managing, Recovering, and Allocating Distribution System Investments* (2025)
- LBNL and Current Energy Group, *DER Integration Framework: Regulatory Innovation for DER Compensation and Cost Allocation* (2025)
- NRL, *New Approaches to Distributed PV Interconnection: Implementation Considerations for Addressing Emerging Issues* (2019)
- NRL, An Overview of Distributed Energy Resource (DER) Interconnection: Current Practices and Emerging Solutions (2019)
- EPRI, The Role of Automation in Distributed Energy Resources (DER) Interconnection (2018)

Contacts

Grace Relf: gerelf@lbl.gov, 510-926-0943
Lisa Schwartz: lcschwartz@lbl.gov, 510-926-1091

For more information

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