CADMUS

Analysis of Publicly Available Distribution-Level Interconnection Data

October 28, 2024

Funded By:
United States Department of Energy
Innovation Interconnection e-Xchange (i2X)

Prepared by:
Ryan Bodanyi
Arielle Magliulo
Elise Logan

Executive Summary

In response to funding incentives and decarbonization goals, the demand for renewable Distributed Energy Resources (DERs) is growing dramatically, as is the challenge of interconnecting these resources to the electric grid in a timely manner. The mission of the U.S. Department of Energy's Interconnection Innovation e-Xchange (i2X) is to enable a simpler, faster and fairer interconnection of clean energy resources while enhancing the reliability, resiliency, and security of the U.S. electric grid; it funded this research effort to explore the publicly-available data on distribution-level interconnection across all 50 states.

Accessible, digestible information regarding the interconnection *process*, *timeline*, and *costs* facilitates interconnection, and therefore the development of new renewable generation at the distribution level. *Process* data includes guidelines, instructions, and other information that explains how to interconnect. Note that interconnection processes vary widely across states, reflecting the significant variability between retail electricity markets. *Timeline* data includes the length of the interconnection queue, and how long a new project can expect to remain in the queue. *Cost* data clarifies application fees, and the potential costs associated with interconnection studies and upgrades to grid network infrastructure and facilities.

Access to this information facilitates interconnection by reducing uncertainty for key stakeholders. These stakeholders include utilities (the interconnection service provider), the interconnection customer (e.g., a household installing rooftop PV, or developers installing a larger system), and the regulator, who shapes the relationship between the interconnection customer and the service provider. The reduction of uncertainty can also help to reduce costs for some stakeholders, including interconnection customers and investors in renewable generation projects.

This research finds that overall, across multiple categories and multiple states, there is a lack of publicly-available interconnection information at the distribution level – and where relevant data was found, its level of granularity and organization varies widely. Key findings include:

- **Information about the distribution-level interconnection process is publicly-available in all 50 states**, but it is frequently unclear, and often provides little detail about what to expect.
- **Only six states provide detailed and frequently-updated project-level interconnection queue data at the distribution level.**
- **Detailed, project-level interconnection cost data is made publicly available for roughly 1% of projects in New York State; otherwise, it was not found.** However, some information regarding defined costs (such as application fees and cost regulation rules) was found across 43 states.

Based on these findings, we developed the following best practices:

- **Clear, easy-to-follow, step-by-step instructions about how to complete the interconnection process – and the costs and timeframes that may be encountered – should be made publicly available.** FAQs, guidance documents, and points of contact can be provided to share more detailed technical information.
- **Whenever possible, detailed distribution-level interconnection timeline and cost data should be made publicly available.** Queue information should be provided in a downloadable format with standardized fields on project specifications, queue status, and dates when key milestones are achieved, and should be updated on a monthly or bi-monthly basis. Cost data should include average historical or project-specific costs.

- **The format and organization of interconnection data should facilitate its use** by developers and other end users, with data fields that are standardized, sortable, and searchable.
- **Resources should be provided** by states and utilities so that developers, homeowners, and project owners can seek additional information and support as needed. This could include FAQs, guidance documents, or an online form that people can use to request help.
- **Available information should be shared via a single landing page or "one stop shop" within each state.** Aggregating the available information in one place facilitates its use by homeowners, project developers, and investors; it also facilitates transparency and oversight from policymakers, the media, and others.

State regulators can implement these best practices by setting requirements that utilities and other stakeholders must comply with. Such implementation will reduce the uncertainty associated with distribution-level interconnection – reducing its cost – and help identify and justify further reforms that may facilitate the deployment of new, small-scale renewable generation.

Introduction

Led by the U.S. Department of Energy (DOE),[1] the Interconnection Innovation e-Xchange (i2X) "enables a simpler, faster, and fairer interconnection of clean energy resources while enhancing the reliability, resiliency, and security of our electric grid." The i2X team works to solve interconnection delays and streamline processes by conducting different activities, including data collection and analysis.[2] Recognizing the dramatic expansion of renewable distributed energy resources (DERs) that are being deployed to meet decarbonization goals[3] – as well as the impact of those resources at the local distribution level (often including delays in interconnection queues) – i2X launched an effort to understand the distribution-level interconnection data that is publicly-available. Data availability matters because (a) it reduces risk and uncertainty for developers, which can help to drive down development costs; and (b) transparency enables accountability, and can help to inform efforts (regulatory or legislative) to make interconnection easier and cheaper. In May 2023, DOE provided funding for Cadmus[4] to conduct the research and analysis for this effort.

The objective of this white paper is to share the results of that effort: an analysis of the distribution-level interconnection queue, application process, and cost data that is publicly available in each of the 50 states. This research aimed to understand the overall quality, accessibility, and transparency of this data, as well as its potential usefulness. These findings were then used to distill best practices and recommendations for improved data availability – improvements likely to benefit the renewable resources needed to achieve climate goals.

This white paper is organized into the following sections: research and analysis methodology; an overview of the distribution interconnection process, timeline, and costs; key findings for each research topic; best practices; and recommendations.

Research Methodology

The research and analysis to assess the distribution-level interconnection landscape took place from May through October 2023. This effort consisted of three phases:

- Phase 1: Defining Research Areas
- Phase 2: Research
- Phase 3: Analysis

---

[1] More specifically, the program is led by the DOE's Solar Energy Technologies Office (SETO) and the Wind Energy Technologies Office (WETO), and is supported by national labs. For more information on i2X, see https://www.energy.gov/eere/i2x/interconnection-innovation-e-xchange.

[2] Additional i2X activities are stakeholder engagement, strategic roadmap development, and technical assistance. Ibid.

[3] At the federal level, the Biden-Harris Administration set a goal of a carbon-pollution-free electricity sector by 2035. At the state level, there are currently 24 states plus the District of Columbia and Puerto Rico that have 100% clean energy goals. Benefits made available by the Inflation Reduction Act – like expanding the Investment Tax Credit/Production Tax Credit, and enabling tax incentives to be paid directly to non-profits, electric cooperatives, municipal utilities, and others without tax liabilities – have also helped to reduce distributed generation costs.

[4] Cadmus is a strategic and technical consultancy that supports federal, state and local government, utilities, and the private sector to solve the world's most challenging problems. The consulting team for this project also includes contractors from Boston Government Services (BGS).

In Phase 1, three research categories were defined (*Process*, *Timeline*, and *Cost*), as well as the relevant information might be publicly available in each.

- *Process* data provides information about the interconnection process and how to apply for interconnection. This includes links to the interconnection application, and instructions and guidelines for completing it. It also includes useful aids (like FAQ webpages or flow charts), as well as points of contact for questions. It may include high-level information or guidance regarding timeline (e.g., links to publicly-available queue data) and costs (e.g., required application fees, and cost allocation).
- *Timeline* data provides information about the status of applications in an interconnection queue. This data includes basic queue data (i.e., the quantity of projects in the queue and the length of time a new project may spend in the queue) as well as high-quality queue data (i.e., the size, type, location, and timeline for individual projects).
- *Cost* data provides information about the expenses developers may incur during the interconnection process. This data includes information regarding defined, broadly-applicable costs (e.g., the application fee) and variable, project-specific costs (e.g., necessary upgrades to equipment or infrastructure). This also includes cost allocation guidance found in relevant statutory or administrative language.

Focus on States

Although utilities can and do publish distribution-level interconnection data – and although this research occasionally found such data – this analysis focuses on states. This is because state legislatures and utility regulators have the power to make policy changes that impact whether and how a regulated distribution utility reports distribution-level interconnection data. Throughout the analysis the text distinguishes when data is made available by a utility ("ComEd in Illinois") or a state PUC or agency ("Massachusetts DOER").

In Phase 2, research was conducted to find this distribution-level information across all 50 states. This consisted of using specific search terms for each state; when our search uncovered one or more utilities providing process, timeline, and/or cost information, we recorded this accordingly (we also recorded when no such information was found). Note that while extensive, this search did not specifically examine each and every distribution utility (regulated or non-regulated) within each state. The findings were then assembled within a single spreadsheet to help identify which categories of information were generally publicly-available (see the specific research questions in **Figure 1**). Doing so also helped identify which states had relevant information publicly-available (or not).

Queue	Application	Cost
Is the interconnection queue available online?	Is an interconnection application available online?	Is information regarding defined costs (e.g., the application fee) available online?
If not online, is queue data available by request?	Is there a step-by-step application guide?	What information regarding variable, project-specific costs (e.g., studies; necessary equipment upgrades) is available online, if any?
How frequently is queue data updated?	What other application information is provided, if any?	What other cost information is provided, if any?

Figure 1. Research Questions

In Phase 3, this data was analyzed to determine high-level themes, identify key takeaways, and distinguish lessons learned from exemplary states.

Overview of the Distribution Interconnection Process, Timeline and Costs

"Interconnection" refers to the process of connecting an energy generation source to either the local or regional electric grid. Interconnection enables both the distribution and monetization of electricity; this is regulated by different entities, depending on geographic reach. As of the end of 2022, roughly 3.2 million distributed PV systems have been installed in the United States.[5]

Transmission- vs. Distribution-level Interconnection

The transmission system carries electricity at high speeds (and high voltage) across the country. Because the electricity in the transmission system crosses state lines, it is classified as interstate commerce, and therefore subject to regulation by the Federal Energy Regulatory Commission (FERC).

The distribution system provides connection between resources and end-users at the state, local, or regional level. Because it occurs within states, distribution systems are regulated by state policy, and administered by state public utility commissions (PUCs). Because there is no federal regulation of these systems, distribution-level interconnection processes – and challenges – vary by location.

This analysis focuses on distribution-level

There is increased demand for intrastate distribution-level interconnection across the country,[6] both to reduce greenhouse gas emissions via distributed renewable generation, and to increase resiliency.[7] Distribution interconnection and renewable generation development are both facilitated by accessible, digestible information regarding the interconnection process, timeline, and cost, because access to such data reduces uncertainty for developers, which thereby reduces cost. However, the timeline and costs associated with distribution interconnection can vary significantly across states, as can the types, quantity, and quality of data shared concerning interconnection process, timeline, and costs.

Interconnection Process

All states roughly follow a basic procedure which consists of a *Pre-Application*, *Application*, *Entry to the Interconnection Queue, Interconnection Studies, Interconnection Agreement, Exit from the Interconnection Queue, Project Construction, and Interconnection*.

The *Pre-Application* step typically includes defining a project's location and size, and developing realistic cost and timeline expectations. This is usually done through preliminary conversations between the developer and the utility, and a review of publicly-available data. Developers next submit their *Application*, which provides information required for interconnection approval (e.g., project size, type, location, and equipment characteristics). Application fees are generally charged to process these applications; the amount varies by jurisdiction. Once an application is accepted, the project *Enters the Interconnection Queue.* While in the queue, projects over a certain threshold size – which also varies by jurisdiction – undergo a *Study Process*, which is typically the most time-consuming piece of the interconnection queue;

---

[5] Barbose et al., *Tracking the Sun, 2023 Edition.* Lawrence Berkeley National Lab (September 2023). https://emp.lbl.gov/sites/default/files/6_tracking_the_sun_2023_executive_summary.pdf. NREL's *Sharing the Sun* project data provides another example of solar deployment that has been interconnected at the distribution level. See NREL, *Sharing the Sun Community Solar Project Data (December 2023),* https://data.nrel.gov/submissions/233.

[6] See e.g., Utility Dive, US grid interconnection backlog jumps to 40%, with wait times expected to grow as IRA spurs more renewables, April 11, 2023, https://www.utilitydive.com/news/grid-interconnection-queue-berkeley-lab-lbnl-watt-coalition-wind-solar-renewables/647287/.

[7] i2X, Improving Interconnection, https://www.energy.gov/eere/i2x/interconnection-innovation-e-xchange.

note that it relies on getting accurate and timely information from the developer. The interconnection study components may include a feasibility study, a system impact study, and/or a facilities study. The purpose of undertaking these studies is to understand whether a project is feasible; what impact it will have on the distribution system; and what equipment or grid upgrades may be needed to safely and reliably enable the project's interconnection. Study costs may vary widely depending on project size and location, and they are typically paid for by the developer; costs associated with facility upgrades and grid network improvements are also paid by the developer (with some exceptions[8]) and may also vary widely. Once the upgrades and costs are determined, projects remain in the queue while the utility and the developer negotiate an *Interconnection Agreement* to agree on the required upgrades and costs. Projects also remain in the queue while the agreement is finalized. If an agreement is reached, a project will *Exit the Interconnection Queue,* and can then be *Constructed,* and finally, *Interconnected*.[9,10]

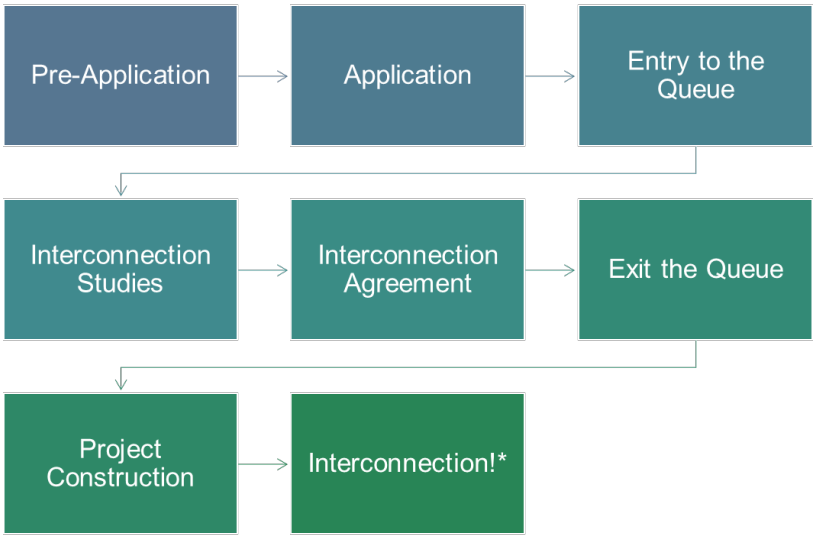


Figure 2. Simplified Interconnection Process

In this analysis, process data are resources that convey information about the interconnection process in a given state or utility service area. If it is publicly available and sufficiently detailed, process information helps developers and other users understand the interconnection process, thereby reducing uncertainty and improving the efficiency of interconnection. Detailed process information often contains elements such as a link to the interconnection application; instructions and guidance for completing the application;

[8] Some states are moving toward cost sharing mechanisms. New York's cost-sharing 2.0, Massachusetts' provisional cost sharing, and Minnesota's cost sharing program are examples of rules that shift away from the cost-causing principle to cost sharing for grid upgrades triggered by interconnection requests. Maryland and Maine are also working on this issue.

[9] Between 2011-2021 the average U.S. interconnection wait time (including both transmission- and distribution-level projects) was 3.7 years. A value specific to the distribution level does not appear to be available. Lawrence Berkeley National Laboratory, Record amounts of zero-carbon electricity generation and storage now seeking grid interconnection, April 13, 2022, https://emp.lbl.gov/news/record-amounts-zero-carbon.

[10] The interconnection step is typically achieved when Permission to Operate (PTO) is authorized.

clear information regarding defined costs (e.g., the application fee), and undefined costs (e.g., infrastructure upgrades); clear timeline information; points of contact for questions; and other useful aids (e.g., FAQs).

Interconnection Queue

The interconnection queue is a "line" of power generation and transmission projects waiting to connect to the power grid. The queue exists so that (a) utilities can determine whether the project can safely and reliably connect to the grid, and so that (b) utilities have the time they need, given their available staff and capacity, to review applications and study how projects can safely and reliably interconnect. Long interconnection queues are a common barrier to interconnection, as is uncertainty about the length of the interconnection queue.[11] This is because longer project timelines and uncertainty can both increase risk and costs for project developers – financing rates change over time, for example, as do the costs of construction materials and labor. Moreover, the longer a project takes to begin operating, the longer it is before project developers and funders see any return on their investment.

Therefore, lengthy queues increase project risk and uncertainty – and the lack of available queue data even more so. By contrast, short interconnection queues reduce risk, as do transparent queues that allow developers to assess likely wait times, project costs, and risks. This ultimately supports more interconnection and renewable energy development, as described above.

Basic interconnection queue data includes the time projects spend in the queue, which can shed light on the time an entirely new project may spend in the queue. High quality, detailed queue data also lists the size, type, location, and timeline data (e.g., dates that key milestones are achieved) *by project*.

Interconnection Costs

Interconnection costs can be defined as the sum of the following:[12]

Defined Costs	1. **Application Fees.** Application fees are common charges paid by the applicant to the appropriate utility to cover the administrative costs associated with processing the application. Fees vary depending on location and project size, and typically range in cost from $25 to $300.
	2. **Interconnection Studies.** Interconnection studies are paid for by developers and conducted by utilities to evaluate impacts to the electric grid that will be caused by the new generation facility under consideration. These studies help to determine whether any infrastructure upgrades are necessary to enable safe interconnection.

[11] Tackling High Costs and Long Delays for Clean Energy Interconnection, Office of Energy Efficiency and Renewable Energy, 2023 https://www.energy.gov/eere/i2x/articles/tackling-high-costs-and-long-delays-clean-energy-interconnection.

[12] Review of Interconnection Practices and Costs in the Western States, NREL, 2018 https://www.nrel.gov/docs/fy18osti/71232.pdf; Energy Storage Interconnection Guide, NYSERDA https://www.nyserda.ny.gov/-/media/Project/Nyserda/files/Programs/Energy-Storage/energy-storage-interconnection-guide.pdf.

Undefined Costs	
	3. **Local Interconnection Facilities.** Local interconnection facility costs represent all the interconnecting equipment that a utility may mandate the developer to secure, in order to connect a new generation facility to the electric grid. These can include (but are not limited to) metering equipment; wires; protection devices; step-up transformers; and substations (substations are also sometimes categorized as a network upgrade), often associated with the point of common coupling. This equipment may be owned by either the developer or the utility, even though it is paid for by the developer.
	4. **Grid Network Upgrades:** Grid network upgrades are the costs associated with utility upgrades to grid infrastructure that will enable safe and reliable interconnection for any given project. They are highly variable and uncertain, depending on points of interconnection, existing network capacity, and other applicants in the queue. This cost is paid for by developers, and varies depending on project location and type. Larger systems (in kW) often incur higher costs because of their greater impact on the grid; these costs will typically be determined in the interconnection study conducted for the project in question.

Interconnection costs can vary significantly across states, partly as a product of differing regulatory frameworks. These costs can also vary significantly across projects within a state, varying based on the point of interconnection; network capacity; utility engineering practices; system size; and other factors. While some of these factors might be defined and therefore more easily understood by developers (e.g., rules and regulations that govern cost calculations), others are undefined, and therefore cause greater uncertainty early in the process (e.g., what infrastructure upgrades may be required to safely and reliably interconnect). While some degree of uncertainty will always remain (as some costs are inherently context-dependent), greater visibility into the costs incurred by other projects can nonetheless serve to reduce uncertainty, and therefore facilitate renewable energy deployment.

Interconnection cost data includes cost or fee definitions and/or requirements, averages, and actual project-level costs. This data may be found within regulations, guidelines, and interconnection queues, and can shed light on the likely or potential costs to interconnect in a given area.

Key Findings

One crucial finding is the relative **lack of available information at the distribution level**, compared with what is possible to share publicly.[13] In the vast majority of states, publicly-available data that is clear and abundant was not found – and where such data was located, it was often found in only one or two of the three research categories. The granularity and organization of this publicly-available data varies widely: in some cases, data was deemed too incomplete for subsequent analysis (e.g., project-level queue data that lacked clear dates for queue entry/exit). Process data is the most prevalent – all 50 states have ***some*** form of process guidance or information that is publicly available. Meanwhile, just 6 states make high-quality queue data publicly-available,[14] and although 43 states have some form of cost information available, this is often limited to standard application fees and tariff language, rather than real-world study fees and infrastructure upgrades assigned to projects.[15] The entity that publishes this data also varies

[13] Utilities have some information that is *not* possible to share publicly, like Critical Energy/Electrical Infrastructure Information (CEII) and competitively sensitive information.

[14] These are California, Connecticut, Hawaii, Illinois, Massachusetts, and New York.

[15] Cost data was not found in Alaska, Arkansas, Missouri, Nevada, South Dakota, Tennessee, Texas, and Wyoming.

widely: in some states, the state government publishes the information; in others it is the public utility commission, or the relevant investor-owned utility.

Figure 3. Summary of Cross-Cutting Findings

Process Data Findings

While some degree of publicly-available process information was found in every state, several utilities stand out for the transparency and detail of the data they provide. For instance, First Energy, in Maryland, maintains a centralized location for all relevant interconnection information, including links to the application, fee information, FAQs, and detailed interconnection guidelines by kW size.[16] Connecticut's investor-owned utilities (Eversource and United Illuminating) both have webpages that function as centralized locations for interconnection information, including the application link, process and queue information, fees, points of contact, and step-by-step guidelines. Figure 4 shows the documents made available by Otter Tail Power Company in North Dakota. They include a flow chart of the distribution generation interconnection process; a document outlining the application process; interconnection requirements; engineering data requirements; a sample interconnection agreement; relevant riders; and a technical handbook.[17]


North Dakota Interconnection

If you generate electricity and are looking to interconnect with our system, read the documents below to learn more about the process, requirements, and more.

Process and technical documents

- Distributed generation interconnection process flow chart
- Application process
- Interconnection requirements
- Application for interconnection
- Engineering data submittal
- Interconnection agreement
- Purchase-power riders and applicability matrix
  - Small power producer rider - Occasional-delivery energy service
  - Small power producer rider - Time-of-delivery energy service
  - Small power producer rider - Dependable service
  - Standby service tariff

In addition to the procedures above, interconnection customers may be required to abide by the guidelines in our technical handbook, which outlines the technical requirements for interconnecting a generator, tie-line, or substation to our electric system. Our Minnesota Technical Interconnection and Interoperability Requirements and our Technical Standards Manual may also provide valuable information on our requirements.

Figure 4. North Dakota Interconnection Resources

In contrast, useful and publicly-available process information was not found in several states. Alaska, for instance, has not yet established an overall standard for interconnection processes, but instead

[16] First Energy, Maryland Interconnection, https://www.firstenergycorp.com/feconnect/maryland.html; Pepco, also in Maryland, makes their application and instructions available, as well as FAQs. Pepco, Apply for Net Metering Interconnection, https://www.pepco.com/smart-energy/my-green-power-connection/developers-contractors/applying-for-interconnection/how-to-apply .

[17] North Dakota Interconnection, Ottertail Power Company, https://www.otpco.com/help-center/how-to-connect-to-our-power-grid/north-dakota-interconnection/.

reviews each regulated utility's interconnection standard to judge for reasonableness.[18] While the Alaska PUC's order adopting regulations on interconnection standards is available online,[19] it is not applicable to all systems, and falls short of the user-friendly guidelines, flow charts, and technical handbooks made available in other jurisdictions.

Queue Data Findings

Both the *quantity* and the *organization* of publicly-available queue data is inconsistent across states at the distribution level. Some states (e.g., New York) make detailed, project-level data publicly available. Information about queues in other states is made available at the ISO level,[20] utility level, or not at all. Among those states that do make detailed queue data publicly available, no two datasets are alike; there are often significant inconsistencies regarding the data fields included, and how those are defined (if definitions are offered).[21] PUCs are the most common source of queue information, although other entities may also make this data available (e.g., utilities and state energy offices).

Six states were found to have detailed, publicly-accessible queue data that was updated within the last two months: California, Connecticut, Hawaii, Illinois, Massachusetts, and New York.[22] Other states make queue data available on a more limited basis, or less frequently.[23] As an exploratory exercise, a deeper look at the data made available in three states (Massachusetts, Hawaii, and Illinois) was taken to determine what analyses the data enabled; more detail can be found in Appendix A.

The research indicates that queue data is most useful when (1) it is updated frequently (every 1-2

---

[18] American Council for an Energy-Efficient Economy, State and Local Policy Database: Interconnection Standards, https://database.aceee.org/state/interconnection-standards.

[19] Regulatory Commission of Alaska, In the Matter of the Consideration of the Adoption of Regulations Implementing an Interconnection Standard, R-09-2 Order No. 4, http://rca.alaska.gov/RCAWeb/ViewFile.aspx?id=e96a536c-91ed-47e6-9055-4d4598b824c2.

[20] Independent System Operators (ISOs) are independent organizations that manage grid operations in specific geographic areas. See FERC, Electric Power Markets, https://www.ferc.gov/electric-power-markets.

[21] For instance, Massachusetts includes eighteen date fields in its queue dataset, while ComEd in Illinois does not include any. And while Hawaiian Electric includes extensive notes to guide the interpretation of its queue dataset, Massachusetts does not. Massachusetts Department of Energy Resources, Utility Interconnection in Massachusetts, https://www.mass.gov/info-details/utility-interconnection-in-massachusetts; ComEd, Interconnection Queue, https://www.comed.com/SmartEnergy/MyGreenPowerConnection/Pages/InterconnectionQueue.aspx; Hawaiian Electric, Integrated Interconnection Queue, https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/integrated-interconnection-queue.

[22] The links to each state's queue data are provided below, with specification on whether the state or utility provides the data.

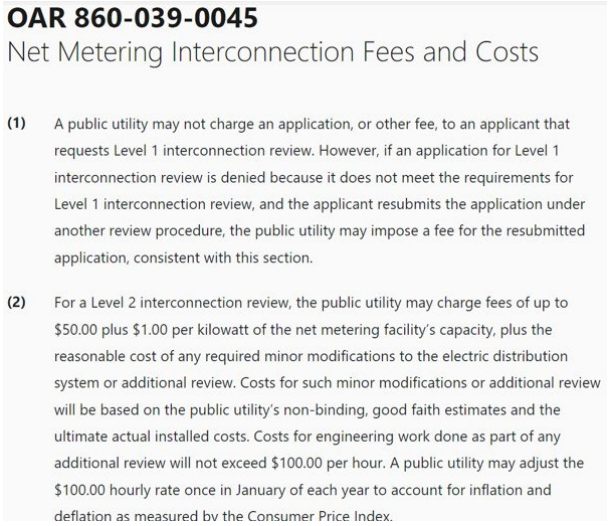
1. California (State): https://www.californiadgstats.ca.gov/downloads/
2. Connecticut (Utility): https://www.eversource.com/content/docs/default-source/builders-contractors/ct-der-queue.xlsx
3. Hawaii (Utility): https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/integrated-interconnection-queue
4. Illinois (Utility): https://www.comed.com/Pages/InterconnectionQueue.aspx
5. Massachusetts (State): https://www.mass.gov/info-details/utility-interconnection-in-massachusetts.
6. New York (State): https://dps.ny.gov/distributed-generation-information.

[23] In South Dakota, for example, utilities are required to file annual reports of small generation interconnection, which are made available in pdf form: https://puc.sd.gov/commissionaction/utilityinterconnectionreports/default.aspx.

months); (2) it is downloadable (e.g., in Excel format); (3) it contains fields of interest such as length and stage in queue, fuel type, location, project size, and project ownership; and (4) data fields are clearly defined. Unfortunately, the research did not reveal a single example that met all four of these criteria. Other criteria that may also indicate high quality queue data are: (5) data that does not need to be cleaned to be useful;[24] (6) data that is and complete;[25] (7) data that is visualized in easy-to-read charts and tables, to facilitate understanding;[26] and (8) data that is disaggregated into useful formats (e.g., by county or utility).[27]

Cost Data Findings

This research found there is very little detailed, project-level cost data that is publicly available at the distribution level. While 43 states have some form of cost data available, this is often limited to required application fees (which typically range between $25 and $300). New York is the only state that provides specific, project-level cost data at the distribution level.[28]



OAR 860-039-0045

Net Metering Interconnection Fees and Costs

(1) A public utility may not charge an application, or other fee, to an applicant that requests Level 1 interconnection review. However, if an application for Level 1 interconnection review is denied because it does not meet the requirements for Level 1 interconnection review, and the applicant resubmits the application under another review procedure, the public utility may impose a fee for the resubmitted application, consistent with this section.

(2) For a Level 2 interconnection review, the public utility may charge fees of up to $50.00 plus $1.00 per kilowatt of the net metering facility's capacity, plus the reasonable cost of any required minor modifications to the electric distribution system or additional review. Costs for such minor modifications or additional review will be based on the public utility's non-binding, good faith estimates and the ultimate actual installed costs. Costs for engineering work done as part of any additional review will not exceed $100.00 per hour. A public utility may adjust the $100.00 hourly rate once in January of each year to account for inflation and deflation as measured by the Consumer Price Index.

Figure 5. Oregon's Interconnection Cost Regulation Rules

Other forms of cost data are occasionally made publicly available. In Oregon, for example, cost regulation rules clarify maximum charges by project tier, which limits uncertainty for project developers. Oregon's rules state that the utility "may charge fees of up to $50.00 plus $1.00 per kilowatt of the net metering facility's capacity…" for minor changes to the grid or additional review, and that "costs for engineering work done as part of an impact study or interconnection facilities study will not exceed $100.00 per hour."[29]

Hawaiian Electric makes interconnection study and infrastructure cost data publicly available, broken out by voltage and location, and presented in charts and tables

[24] See e.g., ComEd, Interconnection Queue, https://www.comed.com/SmartEnergy/MyGreenPowerConnection/Pages/InterconnectionQueue.aspx.

[25] Ibid.

[26] See e.g., Hawaiian Electric, PBR Scorecards and Metrics – Interconnection Experience, https://www.hawaiianelectric.com/about-us/performance-scorecards-and-metrics/interconnection-experience.

[27] E.g., Hawaiian Electric organizes its queue data by county, while Massachusetts organizes it by utility. Hawaiian Electric, Integrated Interconnection Queue, https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/integrated-interconnection-queue; Massachusetts Department of Energy Resources, Utility Interconnection in Massachusetts, https://www.mass.gov/info-details/utility-interconnection-in-massachusetts.

[28] New York Public Service Department, Utility Interconnection Queue Data (February 2024), https://dps.ny.gov/distributed-generation-information. The utility of this data is nonetheless limited: from 2019-2023, this data was missing for a bit less than 99% of New York projects.

[29] Oregon Net Metering Interconnection Fees and Costs, OAR 860-039-0045.

to facilitate understanding.[30] However this data is aggregated and averaged, making it less useful than project-level data that shows a dollar-per-kW value.

Cost to Interconnect Summary

	Voltage	Average IRS Cost per project, Actual	# of projects	Average Interconnection (Company-Owned Facilities) Cost per project, Actual	# of projects
Oahu	12 KV	$181,529	1	$3,345,778	1
	46 KV	$219,770	6	$3,400,357	5
	138 KV	$146,958	4	$12,067,618	2
Maui	12 KV	$37,500	4	$281,201	3
	69 KV	$220,404	2		
Hawaii	12 KV				
	69 KV	$236,795	1		
Lanai	12 KV				
Molokai	12 KV				

Figure 6. Average cost data for projects with Power Purchase Agreements (2017-2021, Hawaiian Electric) [31]

ComEd in Illinois does make project-level cost data available, but only in the form of wide, poorly-defined cost ranges.[32] And while Eversource in Massachusetts doesn't make project-level cost data available after the fact, it does reduce uncertainty for project developers by publishing typical distribution and substation modification costs for DER projects.[33]

Best Practices

Four data availability best practices for distribution-level interconnection were developed based on these findings and are described in more detail below. While the implementing authority to mandate them is at the state level (e.g., a PUC or state energy office), utilities are themselves free to act on these best practices. In many instances, state agencies or PUCs can implement these best practices without the need for additional legislation.

---

[30] Hawaiian Electric, PBR Scorecards and Metrics – Interconnection Experience, https://www.hawaiianelectric.com/about-us/performance-scorecards-and-metrics/interconnection-experience.

[31] Ibid.

[32] These ranges are <=500K; >500K - 1M; >1M - 2M; >2M - 5M; >5M - 10M; >10M. Without a clear definition, however, it is unclear what this "Cost Range" field is meant to convey. Do these figures include costs related to project financing; labor and materials; permitting? If they're limited specifically to the costs of interconnection, how are these costs defined? See ComEd, Interconnection Queue, https://www.comed.com/SmartEnergy/MyGreenPowerConnection/Pages/InterconnectionQueue.aspx.

[33] See https://www.eversource.com/content/residential/about/doing-business-with-us/interconnections/massachusetts/distributed-energy-resources-project-costs. As another example, Central Maine Power makes the following rough order of magnitude estimates available for distributed generation projects: https://www.cmpco.com/documents/40117/115964135/Typical%2BSystem%2BModifications%2Bfor%2BDG%2B01.28.22.pdf/4db88be5-74ee-eb6c-52eb-dfd4ebcf7d51.

Transparency

Clear, easy-to-follow, step-by-step instructions about how to complete the interconnection process – and the costs and timeframes that may be encountered – should be made publicly available. This includes detailed, step-by-step process guidance;[34] a downloadable public queue with relevant, well-defined fields of interest updated on a monthly basis; and average or project-specific historical cost data (see Table 1).

Specifications	Queue Status	Costs
• Utility name • Census block group • Technology type (PV, Gas, Diesel, Wind, CSP, BESS, LFG, H2, Hydro, Other)[35] • Rated power (kW) • Stored energy (kWh), if applicable • IEEE 1547 Reactive Power Category (A, B, legacy) • IEEE 1547 Disturbance Category (I, II, III, legacy)	• Date application received • Date of queue entry • Date application deemed complete • Date of study completion • Date of construction completion • Date of permission to operate • Project status (active, operational, withdrawn, suspended) • Project stage (study, construction, etc.)	• Estimated cost of studies and fees ($ quoted from the utility) • Estimated cost of system upgrades ($ quoted from the utility) • Final cost of interconnection ($ billed from the utility)

Table 1. Recommended Fields of Interest for Interconnection Queue

This data is valuable because it reduces risk and uncertainty for project owners and developers, which reduces costs and can therefore facilitate the deployment of renewable generation. Academics, regulators, policymakers, media, , investors, and other constituencies may also derive value from having this data at their fingertips.

Centralization of Information

Available information should be shared via a single landing page or "one stop shop" within each state. Aggregating the available information in one place facilitates its use by homeowners, project developers, and investors; it also facilitates transparency and oversight from legislators, the media, and others. This can be useful even if the page links to utility pages that contain more detailed, utility-specific information.

Organization of Information

The format and organization of interconnection information should facilitate its use by developers and other end users with data fields that are standardized, sortable, and searchable. For instance, process guidance can be organized by project stage, project size, geography, or another relevant criterion. Downloadable queue data should include fields that define a project's stage and time in the

[34] More specifically, detailed process guidance can include step-by-step instructions; example documents or link to the interconnection application; and useful tools to aid understanding like FAQs, flowcharts and points of contact.

[35] PV stands for Solar Photovoltaic, CSP stands for Concentrating Solar-Thermal Power, BESS stands for Battery Energy Storage System, LFG stands for Landfill Gas Energy, and H2 stands for Hydrogen Fuel.

queue, fuel type, project location, and size – and these fields should be well-defined in supporting documentation.

Additional Assistance

Resources should be provided by states and utilities so that developers, homeowners, and project owners can seek additional information and support as needed. This could include FAQs, guidance documents, or an online form that people can use to request help – which will require sufficient staffing capacity to respond to public requests. Being able to easily address project-specific questions as they arise reduces project design and application costs while simultaneously improving the quality of project applications, thereby reducing their burden on the queue. Open communication channels may also make it easier for states to identify and resolve common issues within the interconnection process.

Conclusion

Distribution-level generation resources have become increasingly important mechanisms to meet climate goals and support grid resiliency – and as interconnection demand has increased, the process of interconnection itself has become a significant bottleneck. Access to timely and high-quality interconnection data can facilitate legislative or regulatory attempts to address this bottleneck, and can, on its own, serve to reduce risk and uncertainty (and therefore costs) for project owners and developers. This white paper assesses the interconnection data that is publicly available across all 50 states, with a particular focus on the quality and usefulness of available process, timeline, and cost data. This research reveals a relative lack of available information (compared with what is possible), and significant inconsistencies in the granularity and organization of the data that *is* available. At the same time, the research also identified best practices – already undertaken in some jurisdictions – that other states can replicate.

For recommendations that go beyond the data-focused best practices described in this paper, please see additional resources on the DOE i2X website.

Appendix A – Queue Data Examples

Massachusetts

Massachusetts' energy office, the Department of Energy Resources (DOER), uploads downloadable queue datasets monthly. The datasets are in Excel format and are available in both aggregated and disaggregated (by utility) form, facilitating further data manipulation and analysis.[36] The data contain multiple fields of potential interest – including timeframe, location, fuel type, project status, project size, and project ownership – broken down into granular categories:

- **Dates**. Multiple date fields exist to identify the date various project milestones were achieved (Application Received/Deemed Complete; Review of Screens Study Begun/Completed; Supplemental Review Begun/Complete; Standard Process Initial Review Begun/Completed; Impact Study Begun/Sent; Interconnection Agreement Sent/Received; Date Construction Begun/Completed; Witness Test Scheduled/Completed; Authorization to Interconnect). This allows for an incredibly granular timeframe analysis.
- **Location**. A project's location is defined by three fields: "Company Name" (denoting which of the four utility territories contain the project), "City/Town," and "Zip Code."
- **Project Type**. This is defined via the following fields: "Design Capacity (kW)," "Fuel Type (Solar, Wind, etc.)," and "Net Metered? (Y/N)."
- **Ownership**. Categories of project ownership (in the "Private/Gov't" column) include "Res" (apparently residential); "Comm" (apparently commercial); "Private" (the category has unclear meaning, but may include both residential and commercial); both "Gov't" and "Public" (these may overlap in meaning or be identical; it's unclear); "P2" (only one project; unclear meaning); "NO EXPORT" (three projects; unclear meaning); and "N/A" (one project).
- **Status**. The dataset includes more than 50 project statuses, several of which appear to mean the same thing (e.g., "Connected," "Online," and "In Operation" all appear to mean the project is completed).

Inconsistencies likely result from the need to aggregate spreadsheets from multiple utilities, but they mean that the data requires cleaning before it can be meaningfully analyzed. The fact that columns and the data they contain are not defined or explained in greater detail also serves as a barrier to useful analysis.

Figure 7. Massachusetts Utility Interconnection Reports

[36] Massachusetts Department of Energy Resources, Utility Interconnection in Massachusetts, https://www.mass.gov/info-details/utility-interconnection-in-massachusetts.

Hawaii

Hawaii's primary utility, Hawaiian Electric, posts interconnection queue data on a monthly basis. The data is *not* available for download, but *is* available on a website that has search and sorting functionality.[37] While it is possible to copy the data into Excel format, doing so is a cumbersome and inhibits further analysis. The data contains multiple fields of interest, including timeframe, location, project status, and project size (fuel type and ownership data is not included). Somewhat uniquely, the data is also presented in charts and tables that help facilitate greater understanding. The data fields and values are also conveniently defined – codes for "Review Status" are explained above each table, and explanations for "procurement" codes are made available in an FAQ.[38]

At the same time, project-level data is occasionally missing – for instance, circuit information is missing for approximately 20 out of the 14,663 projects. And the available data requires minor cleaning – for example, 1930 projects had a listed system size (in kW) of "0," which appears to denote an absence of data.

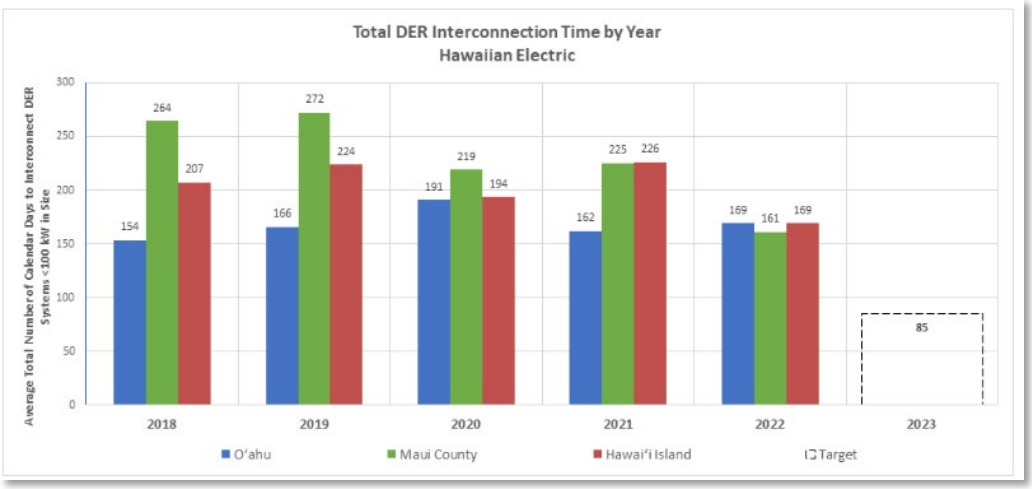


Figure 8. Hawaiian Electric's "Total DER Interconnection Time Scorecard"

Illinois

ComEd, an Exelon Company and investor-owned utility serving Illinois, provides current data with multiple fields of potential interest, including property type, project size, current status, and project cost. At the same time, data regarding timeframe, geographic location, and fuel type is not included, which degrades the usefulness of the available data. As with Hawaiian Electric, the data is *not* downloadable, though it is available on a website with search and some sorting functionality,[39] and can be copied into Excel format.

---

[37] Hawaiian Electric, Integrated Interconnection Queue, https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/integrated-interconnection-queue.

[38] Hawaiian Electric, Frequently Asked Questions, https://www.hawaiianelectric.com/customer-service/frequently-asked-questions.

[39] ComEd, Interconnection Queue, https://www.comed.com/SmartEnergy/MyGreenPowerConnection/Pages/InterconnectionQueue.aspx.

The data appears to be accurate and complete, and does not need to be cleaned to enable useful analysis. However, column headers and the data itself are not defined or explained in greater detail, which hinders data interpretation and further analysis.[40]

Project ID	Property Type	Proposed Size (MW)	Current Status	Cost Range	Substation	Substation Queue Position	Feeder	Feeder Queue Position
17-00206	Commercial/Business	0.12	Approved	<= 500K	S0724	1	F4942	1
17-00475	Community Supply	2	Construction Pending	> 500K - 1M	S0719	1	F1761	1
18-00045	Utility Scale	7	Construction Pending	> 500K - 1M	S0523	1	F1858	1
18-00095	Commercial/Business	0.48	Approved	<=	S0678	1	F2608	1

Figure 9. ComEd Queue Data

[40] For instance, the first two numbers in the “Project ID” code appear to denote the project year, although this is uncertain. Ibid.

Appendix B – State Interconnection Data Resources

This table provides links to the resources foumassnd for each state during the research of interconnection process, queue, and cost data.

State	Resources
Alabama	• Application information report: https://www.alabamapower.com/content/dam/alabama-power/pdfs-docs/SOCO%20Interconnection%20Policy.pdf • Application process information, instructions, forms, and costs for Alabama, Georgia, and Mississippi: https://www.alabamapower.com/content/dam/alabama-power/pdfs-docs/SOCO%20Interconnection%20Policy.pdf
Alaska	• Background process information: http://rca.alaska.gov/RCAWeb/ViewFile.aspx?id=e96a536c-91ed-47e6-9055-4d4598b824c2
Arizona	• Background process information: https://azcc.gov/utilities/electric • Information on application process and fees: https://www.aps.com/-/media/APS/APSCOM-PDFs/Utility/Regulatory-and-Legal/Regulatory-Plan-Details-Tariffs/Residential/Schedules/Schedule06_InterconnectionNon-FERCGeneration.ashx?la=en#:~:text=(A)%20The%20study%20fee%20for,Interconnections%2069%20kV%20and%20above • Step by step interconnection guide: https://www.aps.com/en/About/Our-Company/Doing%20Business%20with%20Us/FERC%20Generator%20Interconnections • Application Fees: https://www.aps.com/-/media/APS/APSCOM-PDFs/Utility/Regulatory-and-Legal/Regulatory-Plan-Details-Tariffs/Residential/Schedules/Schedule06_InterconnectionNon-FERCGeneration.ashx • Study Fee: https://www.aps.com/-/media/APS/APSCOM-PDFs/Utility/Regulatory-and-Legal/Regulatory-Plan-Details-Tariffs/Residential/Schedules/Schedule06_InterconnectionNon-FERCGeneration.ashx; https://www.aps.com/-/media/APS/APSCOM-PDFs/Residential/Service-Plans/Understanding-Solar/InterconnectAppStudyAgree.ashx.
Arkansas	• Contact & Application info: https://www.entergy-arkansas.com/net-metering/ • Background information on interconnection guidelines: https://aecc.com/faqs_category/aecc-interconnection-requirements/
California	• Interconnection queue: https://www.californiadgstats.ca.gov/downloads/ • Contact info: https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/interconnection-agreements

	• Background process info, rules, guidelines (by utility): https://www.cpuc.ca.gov/rule21/
Colorado	• Step-by-step interconnection guidance: https://www.transmission.xcelenergy.com/staticfiles/microsites/Transmission/SGIA-Intercon-Rqst-Template.pdf • Cost information: https://www.transmission.xcelenergy.com/Interconnections
Delaware	• Step-by-Step Instructions for Interconnection: https://www.delmarva.com/SmartEnergy/MyGreenPowerConnection/Pages/ApplyingforInterconnection.aspx • General information and guidelines: https://www.delmarva.com/sitecollectiondocuments/delaware_interconnection_standards.pdf • Cost info: Delaware Electric Cooperative Generator Interconnection Application.

Florida	• Application information and interconnection steps provided by several utilities.
	  ○ Apply for Grid Connection - Duke Energy (duke-energy.com)
	  ○ https://www.duke-energy.com/home/products/renewable-energy/generate-your-own
	  ○ https://www.tampaelectric.com/company/solar-energy/connectingyoursolar/netmeteringapplication/
	• Cost information https://www.westflorida.coop/en/clf/solar-energy-fixed-costs-and-energy-credits-what-you-need-to-know#:~:text=Beginning%20August%201%2C%202021%20WFEC,will%20be%20charged%20%2415.10%20monthly

Georgia	• Background on Process: https://www.georgiapower.com/business/products-programs/business-solutions/qualifying-facilities/interconnection-contracting-process.html • Interconnection process, info, instructions, and forms: https://www.alabamapower.com/content/dam/alabama-power/pdfs-docs/SOCO%20Interconnection%20Policy.pdf • Background cost information: https://solarbuildermag.com/news/georgia-psc-approves-georgia-powers-100-interconnection-fee-for-new-solar-customers/#
Hawaii	• Interconnection Queue: https://www.hawaiianelectric.com/clean-energy-hawaii/integration-tools-and-resources/integrated-interconnection-queue • Application and contact info: https://forms.hawaiianelectric.com/home • Cost info: https://www.hawaiianelectric.com/about-us/performance-scorecards-and-metrics/interconnection-experience
Idaho	• Interconnection Queue: http://www.oatioasis.com/ipco/index.html

	• Interconnection Process and Contact info: https://www.idahopower.com/about-us/doing-business-with-us/generator-interconnection/ • Cost information studies: https://www.idahopower.com/energy-environment/green-choices/solar-power-options-customer-generation/customer-generation/
Illinois	• Interconnection Queue for ComEd: https://www.comed.com/SmartEnergy/MyGreenPowerConnection/Pages/InterconnectionQueue.aspx • Step-by-step guidance for Ameren: https://www.ameren.com/-/media/illinois-site/files/electricchoice/powerclerk-interconnection-application-guide-mar-2023.ashx • Cost information: https://www.comed.com/SiteCollectionDocuments/MyAccount/MyBillUsage/Interconnection/ApplicationForlLevel1DistributedGeneration.pdf
Indiana	• Background application information: https://www.energysage.com/local-data/net-metering/duke-energy/#:~:text=Requirement%20%242%20million-,Indiana,%2FkW%20and%20%242%2FkW • Cost information: https://www.aesindiana.com/electrical-system-interconnection-agreements-and-applications
Iowa	• Application and cost information: https://iub.iowa.gov/regulated-industries/electric/site-distributed-generation • Contact info: https://www.alliantenergy.com/cleanenergy/whatyoucando/customerinterconnection • Application link: https://iub.iowa.gov/sites/default/files/documents/2021/09/level_2-4_interconnection_request_fillable_form.pdf • Write up of Interconnection application rules and guidelines: https://www.iaenvironment.org/webres/File/Iowa%20interconnection%20summary%203_21_17%20fnl.pdf
Kansas	• Instructions and background info: https://www.gardnerkansas.gov/government/departments-and-divisions/utilities-department/renewable-parallel-generation-interconnection-standards • Costs provided in study: https://flinthillsrec.com/sites/flinthills/files/PDFs/KS%20SGIP%20Final.pdf
Kentucky	• Interconnection guidelines: https://psc.ky.gov/agencies/psc/industry/electric/final%20net%20metering-interconnection%20guidelines%201-8-09.pdf; https://www.kentuckypower.com/lib/docs/business/builders/KPCustomerGuideForInterconnection.pdf

Louisiana	• Application link for Entergy: https://www.entergy-louisiana.com/net-metering/process/ • Cost information: https://eta-publications.lbl.gov/sites/default/files/berkeley_lab_2022.10.06-_miso_interconnection_costs.pdf
Maine	• Interconnection regulations: https://www.cmpco.com/suppliersandpartners/servicesandresources/interconnection
Maryland	• Interconnection guidance: Maryland Interconnection (firstenergycorp.com) • Costs from First Energy and Pepco: https://www.firstenergycorp.com/feconnect/maryland.html; https://www.pepco.com/smart-energy/my-green-power-connection/developers-contractors/applying-for-interconnection/apply-by-paper
Massachusetts	• Interconnection information: https://www.mass.gov/info-details/utility-interconnection-in-massachusetts • Cost information: https://www.sandia.gov/app/uploads/sites/163/2021/09/GESDB_MassachusettsInterconnectionStandards.pdf
Michigan	• Interconnection information: https://www.michigan.gov/mpsc/regulatory/electricity/renewable-energy/generator-interconnection • Generation interconnection procedures: Generator Interconnection Procedures (michigan.gov)
Minnesota	• Interconnection information: https://mn.gov/puc/activities/economic-analysis/distributed-energy/interconnections/
Mississippi	• Interconnection procedures: https://www.mississippipower.com/content/dam/mississippi-power/pdfs/business/products-and-services/solar/interconnection-process/mpc-dgip-procedures.pdf • Cost info: https://www.psc.ms.gov/sites/default/files/Solar%20Consumer%20Guide%20AGO%20October%202021.pdf • Additional information on process, instructions, and forms: https://www.alabamapower.com/content/dam/alabama-power/pdfs-docs/SOCO%20Interconnection%20Policy.pdf
Missouri	• Application link: https://psc.mo.gov/CMSInternetData/Electric/Net%20Metering/Interconnection%20Application.pdf
Montana	• Interconnection information: https://northwesternenergy.com/clean-energy/our-environmental-projects/private-generation

	• Cost info: https://eta-publications.lbl.gov/sites/default/files/berkeley_lab_2023.04.20-_spp_interconnection_costs.pdf; https://www.montana-dakota.com/wp-content/uploads/PDFs/Rates-Tariffs/Montana/Electric/MTElectric96.pdf
Nebraska	• Limited application information: https://www.nebraska.gov/psc/ICA_comm/ICA.php
Nevada	• Limited application information: https://www.energysage.com/local-data/net-metering/nv-energy/
New Hampshire	• Application Link: https://www.nhec.com/wp-content/uploads/2017/02/2017-Interconnection-Application-Package.pdf ; https://www.eversource.com/content/residential/about/doing-business-with-us/interconnections/new-hampshire/new-hampshire-application-to-connect • Application information: https://www.eversource.com/content/residential/about/doing-business-with-us/interconnections/new-hampshire/new-hampshire-application-to-connect • General information: https://www.nhec.com/wp-content/uploads/2019/06/Interconnection-Application-w-Battery-Backup_6.-12-19.pdf • Cost information: https://www.eversource.com/content/residential/about/doing-business-with-us/interconnections/new-hampshire/new-hampshire-distributed-energy-resources-(der)-project-costs ; https://www.eversource.com/content/residential/about/doing-business-with-us/interconnections/new-hampshire/new-hampshire-application-to-connect
New Jersey	• General process info: https://www.njcleanenergy.com/renewable-energy/programs/net-metering-and-interconnection • Application and cost info: https://www.energysage.com/local-data/net-metering/jcpl/ • Application steps: https://firstenergycorp.com/feconnect/newjersey.html •
New Mexico	• Interconnection process and contact info: https://www.pnm.com/interconnection-process • Step-by-step interconnection process and cost info: https://www.pnm.com/interconnecting-large-facilities
New York	• Queue data by utility: https://dps.ny.gov/distributed-generation-information • Interconnection process info: https://www.nyseg.com/documents/40132/5899056/NYSEG+Queue+Order+by+Substation+-+updated+09.19.23.pdf ; • Cost info: https://www.nyseg.com/smartenergy/innovation/distributedgeneration/online-portal

	• Application link and contact info: https://www.nyserda.ny.gov/All-Programs/NY-Sun/Contractors/Resources-for-Contractors/Interconnection • Background interconnection application process information: https://www.nyiso.com/-/road-to-2040-our-interconnection-queue-shows-unpresedented-growth-of-clean-energy-investment-in-ny
North Carolina	• Queue data: https://starw1.ncuc.gov/NCUC/page/docket-docs/PSC/DocketDetails.aspx?DocketId=3d2193eb-470e-4721-a791-958dd431b13f • Interconnection info: https://www.dominionenergy.com/north-carolina-electric/large-business-services/using-our-facilities/parallel-generation-and-interconnection • Application request form and cost info: https://www.progress-energy.com/assets/www/docs/company/NC-Interconnection-Attachment-2.pdf • Cost info: https://www.energysage.com/local-data/net-metering/duke-energy/#:~:text=Requirement%20%242%20million-,Indiana,%2FkW%20and%20%242%2FkW;
North Dakota	• Interconnection guidance, steps and cost info: https://www.otpco.com/help-center/how-to-connect-to-our-power-grid/north-dakota-interconnection/ • Link to application: https://www.novapowerportal.com/Verify/New/22
Ohio	• Interconnection process: https://opsb.ohio.gov/processes/ohio-generation-interconnection • Application link: https://puco.ohio.gov/utilities/electricity/resources/interconnection-applicant-info • Cost info: https://www.aes-ohio.com/net-metering ; https://www.aes-ohio.com/sites/default/files/2021-03/AES%20Ohio%20Standard%20Interconnection%20application_LEVEL%201.pdf
Oklahoma	• Interconnection application process: https://www.psoklahoma.com/lib/docs/business/builders/PSO-CompleteGuidetoInterconnection2021.pdf
Oregon	• Queue information: https://www.oregoncsp.org/interconnection/ • Interconnection queue: http://www.oatioasis.com/ipco/index.htm • Interconnection rules and regulations: https://programs.dsireusa.org/system/program/detail/802 • Cost information: https://oregon.public.law/rules/oar_860-039-0045
Pennsylvania	• Interconnection information: https://www.puc.pa.gov/telecommunications/interconnection-agreements/; https://www.puc.pa.gov/media/2652/net-metering-interconnection-report-2021-2023_final.pdf

	• Application link, process and cost information for First Energy Corp: https://www.firstenergycorp.com/feconnect/pennsylvania.html
Rhode Island	• Application link and process info: https://gridforce.my.site.com/s/article/Interconnection-Process-RI • Cost: https://ripuc.ri.gov/
South Carolina	• Interconnection Queue from Duke (lacks small projects): http://www.oasis.oati.com/woa/docs/DUK/DUKdocs/Generator_Interconnection_Information.html#Generator_Interconnection_Queue • Application link and step-by-step application guidance for Dominion: https://www.dominionenergy.com/south-carolina/save-energy/renewable-energy-developers
South Dakota	• Completed small projects list: https://puc.sd.gov/commissionaction/utilityinterconnectionreports/default.aspx • Application link and step-by-step guidance: https://www.otpco.com/help-center/how-to-connect-to-our-power-grid/south-dakota-interconnection/
Tennessee	• Example application: https://mte.com/sites/mtemc/files/Documents/Energy%20Services/MTE_Interconnection_Application.pdf
Texas	• Interconnection info: https://www.puc.texas.gov/agency/rulesnlaws/interconnect/interconnection.aspx • Link to Application for Xcel Energy: https://www.xcelenergy.com/staticfiles/xe-responsive/Programs%20and%20Rebates/Residential/Texas-Interconnection-application-form.pdf; https://www.puc.texas.gov/agency/sitesearch.aspx • Interconnection steps and Application form for EPE: https://www.epelectric.com/files/html/Renewable/TX_DG_REC_forms/EPE%20Texas%20Interconnection%20Application%20Form%20User%20Guide%204.2.20.pdf
Utah	• Link to Application: https://pscdocs.utah.gov/electric/10docs/1003544/72456RedVersAppElecIntercon.pdf • Fees: https://casetext.com/regulation/utah-administrative-code/public-service-commission/title-r746-administration/rule-r746-312-electrical-interconnection/section-r746-312-13-interconnection-fees-and-charges
Vermont	• Contact info: https://vermontelectric.coop/electric-system/distributed-generation • Application Link: https://vermontelectric.coop/electric-system/distributed-generation

	• Process Information and Interconnection Guidelines: https://vermontelectric.coop/client_media/files/VEC_Interconnection_Guidelines_03142019.pdf
Virginia	• Queue (incomplete): https://www.dominionenergy.com/virginia/large-business-services/using-our-facilities/parallel-generation-and-interconnection • Regulations interconnection process and applications: https://law.lis.virginia.gov/admincode/title20/agency5/chapter314/section50
Washington	• Contacts and Application Form: https://www.utc.wa.gov/regulated-industries/utilities/telecommunications/interconnection-agreements • Tariff Information: https://www.pacificpower.net/content/dam/pcorp/documents/en/pacificpower/rates-regulation/washington/rates/136_Interconnection_Tariff.pdf • Costs: https://www.nrel.gov/docs/fy18osti/71232.pdf
West Virginia	• Interconnection Info, including costs: https://firstenergycorp.com/feconnect/westvirginia.html
Wisconsin	• Interconnection info: https://www.we-energies.com/services/wi-customer-owned-generation • application and process information per tier: https://psc.wi.gov/Pages/ForConsumers/MoreResources/CustomerOwnedGeneration.aspx
Wyoming	• Interconnection information: https://www.rockymountainpower.net/savings-energy-choices/customer-generation/large-interconnections.html