Shaping our future with clean energy

Priority Interconnection Considerations Memo
June 2017

The power grid is much like our network of country roads, highways and freeways, carrying energy from its origin to its final destination. Interconnection standards are, in effect, the "rules of the road," set by policymakers, which both system owners and utilities must follow to keep traffic flowing smoothly. The quality of these rules -- like any given street sign, traffic direction or roadmap -- can facilitate an easy free-flow of traffic, or result in unnecessary gridlock. As we introduce new technologies and services, the rules must evolve.

At a basic level, interconnection standards should outline with clarity the timelines, fees, technical requirements and steps in the review process for connecting distributed energy resources—such as a solar PV system or an energy storage system—to the electricity grid. Ideally, the process to interconnect should not be an obstacle or a source of frustration and contention for any party involved in the process. Clear, forward-thinking rules are essential to maintain the safety and reliability of the grid, while also enabling the adoption of distributed energy resources and achieving broader clean energy and resiliency goals.

As an active participant at the Federal Energy Regulatory Commission (FERC) and in dozens of state commission rulemakings over the past decade, the Interstate Renewable Energy Council (IREC) has identified and synthesized the best practices in use across the country in our *Model Interconnection Procedures*, which is a free resource available to states for reference as work to develop and/or refine their own rules. IREC's aim with these model procedures is to streamline the regulatory process, save states' resources, and avoid the need to reinvent the wheel on interconnection.

This document is intended to serve as a supplement to IREC's Model Rules and provides a list of key interconnection considerations for states working to improve/update interconnection procedures. Each section offers a description of the key components to interconnection based upon established and well-vetted national best practices. In each case, we provided links to the most relevant examples, though other examples do exist in most cases.

For more information and to download other resources, please visit our website at www.irecusa.org.

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I. Project Applicability and Review Processes for Interconnection Applications

A. Applicability to All Projects

Some state procedures have been drafted so that they are applicable to projects only below a certain size threshold. This limitation means that some state jurisdictional projects may have no clear pathway to obtain an interconnection agreement since jurisdictional considerations, and not necessarily size, dictate whether a project must interconnect pursuant to state or federal interconnection procedures. This determination may correlate to some degree with size, since the state-jurisdictional distribution system uses lower voltage lines that can typically only accommodate projects up to a certain size (e.g., 20 MW). Nonetheless, the decision between state versus federal procedures ultimately comes down to application of jurisdictional rules related to the sale of the power. Therefore, it is not necessary or advisable to apply a size limit to state-jurisdictional procedures. For example, a project may exceed the established size limit on state procedures but still need to obtain a state-jurisdictional interconnection agreement, and in that case, it would not be clear what process the project proponent should go through to obtain an interconnection agreement. Instead, IREC recommends removing the size limit restriction on determining applicability of the procedures and let application depend solely on jurisdictional considerations. The study process traditionally used within most state procedures is generally robust enough to handle projects of any size, though the terms in an interconnection agreement may need to be modified to accommodate larger projects.

- IREC's *Model Interconnection Procedures* are applicable to all state-jurisdictional interconnections (see Section I.A).
- The FERC SGIP applies to projects up to 20 MW (see Section 1.1.1). Larger projects would proceed under the Large Generator Interconnection Procedures (though some ISOs have eliminated this distinction). Unlike FERC, most states do not have separate procedures for large and small systems, so such a size cap is not necessarily relevant at the state level.

B. Inclusion of Energy Storage

As energy storage prices continue drop, it will become increasingly attractive for customer to consider installing energy storage systems, either with or without on-site generation systems (such as solar PV). Future policies, incentives and/or tariffs may further facilitate the adoption of energy storage, which is poised to offer a range of benefits to customers directly as well as their utilities. From an interconnection perspective, energy storage can mostly be treated the same as other generation technologies, however for the sake of clarity and transparency, the interconnection procedures should specifically indicate that they cover energy storage, and may also want to consider steps to help ensure an efficient review process that recognizes the capabilities of energy storage systems.

- In its Glossary of Terms in Attachment 1 (see Small Generator Interconnection Agreement (SGIA), Attachment 1) the FERC SGIP explicitly incorporates energy storage by defining "Small Generator Facility" to include devices for the production and/or storage for later injection of electricity. It also allows the utility to not always study the absolute maximum capacity if the applicant demonstrates the system will not be operated in that manner.
- IREC's recent papers, *Deploying Distributed Energy Storage: Near-Term Regulatory Considerations to Maximize Benefits* (Feb. 2015) and *Charging Ahead: An Energy Storage Guide for Policymakers* (April 2017) address some considerations regarding the interconnection of energy storage.
- California's Rule 21 Order (issued June 23, 2016) adopted an approach for how both the charging and discharging functions of energy storage systems should be reviewed. The adopted approach ensures that the load from energy storage systems is not treated differently from other types of customer load when it comes to assigning costs for review and upgrades.

C. Size Limit for Small, Inverter-based System Review, Also Known as "Level 1" Review

The expedited review process for small, inverter-based systems (e.g., solar PV and storage) is intended to allow for a streamlined process for generators that are unlikely to trigger adverse system impacts. This process requires similar, if not identical, technical screening to the Fast Track process (discussed below) but, unlike Fast Track, allows applicants to submit a relatively short, combined application and interconnection agreement. Doing so reduces the time and cost associated with the process for both applicants and utilities, and typically this savings is reflected in the lower fee charged for such applications. Historically, many states allowed systems up to 10 kW to participate in this expedited process because 10 kW reflected the upper limit for most net-metered residential solar PV systems. In recent years, states have begun to raise the eligibility size limit to 25 kW or above in recognition that systems larger than 10 kW may participate in net metering, and systems up to 25 kW are unlikely to cause adverse system impacts and thus can be safely connected with a simple screening process.

- IREC's *Model Interconnection Procedures* permit inverter-based generators up to 25 kW to undergo Level 1 review (see Section III.A.2.a).
- NREL's *Updating Small Generator Interconnection Procedures for New Market Conditions* explains the expedited small, inverter-based system review process and provides the rationales for increasing its size limit to 25 kW (see pp. 15-16).
- Some other states that have size limits that are greater than 10 kW include North Carolina, Ohio, Oregon, Utah and Massachusetts.

D. Size Limit for Fast Track Review, Also Known as "Level 2" Review

The Fast Track process consists of several technical screens intended to easily identify proposed interconnections that will not threaten the safety and reliability of the electric system, and allow these systems to proceed through an expedited review process. Although the technical screens decide whether a project will be able to interconnect without a full study, an overall size limit for Fast Track eligibility offers applicants a useful indicator as to whether or not their system is at all likely to pass those screens and serves an administrative function for utilities to help sort projects into the proper study track. In the former iteration of the FERC SGIP and in many states' procedures, Fast Track review is limited to systems up to 2 MW. More recently, FERC and several states have moved away from a broadly applicable cap to a more nuanced, table-based approach, which takes into account location-related factors that affect the likelihood of the generator to have adverse impacts on the electric system. Specifically, the table-based approach allows the size limit to increase as the voltage of the line increases and if a generator is closer to the substation. As with the inverter-based review process discussed above, the robust technical screening process is the ultimate arbiter of whether or not a system can receive Fast Track review. Thus, the rule of thumb in setting size limits should be to allow the largest sized project that could potentially pass the interconnection screens on the particular line size to use the Fast Track procedures. If the project is too large the screens will prevent the project from interconnecting without study. If the size limit is too low, projects could be forced into a multi-month, expensive study process unnecessarily.

- Section III.B.2.a of IREC's *Model Interconnection Procedures* incorporates a table-based approach to Level 2 eligibility.

Line Voltage	Level 2 (Fast Track) Eligibility	
	Regardless of Location	On ≥ 600 amp line and ≤ 2.5 miles from substation
≤ 4 kV	≤ 1 MW	≤ 2 MW
5 kV – 14 kV	≤ 2MW	≤ 3 MW
15 kV – 30 kV	≤ 3 MW	≤ 4 MW
31 kV – 60 kV	≤ 4 MW	≤ 5 MW

- NREL's *Updating Small Generator Interconnection Procedures for New Market Conditions* explains the Fast Track process and the rationale for adopting a table-based approach to eligibility (see pp. 19-21).
- Section 2.1 of the FERC SGIP also incorporates a Fast Track Eligibility table. Compared to the IREC and NREL tables, FERC relies on similar but slightly more conservative numbers that were negotiated during the tariff review process. The following states have also adopted a table based approach to Fast Track: Illinois, Iowa, Ohio, North Carolina, and South Carolina.
- For information on the amount of generation that can be potentially accommodated on different line voltages, see Tom Short, Electric Power Distribution Handbook, CRC Press, Section 1.3 (2004). A pdf version is available here.

E. Supplemental Review

If an interconnection applicant fails one or more of the Fast Track screens, many states' procedures allow it to undergo "supplemental review" or "additional review" to determine whether or not it could interconnect without full study. Until recently, however, this review was a "black box," providing no details on its scope, cost or process. In its most recent revision to SGIP, FERC integrated a more transparent supplemental review process that relies on three screens, including a penetration screen (Screen 1), set at 100 percent of minimum load. In most cases, if the proposed generation facility is below 100 percent of the minimum load measured at the time the generator will be online, then the risk of power backfeeding beyond the substation is minimal and thus there is a good possibility that power quality, voltage control and other safety and reliability concerns may be addressed without the need for a full study. The other two screens allow for utilities to evaluate any potential voltage and power quality (Screen 2) and/or safety and reliability impacts (Screen 3). Several states, including Ohio, Massachusetts, Illinois, Iowa and California, have adopted this transparent supplemental review process, and it is under consideration in others, including Maine and Minnesota.

In nascent solar markets, supplemental review may not seem immediately valuable, however as penetrations of solar increase, and more projects fail the Fast Track screens, particularly the 15 percent of peak load penetration screen, a transparent supplemental review process will become increasingly important. It provides additional time to resolve some of the safety and reliability concerns identified by the conservative initial review screens while still allowing for transparent, efficient and cost-effective interconnection of projects.

- Section 2.4 of the FERC SGIP describes its Supplemental Review process and the support for using a 100 percent of minimum load screen in it.
- IREC's *Model Interconnection Procedures* incorporate a nearly identical supplemental review process in Section III.D.

- NREL's *Updating Small Generator Interconnection Procedures for New Market Conditions* explains the rationale for a transparent supplemental review process and refers to California's process, which served as a model for the FERC SGIP (see pp. 30-31).
- This approach is currently used in California, Massachusetts, Hawaii, Illinois, Iowa, New York and Ohio.

II. Improving the Timeliness of the Interconnection Process

Below are some methods that could be considered to improve the timeliness of the interconnection process. In addition to these subsections, also note that a number of the other recommendations in this memorandum are likely to also assist with improving the timeliness of the interconnection process. In particular, the pre-application report can reduce the number of unrealistic project applications that have to be reviewed and also improve the quality of the application submittals, which speeds up the review process. The use of a robust Supplemental Review process can help move projects more efficiently through the process by requiring fewer projects to go to study and also giving developers information about their likely project costs earlier (this often means projects can make a decision whether to proceed in a more efficient manner). Finally, the section below on reporting requirements is likely to also have a significant impact on utility compliance with deadlines because they will be required to report delays to the Commission.

A. Electronic Application Submittal, Tracking and Signatures

One method for increasing the speed and efficiency of the interconnection process for both customers and utilities is to enable the use of technology to expedite the processing of applications. IREC's *Model Interconnection Procedures* include provisions that would allow for electronic submittal of applications and electronic signature of interconnection documents. In addition to being able to submit an application electronically, it is helpful to have an online interface wherein customers can track the progress of their application and be notified quickly of any deficiencies or delays. A number of utilities across the country utilize electronic submittal and processing techniques. Two California utilities have reported millions in dollars in annual savings through successful adoption of an electronic submittal and tracking process that has dramatically reduced processing times for NEM applications.[1]

B. Ensure That Projects are Cleared from the Queue If They Do Not Progress

One way to better enable utilities to keep up with the timelines set forth in the procedures is to make sure they are focusing their efforts on projects that are ready to move forward. It is often true that interconnection backlogs can be due to delays on the customer's end and not just by the utility. Particularly for projects in the study process, it is important that they keep up with their responsibilities in the tariff or that they withdraw. Failure to do so results in delays for all projects that are later in the queue. Since projects are studied "serially" in most cases, projects stalled in the queue effectively reserve capacity that should be made available to later queued projects at some point. Massachusetts, California, North Carolina and New York have all recently adopted processes that allow projects to be removed from the queue if they fail to move forward in an efficient manner.

[1] K. Ardani & R. Margolis, *Decreasing Soft Costs for Solar Photovoltaics by Improving the Interconnection Process: A Case Study of Pacific Gas and Electric*, at 7 (Sept. 2015), National Renewable Energy Laboratory, available at: www.nrel.gov/docs/fy15osti/65066.pdf; Electric Power Research Institute, PV Integration Case Study: SDG&E's Distributed Interconnection Information System (DIIS), *Solar PV Market Update, Volume 10: Q2 2014*, at 4 (June 2014), available at: https://www.sdge.com/sites/default/files/documents/1508554296/EPRI%20DIIS%20Case%20Study.pdf

C. Include Timelines for Construction of Upgrades and Meter Installs

It is often the case that interconnection procedures contain detailed timelines for the interconnection application review process, but little if any detail regarding the timeliness of the steps that have to be taken after an interconnection agreement is signed. Procedures should include specific and enforceable timelines for construction upgrades and meter installs to avoid unnecessary delays once interconnections are approved.

D. Implement a More Efficient Dispute Resolution Process

When delays do arise due to disagreements about the rules, technical requirements or costs, developers often do not seek to resolve them through existing dispute resolution procedures because those processes can often drag out longer than the delay. In addition, developers are often hesitant to use those procedures for fear that it will damage their working relationship with the utility going forward. One strategy for states to consider is to appoint an ombudsman within the Commission, or at the utility, to who could help facilitate resolution of minor complaints in a timely manner. New York and Massachusetts use ombudspersons within the Commission to help resolve disputes, and Minnesota used an ad hoc process involving outside engineers to help mediate interconnection disputes. Another option would be to appoint a technical master to help facilitate resolution of disputes regarding technical requirements.

E. Implement Enforcement Measures for Utility Compliance

Interconnection standards should contain clear requirements for when utilities and customers must complete each step of the interconnection process. In addition, there should be a meaningful mechanism to enforce compliance with the timelines. This has been a challenging issue across the United States with very few state policies that provide for meaningful enforcement. The only significant example comes from Massachusetts, which recently approved a "timeline enforcement mechanism," which would impose monetary penalties on the utilities if they fail to meet timelines specified within the interconnection procedures.[2] The proposed mechanism was developed collaboratively and submitted jointly by utilities, developers, and the Massachusetts Department of Energy Resources. New York has adopted an "earnings adjustment mechanism" that connects utilities' performance incentives (and/or penalties) on interconnection timelines and customer satisfaction with the process.

III. Improving Grid Transparency and Access to Information

A. Transparency and Reporting Requirements

Transparency and reporting regarding the interconnection process, and specifically the interconnection queue—that is, the order projects proceed through the process and their status—can be beneficial for interconnection applicants as well as utility regulators and others interested in understanding the process. Publication of an interconnection queue, along with regular reporting can allow applicants to see how many projects require utility review before them and the status of their review, thereby giving them a more realistic sense of timing. In addition, similar to the pre-application report and distribution system mapping discussed below, a public interconnection queue can show where applicants earlier in the queue are located, and therefore help later applicants determine which locations may have limited capacity and thus would be more likely to require costly interconnection review. A public interconnection queue and regular reporting can also help to identify bottlenecks or other problems for utilities and regulators to address.

[2] Mass. Dept. of Pub. Utils., DPU 11-75-F, Order on a Timeline Enforcement Mechanism (July 31, 2014) (Appendix B to the order contains a clean version of the mechanism) and DPU 11-75-G, Order on the Model Interconnection Tariff (May 4, 2015).

- The Massachusetts Department of Energy Resources (DOER) collects monthly data from the utilities, which it provides on a publicly accessibly web site (click on "Interconnection activity").
- In California, each utility has a detailed interconnection queue:
  - Pacific Gas and Electric Company (PG&E) (see "What's New: Public Queue").
  - San Diego Gas & Electric Company (SDG&E) (see "SDG&E Generation Interconnection Request Queue (WDAT & Rule 21)").
  - Southern California Edison Company (SCE) (see "Public WDAT-Rule 21 Queue").
- The Hawaiian Electric Company (HECO) provides an Integrated Interconnection Queue for interconnections on Hawaii and Maui.

B. Utility Distribution System Maps

Similar to the pre-application reports, discussed below, utility maps can help potential interconnection applicants to evaluate siting options for their projects and avoid wasted resources spent on evaluating interconnection applications for projects located at poor grid locations that ultimately will never be built. In particular, maps can identify grid characteristics (e.g., substation or line capacity, existing generation capacity on a line, available capacity for new generation, etc.) and areas of the grid that can accommodate new generation as well as areas that cannot accommodate new generation without significant upgrades (i.e., at a significant cost). Maps can also identify areas where projects might provide system benefits. When this kind of information is provided in advance in a publicly accessible way, potential applicants can use it to narrow down locations for their projects and submit fewer dead-end applications. Although maps can take some resources upfront to develop, they can save utilities time and money in the long run because they do not have to respond to individual information requests or evaluate applications submitted only to get the locational information that will instead be provided via the maps.

- The New York utilities have all recently launched maps that provide information on good potential points of interconnection.
- ComEd has more basic maps for its service territory in Illinois.
- The Hawaiian Electric Company (HECO) provides "Locational Value Maps" that provide an indication of the percentage of DG on the utilities' distribution circuits.
- Delmarva Power provides a map of "restricted circuits" in their territory in Delaware.
- The California utilities have some of the most robust maps available today. Originally called "preferred location" maps, they are now evolving to include full hosting capacity information.
  - Southern California Edison (SCE) (click "Content" on left side of page and zoom in on map to see detail)
  - Pacific Gas & Electric (PG&E) (registration required)
  - San Diego Gas & Electric (SDG&E) (registration required)
- Minnesota and Maryland are undertaking similar processes as part of their grid modernization proceedings.
  - Pepco, a regulated electric utility serving customers in Maryland and the District of Columbia, has developed a detailed hosting capacity map that provides available capacity at the distribution feeder level.

C. Pre-application Reports

While maps can provide a helpful, high-level picture of optimal and non-optimal grid locations, pre-application reports can allow potential applicants to obtain more granular information about potential project locations. The pre-application report is intended to require limited effort from the utility and, in most cases, relies entirely on pre-existing data. Pre-application reports can be optional or mandatory for all or some subset of projects, such as larger projects expected to have greater system impacts. Most pre-application reports require a relatively minimal fee (e.g., $300). Since first introduced in California, pre-application reports have been widely accepted as a useful tool by both developers and utilities in all states

IREC has appeared in recently. Indeed, California recently expanded their pre-application process to include an "enhanced" report that allows potential applicants to obtain more site-specific information that can sometimes require a utility truck-roll in exchange for an additional fee.

- The Federal Energy Regulatory Commission (FERC) has incorporated a pre-application report requirement into Section 1.2 of its Small Generator Interconnection Procedures (SGIP), which were revised in 2013.
- IREC's *Model Interconnection Procedures* (2013) include a pre-application report in Section II. In addition, IREC has developed a model pre-application request form for use in North Carolina and Illinois that could be easily modified for South Carolina.
- Finally, a paper published by the National Renewable Energy Laboratory, *Updating Small Generator Interconnection Procedures for New Market Conditions* (2012) , pp. 12-15, provides an explanation of why pre-application information is so valuable.

Other states that have adopted a pre-application report include Massachusetts, Iowa, Illinois, Ohio, North Carolina, South Carolina, and New York.

Taking the mapping and pre-application reporting components one step further, some states and utilities have begun to conduct hosting capacity analyses that allow potential interconnection applicants to access significantly more detailed and accurate information about the state of the grid at the proposed point of interconnection. A hosting capacity analysis determines how much capacity there is for additional distributed energy resources (load or generation) at precise points on the grid without the need for traditional upgrades to the system. In addition to the map interface, a hosting capacity analysis will also include downloadable data that will provide applicants with the detailed load curves for particular sites that can significantly assist with "right-sizing" of projects for each location.

IV. Allowing Construction for Level 1 & 2 Projects

Many state procedures and the FERC SGIP force a project to fail a Level 1 or 2 screen if the project would require *any* construction to be interconnected. Some states allow construction through the supplemental review process, but often this process is not well used. The effect of this screen is that a project may have been determined to not pose any system impacts (which is what the other technical screens evaluate), but still have to go through the full study process simply to determine the costs of any upgrades. In some cases, utilities do not adhere strictly to this rule and allow some construction. As utilities have gained more experience with the interconnection of distributed generation facilities it has become apparent that it is not necessary to send a project to the full study process just because some construction is required. If a project triggers construction after having passed the other Level 1 or 2 screens it means that the required construction does not require a system impacts study, and it is likely the construction is minor enough that a full facilities study is not warranted either. For example, it is common for a project to need to have interconnection facilities constructed. Interconnection facilities do not have upstream impacts and thus there is not a need to conduct a full system impacts study in order to move ahead with approving the project. In addition, some utilities have recognized that it is more efficient for them to allow the upgrading of line transformers and certain other equipment at this stage. Thus, a process has been developed to allow Level 1 & 2 projects to still proceed even if they require construction. For minor construction, a cost estimate is provided, and for more significant upgrades, a utility may opt to prepare a Facilities Study.

- FERC approved modifications to the wholesale tariffs of SCE and PG&E to allow for certain construction in 2011. It also included a process to allow projects in the supplemental review process to proceed even if some construction is required.

- Numerous states have moved away from using a no construction screen, including North Carolina, Illinois, South Carolina, California and Massachusetts.

V. Consolidating the Study Process

When projects are either ineligible for or fail to pass through expedited review they must undergo a more thorough study process in order for the utility to be able to determine what system impacts the project may pose, to design solutions to mitigate for any impacts, and to identify and allocate the costs for these solutions. Following the lead of the FERC LGIP and SGIP, many state procedures contain a three-tier study process, which includes a feasibility study, a system impacts study, and a facilities study. Altogether the processing of three layers of study can take many months. Many utilities and interconnection applicants are discovering, however, that the feasibility study is not necessary or valuable in all cases and can be eliminated in the interest of time and cost efficiency.

- Some states such as Minnesota, New York, and Nevada have a single study that combines the assessment of system impacts with the determination of the upgrade costs. This can result in a more efficient review process, but it also means that an applicant may end up paying for the development of a cost estimate even if they would be unlikely to proceed after learning of the system impact results.
- Other states have started to just eliminate the feasibility study in favor of a two-tier study process, including North and South Carolina.
- A paper published by NREL, *Updating Small Generator Interconnection Procedures for New Market Conditions* (2012) , pp. 31-36, provides a discussion of possible methods to improve the efficiency of the study process itself.

VI. Determination of Upgrade Costs

Once a utility has examined the potential impact a project may have on the system they may identify upgrades that need to be completed to allow the project to go forward. The process for determining upgrade costs, providing estimates, and ensuring those estimates are meaningful has been a source of considerable discussion in many high penetration states lately. There are three central concepts: cost predictability, cost certainty, and cost allocation. There are not yet clearly established best practices in these areas, but there are a few key practices that are beginning to take hold and warrant consideration.

- Cost Tables: At the transmission level it is common for Independent System Operators (ISOs) and Regional Transmission Organization (RTOs) to publish cost tables that show the prices of typical equipment to enable customers to have a better sense of the expected cost of undertaking specific upgrades. The California utilities agreed to publish a cost table for distribution level interconnections as well. In addition to helping provide more transparency and predictability into the interconnection costs, this process also can reduce concerns about utility manipulation of cost estimates.
- Cost Envelopes: Massachusetts was the first state to implement a process that requires the utilities to provide a binding cost estimate to interconnection applicants. Depending upon what stage the customer requests the estimate, it cannot exceed the estimated amount by either 25% (if sought earlier in the process) or 10% (if obtained at the end of the review process). This cost envelope approach means that the utility is responsible for any costs that exceed those inflation amounts. California recently implemented a similar cost envelope process, using a 25% threshold, and allowing utilities to seek rate recovery for overages if they can show their failure to accurately estimate the costs was

reasonable. New York's new rules contain softer language that could impose a greater burden on utilities to provide accurate estimates.

- Detailed Cost Estimates: Another way to improve the transparency of the interconnection upgrade cost process is to require that utilities provide more detail in their interconnection cost estimates. Though it varies by utility, often cost estimates contain no more than one bulk figure with no further information on the cost of the components and labor that make up that cost. Instead, the estimate given could provide a list of the major equipment required and particular prices along with a breakdown of the utility time that will be spent reviewing and constructing the upgrades. Providing detailed estimates should improve the accuracy of the estimates and also the confidence the applicant has that the costs assessed are being charged at reasonable rates.
- Cost Allocation: How interconnection costs are divided between different interconnection customers is a topic that has been raised in various states in recent years, but there has not yet been considerable progress in developing functional mechanisms that improve the allocation of costs across responsible customers. The distribution level interconnection process typically operates on a cost causation principle that assigns the full cost of system upgrades to the first project that triggers the need for them. This applicant will bear the full cost of the upgrade, although projects before them may have contributed to the need for the upgrade, and later queued projects may also take advantage of the increased capacity created by the upgrade. This process creates perverse incentives and behavior in many cases, can be a central cause of queue backlogs, and prevent upgrades from occurring that might be economically efficient if spread across all potential beneficiaries. On the transmission system costs are usually paid back over a period of years since the system is networked and the idea is that all projects ultimately benefit the system. However, more limited examples of cost sharing exist on the distribution system.
  - Some states such as California and Massachusetts have experimented with "group studies" on the distribution system, and Massachusetts' standards contain a rule that requires allocation of costs across customers, but it is not clear how often this rule is actually applied.[3]
  - New York just launched one of the first examples of a formal cost sharing mechanism for projects that are not being studied concurrently. For upgrades of a certain type and cost, the generator that first triggers the need for the project will cover all the costs upfront, but a mechanism has been put in place to require later projects to reimburse the first project if they connect within a defined period of time.

Additional Resources

- Interstate Renewable Energy Council, *Model Interconnection Procedures*, (April 2013), available at: http://www.irecusa.org/publications/model-interconnection-procedures/ (last accessed June 5, 2017).
- Sky Stanfield et al., *Charging Ahead: An Energy Storage Guide for State Policymakers*, Interstate Renewable Energy Council, (April 2017), available at: http://www.irecusa.org/publications/charging-ahead-an-energy-storage-guide-for-policymakers/ (last accessed June 5, 2017).
- Sky Stanfield and Amanda Vanega, *Deploying Distributed Energy Storage: Near-Term Regulatory Considerations to Maximize Benefits*, Interstate Renewable Energy Council, (February 2015), available

[3] MA DPU Order 11-75-G (Revised Tariffs), Section 5.4 ("Should the Company combine the installation of System Modifications with additions to the Company's EPS to serve other Customers or Interconnecting Customers, the Company shall not include the costs of such separate or incremental facilities in the amounts billed to the Interconnecting Customer for the System Modifications required pursuant to this Interconnection Tariff. The Interconnecting Customer shall only pay for that portion of the interconnection costs resulting solely from the System Modifications required to allow for safe, reliable parallel operation of the Facility with the Company EPS.").

at: http://www.irecusa.org/publications/deploying-distributed-energy-storage/ (last accessed June 5, 2017).

- Erica McConnell and Laura Beaton, *You Snooze, You Lose: Enforcing Interconnection Timelines for Everyone Involved*, Greentech Media, (December 2016), available at: https://www.greentechmedia.com/articles/read/you-snooze-you-lose-enforcing-interconnection-timelines-for-everyone-involv (last accessed June 5, 2017).
- Erica McConnell, *Experiencing Holiday Traffic or Airport Security Lines? That's How Interconnection Queues Feel for Solar*, Greentech Media, (November 2016), available at: https://www.greentechmedia.com/articles/read/sick-of-airport-security-lines-think-about-how-solar-companies-feel-in-inte (last accessed June 5, 2017).
- Erica McConnell and Cathy Malina, *Interconnection: The Key to Realizing Your Distributed Energy Policy Dream*, Greentech Media, (October 2016), available at: https://www.greentechmedia.com/articles/read/interconnection-the-key-to-realizing-your-distributed-energy-policy-dream (last accessed June 5, 2017).
- Chelsea Barnes et al., *Comparing Utility Interconnection Timelines for Small-Scale Solar PV: 2nd Edition*, EQ Research, (October 2016), available at: http://eq-research.com/wp-content/uploads/2016/10/EQ-Interconnection-Timelines-2016.pdf (last accessed June 5, 2017).
- Kristen Ardani et al., *State-Level Comparison of Processes and Timelines for Distributed Photovoltaic Interconnection in the United States*, National Renewable Energy Laboratory, (January 2015), available at: http://www.nrel.gov/docs/fy15osti/63556.pdf (last accessed June 5, 2017).
- Vote Solar and the Interstate Renewable Energy Council, *Freeing the Grid*, website, available at: http://freeingthegrid.org/#state-grades/ (last accessed June 5, 2017).