2021 Local Solar Developer Survey

By Katie Kienbaum and John Farrell

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ILSR INSTITUTE FOR Local Self-Reliance

About the Institute for Local Self-Reliance

The Institute for Local Self-Reliance (ILSR) is a national nonprofit research and educational organization founded in 1974. ILSR has a vision of thriving, diverse, equitable communities. To reach this vision, we build local power to fight corporate control. We believe that democracy can only thrive when economic and political power is widely dispersed. Whether it's fighting back against the outsize power of monopolies like Amazon or advocating to keep local renewable energy in the community that produced it, ILSR advocates for solutions that harness the power of citizens and communities. More at **www.ILSR.org**.

We would like to thank everyone who participated in and helped to distribute the Barriers to Distributed Energy Survey *and all who sat down for an interview. Special thanks to graduate student intern Shiva Patel, who worked with ILSR's John Farrell to conceive this survey project, process initial results, and review this report. Thanks also to Seth Handy and Jean Su for providing perspective on question design. We'd like to extend additional appreciation to Corey Ramsden of Solar United Neighbors and David Morris of ILSR for reviewing drafts of this report, and to our other colleagues at ILSR, especially Clarissa Libertelli for designing the infographic featured in the Executive Summary.*

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Executive Summary

Whether a small business, a community school, or a local household, millions of American electric customers have installed rooftop solar or subscribed to shared solar farms. And it doesn't just save money for solar customers – widespread adoption of distributed solar benefits all of us by creating jobs and lowering the costs of building a cleaner, more resilient power grid. As the price to install solar continues to fall, the opportunity expands each year to more and more Americans.

However, many state and local governments and electric utilities have hampered solar growth by failing to remove roadblocks to local solar, or even by adding new ones. These barriers created by policy decisions and utility actions are particularly problematic because customers (and their chosen solar developers) can't choose which electric utility they connect to or which state and local solar policies they get to follow. "We just have to take what [the utilities] give us basically," said one solar developer who ILSR interviewed.

This report shares data from ILSR's first ever *Barriers to Distributed Energy Survey* and stories from interviews with solar developers to identify the most common and most impactful issues facing local solar projects as a result of both policymaker and utility choices.

Survey respondents identified several sources of unforeseen delays and costs for distributed solar development:

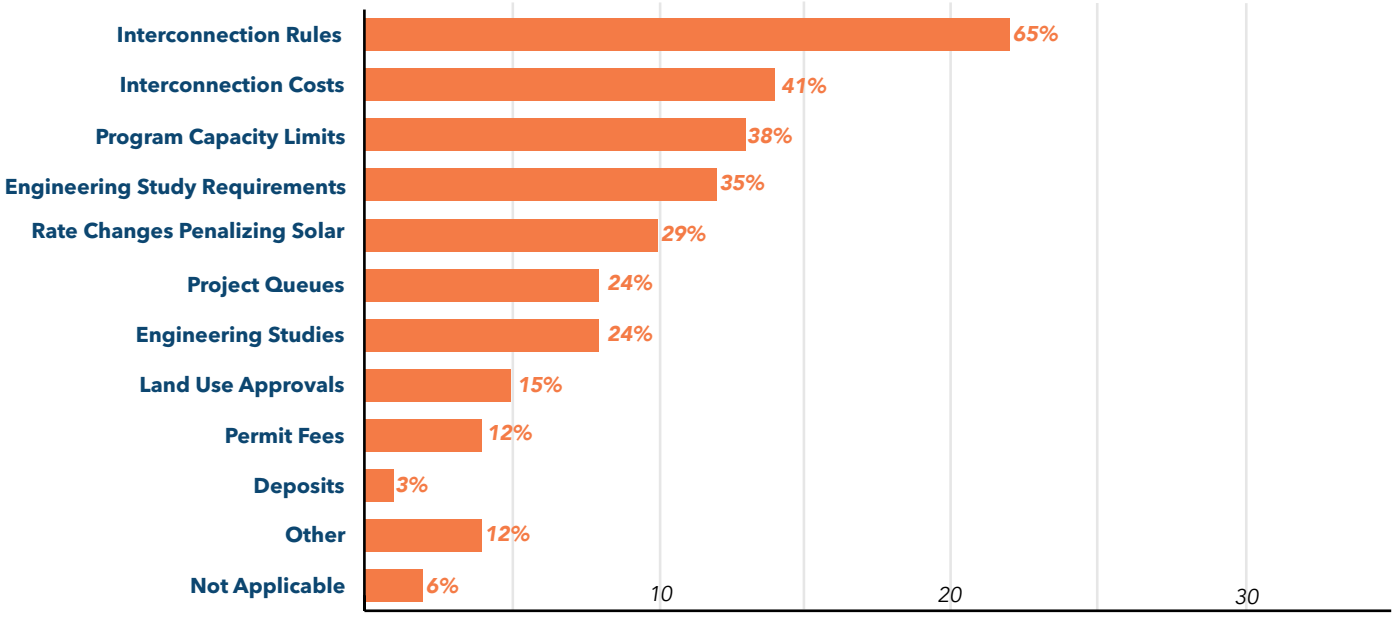
- A majority of survey participants indicated that they have experienced project setbacks due to challenges interconnecting solar systems to the electric grid. Just over three quarters of respondents reported unexpected delays and/or costs as a result of **changes to state interconnection policies**. About 85 percent of respondents reported unexpected delays and/or costs as a result of **utility noncompliance with state interconnection policies**.

- Respondents identified **interconnection rules and costs**, **program capacity limits**, and **engineering study requirements** as the barriers that have caused the longest delays and/or highest unexpected costs, with nearly four in five respondents pointing to interconnection rules and/or costs in their top answers.

- In addition to interconnection challenges, other common solar roadblocks encountered by survey respondents included project queue issues, engineering study requirements, program capacity limits, unfair solar rates, and local permitting and regulations.

- In a question asking which obstacles are unfair or could be significantly reduced, interconnection rules, interconnection costs, and rate changes penalizing solar customers were the most popular responses.

Barriers That Have Created the Greatest Delays and/or Costs

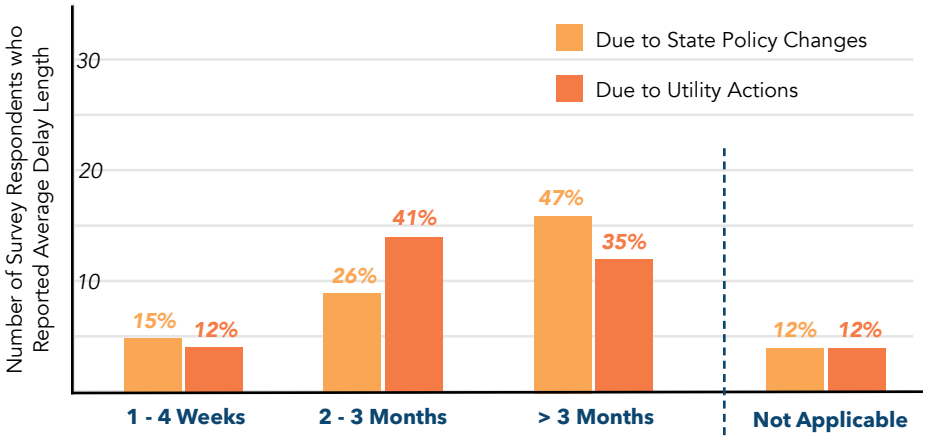


Number of Survey Respondents who Selected the Barrier as Causing the Greatest Delays and/or Costs
(Respondents Could Select Multiple Answers)

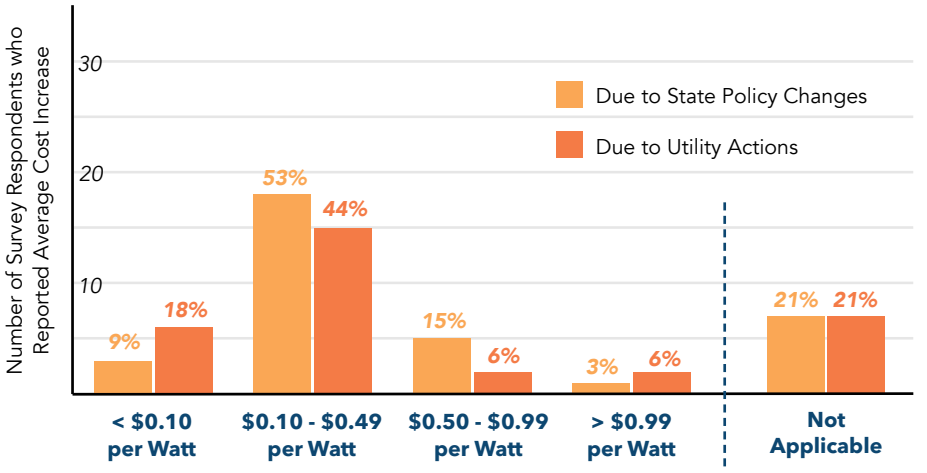
These barriers have had a notable impact on solar developer respondents and their customers, and may be affecting the broader solar industry, as well:

- Survey respondents reported unexpected setbacks affecting thousands of solar projects in total.
- Almost half of respondents noted that delays caused by policy changes were longer than three months. Over a third of respondents said that delays caused by utility actions were longer than three months.
- Over half of respondents noted that policy changes resulted in unanticipated cost increases of between $0.10 to $0.49 per watt. Almost 45 percent of respondents said utility actions caused similar price increases. To illustrate the impact, a 50 cents per watt price jump would increase the cost of a typical residential solar project by roughly 15 percent.
- Despite challenges, about 80 percent of survey respondents ranked their relationships with local utilities as a three out of five or better, with numerous respondents noting the importance of maintaining good relationships with utility employees.

Average Lengths of Solar Project Delays



Average Amounts of Unexpected Solar Project Costs



The survey results reflect a diverse array of barriers to distributed solar deployment. In part, this is a result of balkanized solar marketplaces and regulatory environments — policies differ across all 50+ states and territories, with even more variation across local jurisdictions. Differences in how electric utilities implement and comply with assorted policy requirements further complicate the picture.

One example of this variation is net metering policies, which allow customers to receive bill credits for solar power generated onsite that is shared with the grid. A handful of states have no state-level net metering requirements, leaving utilities free to offer the policy or not. Among the majority of states that do have mandates, the rules may only apply to specific utilities, such as investor-owned utilities, or to a certain number of eligible systems. Impacts vary too — in interviews, a solar installer in Arizona said that state regulators' ending of net metering has induced customers to install larger systems, while a solar developer in Massachusetts noted that capacity limits on the state's net metering program keep projects from even being built. Survey respondents also mentioned that interconnection rules and municipal permitting requirements may vary by solar project location.

Solar project size and whether it is built on a building or in a large field also plays a role in the type and significance of challenges facing solar developers. In interviews, survey participants who install rooftop solar panels more frequently spoke of local permit requirements as a barrier, while those who develop large commercial installations or community solar farms more often brought up the issue of high grid upgrade costs during the interconnection process.

Survey respondents in particular highlighted the unpredictable nature of many of these barriers. Interconnection costs for grid improvements were one major source of uncertainty for survey respondents. "You find out it's a million bucks or you find out it's 20 grand," said a commercial solar developer.

> *One solar developer noted that while the required interconnection timeline was under six months, approvals actually took 2-7 years. Another said, "It is definitely the biggest place where it's just blatant contractual noncompliance."*

Photo credit: DOE/Kate Costa via Flickr

> *A community solar developer described a project that experienced a yearlong delay and incurred over $200,000 in extra costs.*

> *A solar installer interviewed for the report explained, "If we think we're gonna get the country anywhere near 50 percent renewables, we're kidding ourselves as long as we have the building department and the utilities fighting us."*

Photo credit: groSolar© via NREL/DOE

> *One survey respondent saw revenues decline by around 70 percent over a three year period. Another said that barriers prompted them to lay off over half of their employees.*

One developer suggested that the success of a project can depend greatly on how much the utility in question likes it, possibly for the public relations value. In an interview, the developer shared an example of how one recent project received no interconnection fee and an expedited review, while a different project five years earlier was blocked by the same utility. "Our recent experience has been much better than our early experience," the developer said. However, they aren't sure whether the utilities will remain supportive of future projects, explaining later, "They're not cozying up to us; they cozy up to the project."

In some cases, solar developers said that utilities might intentionally restrict the growth of distributed solar installations. A number of surveyed developers reported that they've experienced issues with utilities exceeding state-mandated interconnection timelines, sometimes by months or years. One interviewee shared how a utility claimed it processed an interconnection application in 22 days after it actually took 2.5 years, facing no consequences from state regulators. In other instances, utilities might subvert state policies to create unnecessary roadblocks for solar developers. For example, utilities might take advantage of loopholes in state interconnection policies that allow them to pause required timelines. Survey respondents also spoke to the considerable political power that many utilities, especially large investor-owned companies, wield over elected officials and regulators, which can win them favorable legislation and regulatory decisions. In general, where utilities have discretion, it can be used to hinder solar projects.

It won't be easy to overcome these challenges, but it's necessary. Without improved state and local policies and increased regulatory enforcement of the solar project process, states may miss out on the job-creating and money-saving benefits of bringing solar to everyone, including working class families, people of color, and rural communities. A solar installer interviewed for the report explained, "If we think we're gonna get the country anywhere near 50 percent renewables, we're kidding ourselves as long as we have the building department and the utilities fighting us."

What's Holding Local Solar Back?

ILSR's Barriers to Distributed Energy Survey asked rooftop solar installers, community solar developers, and other commercial solar developers about the issues their local solar projects face. Here's what we found:

Most developers have challenges interconnecting solar systems to the electric grid.

76% of respondents reported unexpected delays and/or costs as a result of **changes to state interconnection policies.**

85% of respondents reported unexpected delays and/or costs as a result of **utility noncompliance** with state interconnection policies.

79% of respondents reported interconnection rules and/or costs as a barrier that caused **the longest delays/highest costs.**

In addition to interconnection challenges, other common solar roadblocks are:

- **Project queues**
- **Engineering study requirements**
- **Program capacity limits**
- **Local permitting and regulations**
- **Unfair solar rates**

These barriers impact solar developers and their customers, and they might be hurting the broader solar industry, too.

Survey respondents reported unexpected costs and delays affecting **thousands of solar projects** in total.

Length of delays

Almost half of respondents said delays caused by **policy changes** were longer than three months.

Over a third of respondents said delays caused by **utility actions** were longer than three months.

Impact on costs

Over half of respondents said **policy changes** increased costs between $0.10 to $0.49 per watt.

Almost 45% of respondents said **utility actions** increased costs between $0.10 to $0.49 per watt.

For context, a 50 cents per watt price jump would increase the cost of a typical residential solar project by roughly 15%.

Solar Developers Have a Love-Hate Relationship With Utilities

~80% of survey respondents ranked their relationships with local utilities as a ★★★☆☆ **3 out of 5 stars** or better, saying that good relationships are key to getting projects over the barriers.

Introduction

In many instances, the process of installing rooftop solar panels can be measured in terms of weeks or months. But **according to comments** one solar installer filed with the Minnesota Public Utilities Commission earlier this year, the electric utility Xcel Energy said its customer may have to wait *15 years* for the utility to connect their 9.6 kilowatt AC rooftop solar system to the grid.

Though it's a severe case, this isn't the only solar project that's been blindsided by unexpected delays or other barriers. Distributed solar developers and installers across the country often face a briar patch of unplanned project standstills, burdensome surprise fees, and precipitous policy revisions in which solar projects can get caught on any one branch, slowing the growth and viability of local solar.

To parse these challenges, ILSR issued its first *Barriers to Distributed Energy Survey*. The survey aimed to collect information from companies installing solar to understand if barriers to distributed solar project development are widespread and to explore their impact on expanding solar energy.

Survey respondents identified a wide range of issues that affect distributed solar projects. The barriers that developers most commonly pointed to included interconnection rules and costs, program capacity limits, project queues, engineering

study requirements, unfair solar rates, and local permitting and approvals. Some barriers are the result of state and local policy choices, some are due to utility actions (both in and not in compliance with public policies), and some are caused by a mix of policy and utility decisions.

"We in the solar industry keep making improvements by bringing down the cost of the equipment and making the equipment better and more reliable…" a solar installer shared in an interview. "On the flip side of it, the authorities, between the building departments and the utilities, just keep making it harder and harder and harder."

These barriers can complicate solar developers' day-to-day operations and create unmanageable risks, especially for smaller businesses or for projects serving community organizations. Sometimes, unexpected (and avoidable) costs and delays put an end to solar projects, even after developers have invested significant time and money. And by pushing up the price of solar and restricting the growth of local energy, the roadblocks described in this report work to keep solar from **equally benefiting** Americans of all **incomes, colors, and geographies**.

Under the traditional monopoly model, most electric utilities have little incentive to address the obstacles facing distributed solar projects or to support efforts to increase energy equity and the economic opportunities created by local solar. "This is a monopoly, slow industry," explained a solar developer in an interview. The utilities are "just old and literally the problem because of their financial interests or perceived financial interests," the developer continued.

Some survey respondents and interviewees suggested that utilities might even use their role as grid operator and their discretion in the interconnection process to specifically slow the growth of local solar, in addition to using their considerable political influence to secure favorable public policies and hands-off regulatory enforcement.

Regardless of the source of these challenges, a number of solar developers spoke to the urgency of streamlining local solar deployment, to make solar energy more accessible and to avert the worst effects of climate change. "How do we incentivize [the utilities] to make this happen and make this happen fast enough?" said one interviewee.

Who We Surveyed and What We Asked

The information and stories in this report were collected through ILSR's *Barriers to Distributed Energy Survey* — which was answered by representatives of companies that install solar in many places across the country — and from interviews conducted with survey respondents. For the purpose of the survey and this report, we defined distributed solar projects to include all behind-the-meter solar systems, installations of any size connected to a distribution line, and projects 20 megawatts and smaller interconnected to a transmission grid.

The survey asked about unexpected delays and costs on solar projects as a result of policy decisions and/or utility actions inconsistent with policy requirements. Questions focused on the specific causes of these delays and/or costs, which stages of project development they occurred at, and how they impacted the respondents. The survey is **available online**.

ILSR collected responses to the survey from November 2020 through September 2021. To publicize the survey, we shared it with solar developer networks and other nonprofit organizations. We also advertised on *Solar Power World*'s website, on the ILSR website, in the Energy Democracy Initiative's newsletter, and on social media platforms.

In addition to the survey, we conducted phone and video call interviews in September and October 2021 with nine developers and installers.

Survey responses and interview comments included in the report are anonymous, to allow respondents to speak freely and to protect against potential backlash from electric utilities. "When we complain about the utilities… we then get punished, and our next projects end up with even more severe consequences," explained one developer.

Thirty-four solar developers and installers completed the survey, and we conducted additional interviews with nine of those respondents. Two respondents completed the survey twice; their first responses were removed from final data tabulations.

Respondents who provided information on their market sectors primarily develop residential and commercial projects, including home and small business rooftop systems, commercial and industrial behind-the-meter installations, and community solar farms. A smaller number of respondents reported

working on wholesale and utility-scale projects. Interviewees represented a mix of residential solar installers and commercial project developers.

Among those who indicated a geographic location or region in their response, survey participants reported working in more than a dozen states across the country with a heavier concentration in the Northeast and the Midwest. Notably, no respondents identified themselves as specifically operating in the West Coast, the Southeast, or Alaska, though some respondents work nationally.

"When we complain about the utilities… we then get punished, and our next projects end up with even more severe consequences."

About 85 percent of survey participants reported that they primarily work in the territories of investor-owned utilities. Others work with member-owned rural electric cooperatives or publicly owned utilities, such as municipal electric departments. In total, respondents reported working in at least 30 different utility territories.

The limitations of this survey include a small sample size that didn't necessarily capture the full universe of distributed solar developers' experiences or opinions. Not all regions, states, or utilities are equally represented among the respondents. Furthermore, developers facing greater challenges to solar deployment may have been more likely to respond than those who are generally satisfied. While not a definitive accounting of the national solar industry, these survey results provide a snapshot of some of the barriers facing distributed solar projects today.

Who to Blame – the Law or the Utility?

This survey attempted to distinguish between barriers related to public policies and barriers related to utility actions not in compliance with those policies. However, it's difficult to draw clear lines between the two, which may be reflected in survey results. Additionally, it appeared that some respondents were confused by the survey's distinction between policy- and utility-caused barriers, possibly because of the wording or formatting of the questions or because of the overlapping sources of barriers.

State legislation and regulations often give utilities some discretion or leeway when implementing policies, which utilities may use to subvert the original intent of the policies or to otherwise make decisions that negatively impact solar development.

As an example, solar developers in Minnesota pointed to Xcel Energy's current interconnection review process and "on hold" designation, which the utility implemented after a regulatory change. It has **delayed solar projects** for an average of 18 months, according to one developer, with some projects waiting years. "We don't think the change was required at all by the tariff, by the commission," a community solar developer shared in an interview. "It's more just like the utility decided to do this unilateral change to their process without our input, without the commission, that has led to these multi-year delays for a lot of projects."

Utilities can also explicitly violate state policies, such as interconnection timelines. Or, utilities may attempt to influence state legislators and regulatory bodies to gain favorable policies in the first place.

Prominent Solar Barriers

Overall, many survey respondents indicated significant challenges in deploying distributed solar projects in a timely and cost-effective manner. "Every project seems to have a hiccup," shared one developer in an interview.

Among the issues raised by solar developers, interconnection delays and costs (as well as related processes and requirements) emerged as the most common barrier experienced. For instance, more than seven in ten survey respondents reported unexpected delays in the last two years caused by utility noncompliance with state interconnection policies. In a multiple choice question asking which obstacles have caused the greatest overall costs or delays, respondents most frequently selected interconnection rules and/or interconnection costs as answers.

Other common causes of unanticipated costs and delays identified by survey respondents included: project queues, engineering study requirements, program capacity limits, local permitting, and unfavorable rates for solar customers.

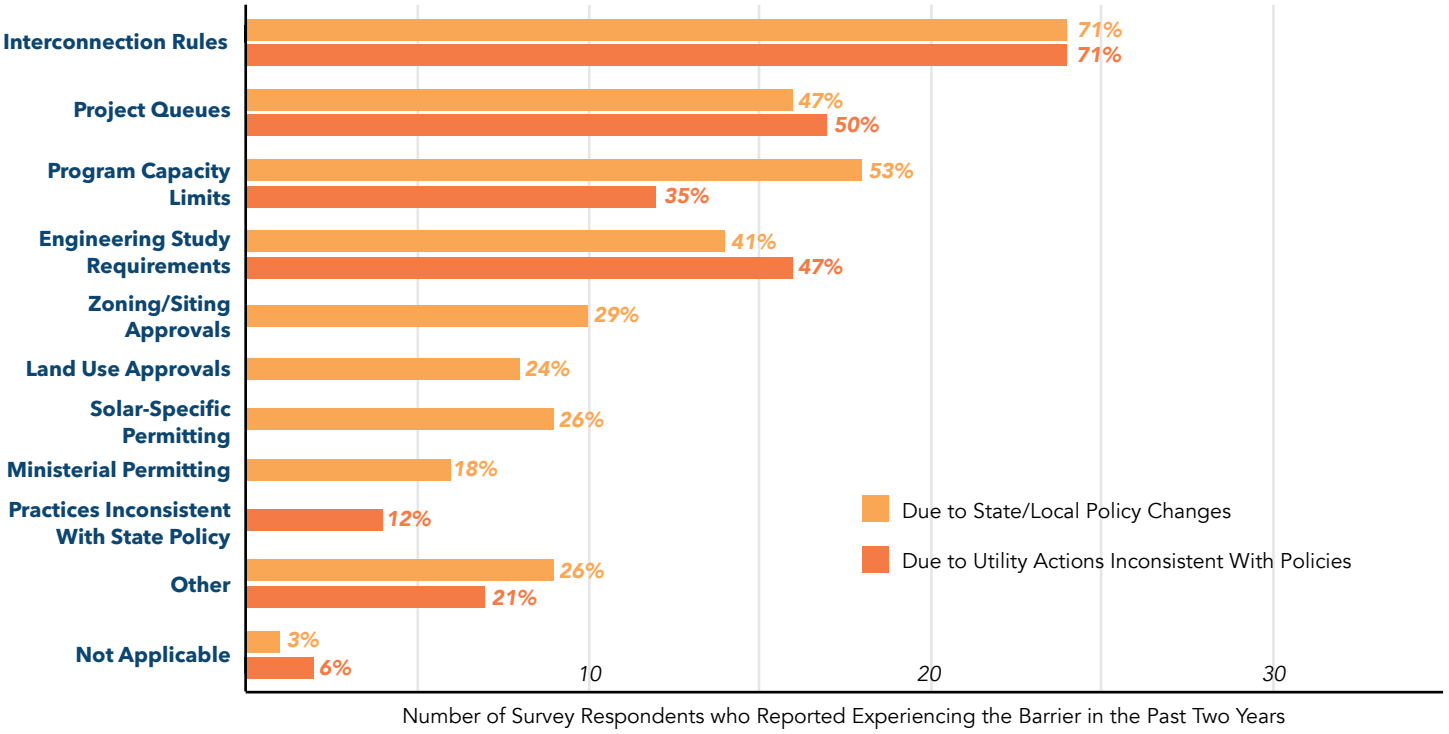
The specific challenges that distributed solar developers face vary widely due to differences in state and local regulations, utility structures and policies, solar installation types, and developer business models. For example, many residential rooftop installers pointed to local permitting and regulations as top-of-mind barriers, while community solar developers often voiced greater frustrations with the interconnection process.

Summary of Survey Results

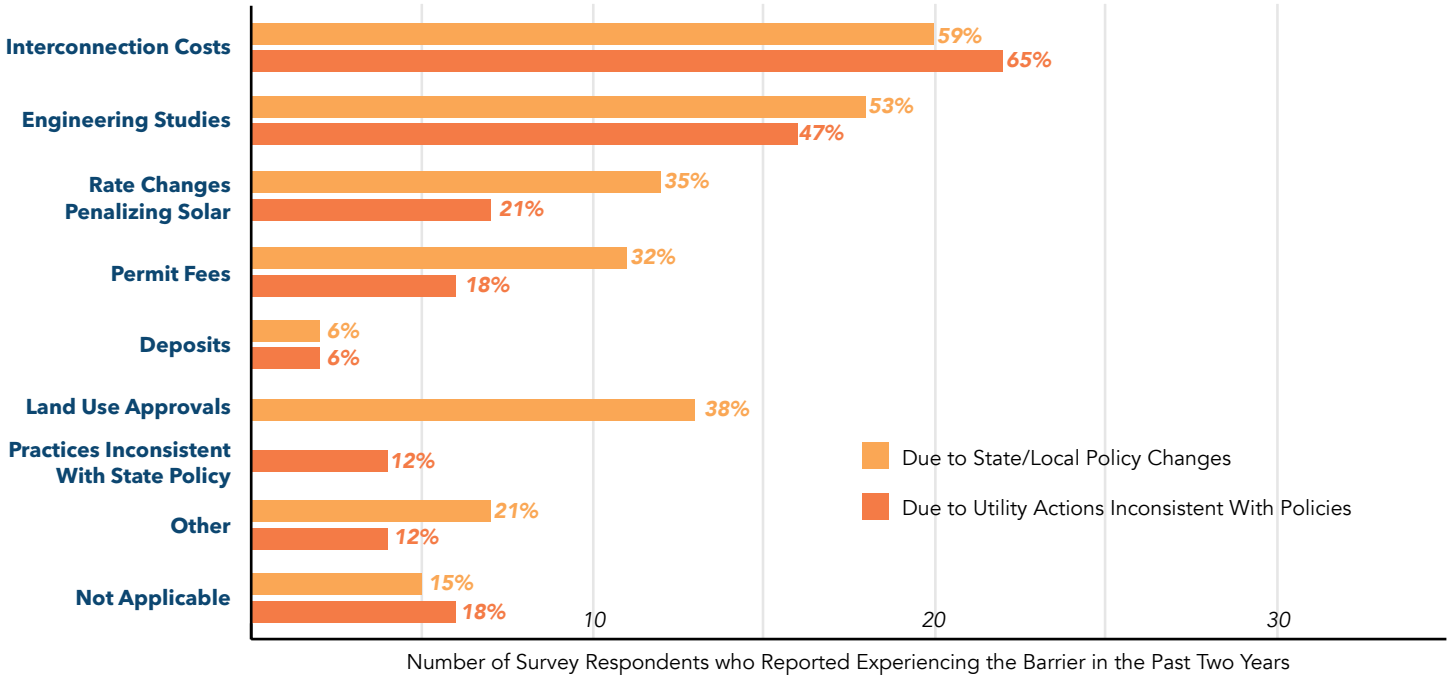
In response to the survey, solar developers and installers identified the sources of unexpected delays and/or costs that occurred within the past two years.

The charts below display the top responses selected from a list of possible answers, broken out by delays due to policy changes and utility noncompliance with policies and costs due to policy changes and utility noncompliance with policies.

Sources of Unexpected Solar Project Delays



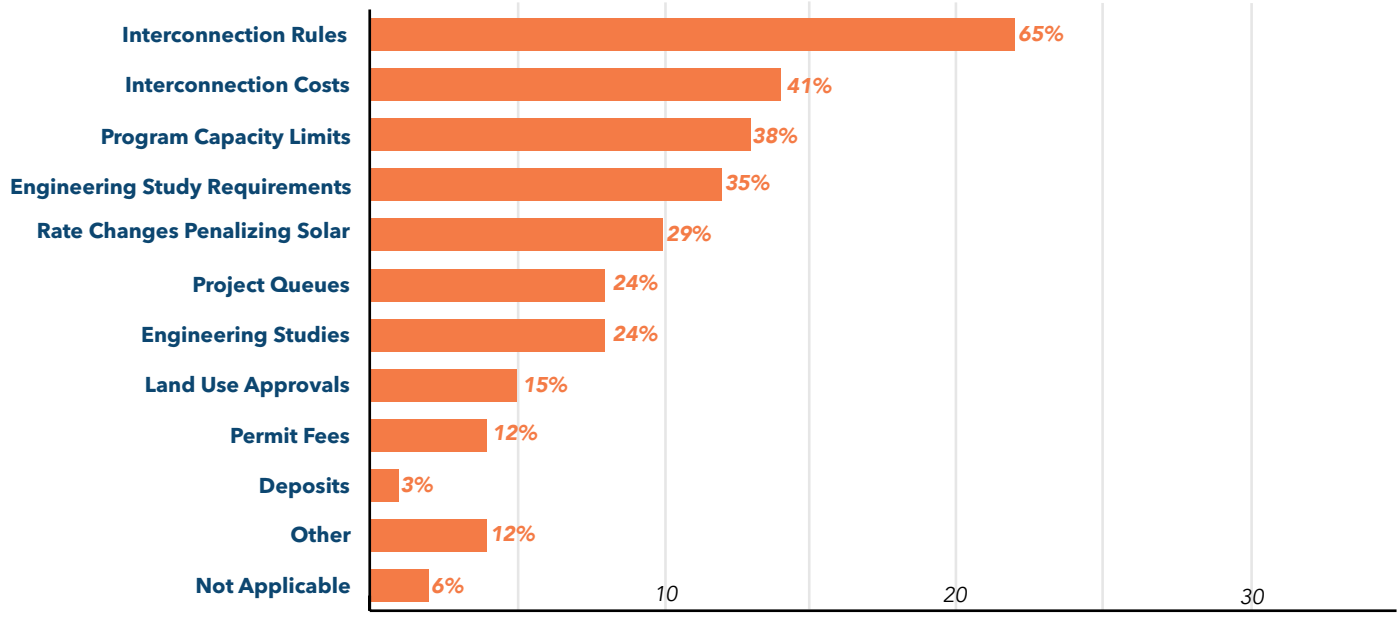
Sources of Unexpected Solar Project Costs



We also asked respondents to identify from a list of possible barriers which have caused the greatest costs and/or delays over the past two years, as well as the barriers that are unfair or could be significantly lessened. The answers are in the charts below.

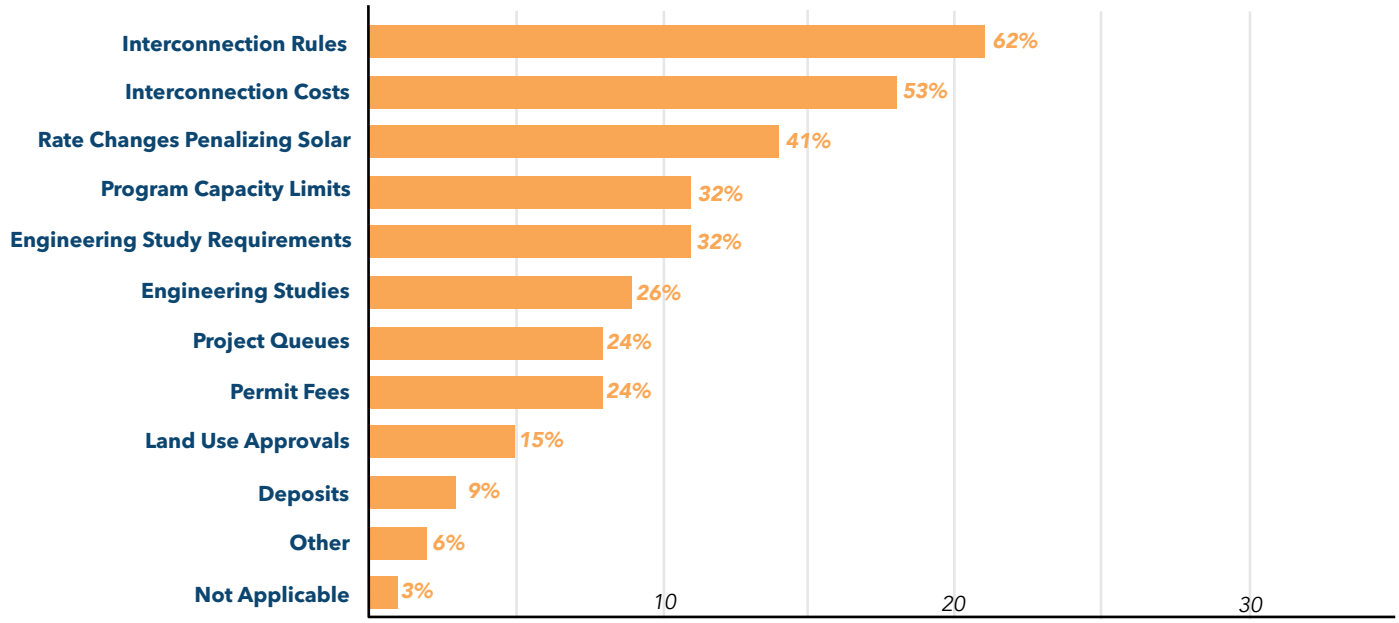
Overall, these results show that a majority of survey participants experienced challenges that increased the cost of solar projects and/or slowed down project development.

Barriers That Have Created the Greatest Delays and/or Costs



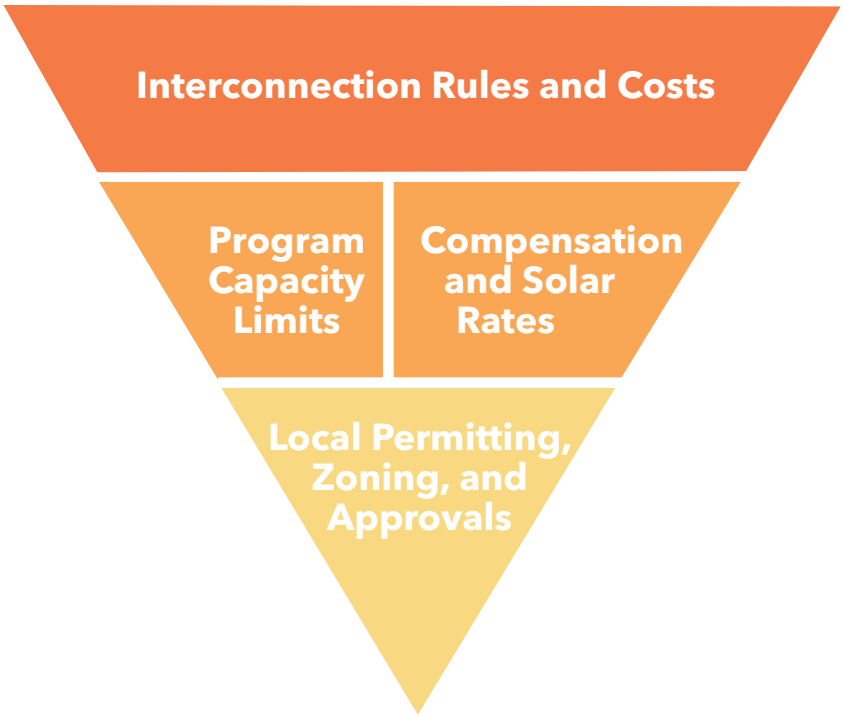
Number of Survey Respondents who Selected the Barrier as Causing the Greatest Delays and/or Costs
(Respondents Could Select Multiple Answers)

Barriers That Are Unfair or Could Be Significantly Reduced



Number of Survey Respondents who Selected the Barrier as Unfair or Capable of Being Reduced
(Respondents Could Select Multiple Answers)

Most Common and Impactful Barriers Reported by Solar Developer Survey Respondents



Interconnection rules and costs — in addition to issues such as project queues and engineering study requirements that are often part of the interconnection process — appear to be the most common barriers for respondents, whether caused by public policy or utility actions. Furthermore, survey results suggest that interconnection issues also commonly cause the longest delays and/or largest unexpected costs, and many respondents identify interconnection challenges as obstacles that are unfair or could be significantly reduced.

"Every project seems to have a hiccup."

In addition to interconnection, the survey results signal that program capacity limits are a common and significant cause of project delays, both as a result of state policy and of utility actions related to those program caps. Responses also suggest that changes to state policy on rates and rate structures that penalize solar owners (and, to a lesser extent, utility-initiated changes to rates) are a notable source of unanticipated costs and that this is seen as a barrier that's unfair or able to be lessened. Lastly, survey participants indicate that policies around zoning, permitting, and other local approvals commonly cause delays and extra costs, though fewer respondents pointed to any one of these barriers as creating the most significant impacts.

Interviews conducted with survey respondents largely reflected the survey results in terms of most commonly experienced challenges to distributed solar deployment. Interviewees placed additional emphasis on the issue of grid constraints and on the uncertainty created by inconsistent utility policies.

Both the survey responses and participant interviews suggest that solar installers and developers experience different challenges depending on market segments and other factors, such as their location and

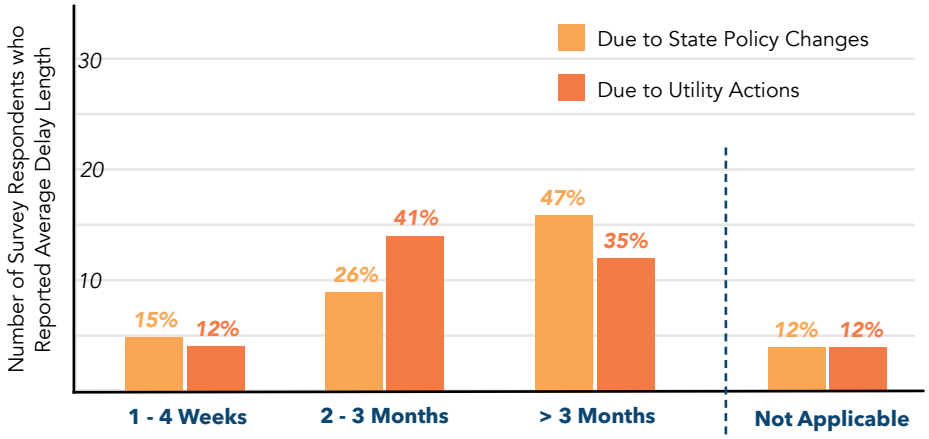
the accompanying state policies, local regulations, and utility service territories. For example, the survey results suggest that residential solar installers more commonly experienced unexpected costs and delays related to local permitting policies than commercial and utility-scale developers. However, we are unable to draw further conclusions on these differences because only a limited number of respondents indicated which market sector(s) they serve.

Across all survey respondents, these unanticipated costs and delays may have affected thousands of projects, to varying extents. One survey respondent wrote of impacts "ranging from weeks to years and from hundreds of dollars to hundreds of thousands of dollars."

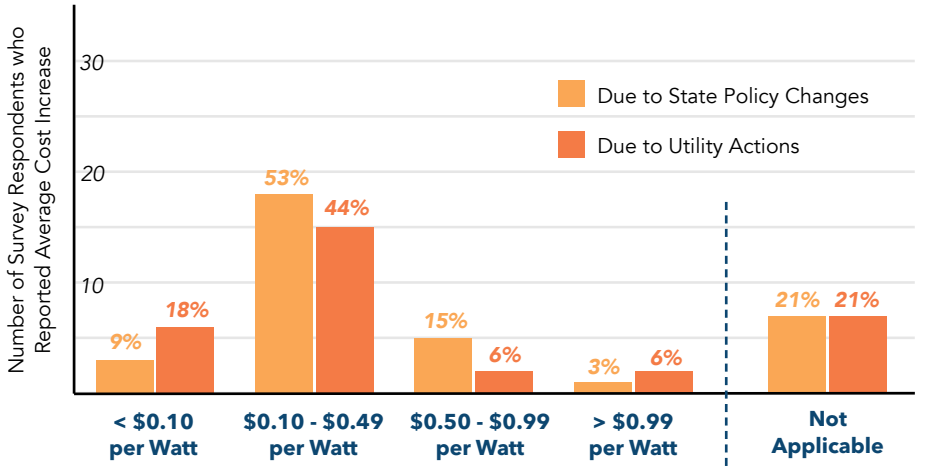
One survey respondent wrote of delays and costs "ranging from weeks to years and from hundreds of dollars to hundreds of thousands of dollars."

Nearly half of respondents said delays caused by policy changes created project setbacks longer than three months, and more than one third said utility actions caused delays over three months long. The top chart below shows the lengths of delays from policy changes and utility actions as reported by survey respondents.

Average Lengths of Solar Project Delays



Average Amounts of Unexpected Solar Project Costs

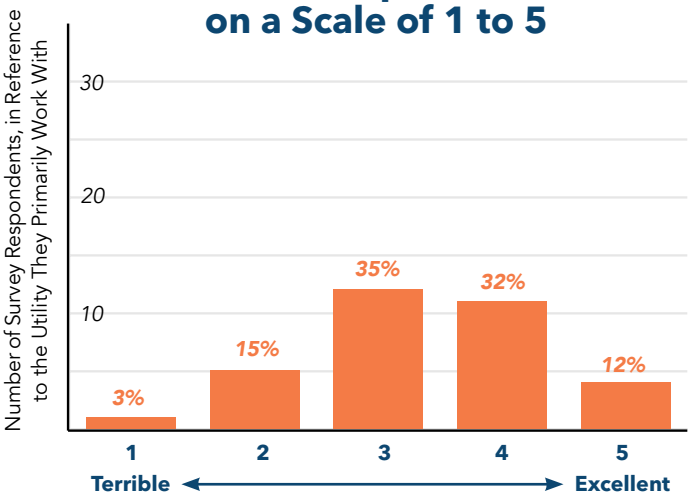


Many residential solar panel installers reported delays on the order of weeks or months. Other solar developers disclosed holdups for community solar farms and larger commercial and industrial installations as long as one or two years or more. These delays stretch out overall project timelines. "Our projects typically take anywhere from two to five years from inception to [commercial operation date] and that's just ridiculous for a five megawatt project," shared one developer in the Northeast. "It should not take that long."

More than half of survey respondents said unanticipated costs from policy changes resulted in $0.10 to $0.49 per watt cost increases. (For context, a 50 cents per watt price jump would roughly increase the cost of a typical residential solar project by 15 percent.) Nearly 45 percent of survey respondents said utility actions caused similar price increases. In the bottom chart on the previous page, solar developers indicated the ranges of cost impacts that policy changes and utility actions had on projects.

Despite the pervasive challenges that many developers described, about 80 percent of survey respondents indicated that on a one to five scale, with one being the poorest, they had relationships of three or higher with their local utilities, as shown in the chart below.

How Survey Respondents Rank Their Relationships With Utilities, on a Scale of 1 to 5



This could suggest that survey participants see value in and have invested in building workable relationships with utilities. In interviews, many developers — including those who had major complaints about their local utilities and those who were relatively satisfied with utility performance — reported that maintaining connections with utility employees was essential to getting projects done. "The only way we've been able to install is we have good relationships with the engineers," who are also frustrated, shared one installer.

"We're more or less happy with the relationships that we develop [with the utilities]…" another solar developer agreed. "Some utilities are far easier to work with than others, clearly, but we have kind of a love-hate relationship with the utilities in general."

The Role of Electric Utilities

As noted, one source of variation in the barriers that distributed solar developers face is electric utilities' diverse approaches to solar, which impact how utilities implement and comply with state policies. "It's almost shocking the different ways that these things are handled," shared one survey respondent in an interview.

Different Utilities, Different Cultures

Solar developers reported that internal company cultures seem to influence utilities' practices around distributed solar projects and their approaches to renewable energy generally. For example, an interviewee noted that the **newest CEO** of Arizona Public Service (APS) appears to be **more open to renewable energy** and that the utility department the installer interfaces with has become more responsive (though the utility still has not changed its rules that impede solar development).

On the other hand, a solar installer identified First Energy in Ohio as an example of a utility that has unnecessarily delayed local solar projects, possibly because it views renewable energy as a threat to its historic business interests. Currently, First Energy is at the center of a **massive bribery scandal** involving an Ohio state law that bailed out uneconomic nuclear and coal plants owned by the utility and slashed state clean energy standards. "It's not just that we think [First Energy is] slow. They're way slower than the other two utilities we work with." explained the installer.

Incentive to Oppose Solar

Survey respondents suggested that some utilities may try to intentionally disadvantage local solar, either because the utility owns its own energy generation or because it lacks financial incentive to encourage distributed energy. **Research by ILSR** and others supports the idea that utilities have an incentive to discourage customer-owned solar projects. In particular, solar developers offered that interconnection delays (that either exceed mandated timelines or technically comply with state policies) and paperwork requirements could be calculated attempts by some utilities to slow down local solar projects. Respondents also suspected that some utilities may be understaffing or underfunding the departments that manage distributed energy programs. "What we find is that the utility company doesn't take this as a priority, obviously," said one solar installer.

"We have kind of a love-hate relationship with the utilities in general."

"We've got incentive to build as fast as possible…" a community solar developer explained. "But the utility doesn't have any incentive. The only thing that they potentially have is a stick, if the [utilities] commission, says, 'Wow, you guys are really misbehaving.'"

An Asymmetry of Power

Electric utilities, especially big investor-owned companies, often hold much sway over state legislators and regulators, complicating efforts to reign in practices and policies that needlessly deter local solar development. "Our senator said, 'You just have to understand that the utilities are in charge, and you have to do what they ask you to do,'" one interviewee shared, adding that they had done so and the utility still did not follow state regulations. Large utilities often have more resources, greater political connections, superior technical expertise, and more access to relevant data than ratepayer groups and other advocacy organizations, giving them a leg up in regulatory proceedings and policy decisions.

However, it was difficult for many survey respondents to clearly establish whether utilities intentionally caused delays or other challenges. "You don't want to assume the worst, and that's the thing," one developer shared. "We work with these folks every day of the week."

Mandating Utility Support for Solar

To encourage utilities to support distributed solar development, several states have implemented renewable energy mandates for electric utilities that include carveouts for local solar generation. For example, Oregon's **renewable portfolio standard** requires that eight percent of the state's aggregate electrical capacity should come from community renewable energy projects, including solar, by 2025. Maine has **called for 375 megawatts** of distributed solar in the state by 2024.

ILSR's **Community Power Map** shows which other states have renewable portfolio standards with distributed solar carveouts.

Impacts on Developers and their Customers

Added expenses, unexpected holdups, and cratered projects can make it difficult to run a viable solar business. While some survey participants have mostly been able to manage the setbacks they face — "Business is booming despite the impediments," wrote one respondent — others indicated that the barriers they experience have severely affected their ability to operate, possibly due to differing state and/or utility policies. One survey respondent reported that their revenues declined by around 70 percent over a three-year period. Another developer wrote in survey comments that barriers to solar deployment prompted them to lay off over half of their employees.

"Our senator said, 'You just have to understand that the utilities are in charge, and you have to do what they ask you to do.'"

Many survey respondents in particular noted how delays can have a significant impact on project financials and cash flow. For one, developers typically have money tied up in materials, fees, and other investments while waiting for projects to advance. Stoppages may also happen in the middle of development cycles, saddling developers with sunk costs. "Floating cash for extended periods makes operating and expanding difficult," wrote one survey respondent.

Long delays push back revenue for community solar farms and other larger projects, but debt payments remain due. "It took a year and a half after mechanical completion for the utilities to come out and… install the standalone meters and place them in service," said an interviewee. "How do you make capital payments while you're waiting a year and a half?" Another interviewee shared how they needed to negotiate multiple extensions of interest-only periods with their lender as a result of interconnection delays.

The financial risks are particularly difficult for small businesses, community-based developers, and organizations serving low-income households to manage. **Previous analysis** by ILSR has noted that small businesses, especially minority- and women-owned business enterprises, tend to have lower access to capital and financing. In an interview, a community solar developer described how a utility's delay in processing incentive payments forced them to advance with a one megawatt project without confirmation on incentive amounts, making the project difficult to finance. "We had to go ahead and build just based on a really good guess because everything else was moving…" they shared. "The risks are so big for an organization without pockets, never mind deep pockets."

Naturally, project setbacks and higher expenses impact not only the developer or installer but their customers, too.

Extra costs and unanticipated delays can stop customers from moving forward with projects, reported survey respondents. One community solar developer lost about 15 percent of their subscribers when a new project was delayed by about a year, resulting in approximately $20,000 in lost revenue.

One respondent saw revenues decline by around 70 percent over a three-year period. Another said that barriers prompted them to lay off over half of their employees.

In another example, a solar installer shared how a rural electric cooperative refused to supply a member with the necessary paperwork because the co-op was planning to change their solar program, even though it wouldn't adopt the new policy for months. Because of the holdup, the installer's customer, a soldier who wanted to lock in energy costs for his family while stationed away from home, dropped the project. "He was being deployed. He didn't have time to fight," the installer explained.

In other situations, the potential for surprise fees and other setbacks is what deters interested customers from moving forward with solar. One installer interviewed described how their company gives "paragraphs worth of caveats" about the possibility of utility delays and rate changes to potential customers. "That really puts a lot of friction into a solar sale," the installer explained, "and it puts a lot of friction into solar adoption because it makes people think twice: 'Well, Jesus, if the utility company's gonna screw me over, I might not want to do this.'"

When customers decide to move forward, they can face higher costs, which developers often have to pass on to the customer. A solar installer reported that the requirements instituted by local governments and the utility approximately add an extra $1,000 to the cost of an average home solar system, which stretches out the payback time. As a result of these extra costs as well as reduced solar compensation values, the financial benefits of solar aren't high enough to attract households that could otherwise finance systems, and the installer primarily works with retirees and early adopters who can afford to buy systems outright.

Long waits and creeping costs affect developers' relationships with customers, even when the cause is out of the developer's control. "It's very frustrating for our customers, because they've paid for a system, we've installed it, it's ready to go. And it's not producing any energy for them because the utility company is so slow," said an installer in an interview.

This is especially true when developers have to repeatedly run unexpected project changes by customers for approval, sometimes several times during a single project. "We told customers one thing and then needed to shift gears over and over again, each time increasing costs and reducing their benefits," one developer wrote in their survey response. "Our customers struggled to maintain their faith in us."

"Well, Jesus, if the utility company's gonna screw me over, I might not want to do this."

On a larger scale, these various solar roadblocks restrict the growth of local solar and threaten the success of clean energy goals. "If we think we're gonna get the country anywhere near 50 percent renewables, we're kidding ourselves as long as we have the building department and the utilities fighting us," said one interviewee.

Solar Barriers by Project Stage

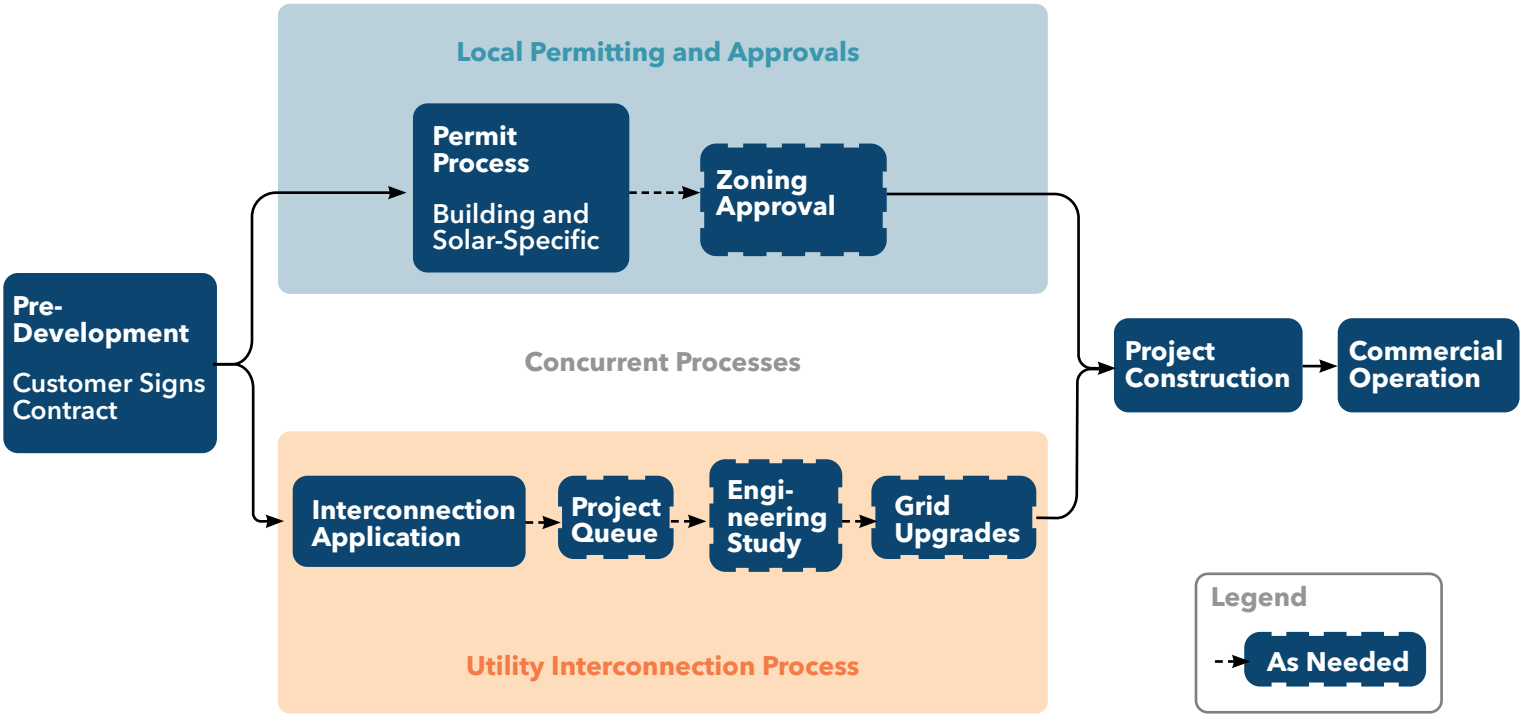
Solar developers and installers follow different project paths depending on factors like location and system type, but they include many of the same steps. The simplified diagram on the next page represents a typical project development process.

Surprise costs and delays can crop up at many stages of solar project development, stretching from initial planning to after commercial operation. The chart on the next page shows at which project development stages survey respondents reported different types of unanticipated delays and costs.

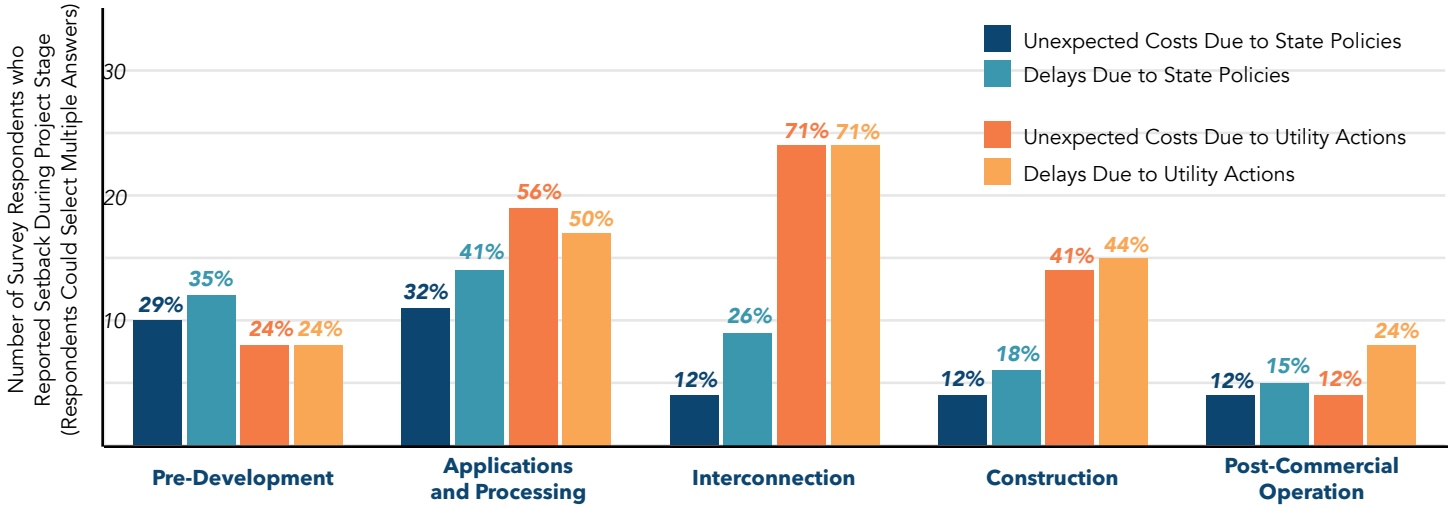
Survey responses indicate that costs and delays caused by state policy tend to occur earlier in solar project development, during the pre-development and initial application stages, while costs and delays caused by utility actions are more common later in project development, during the initial application, interconnection, and construction stages.

Examples of barriers that occur during the pre-development phase of solar projects include grid capacity limits, unfavorable rates for solar customers, and caps on state solar programs. Next, solar developers must apply for interconnection, which can

Simplified Development Process for a Typical Solar Project



Sources and Types of Solar Project Setbacks by Development Stage



involve challenges with delayed utility responses to interconnection applications, high grid upgrade costs, and long waits to complete engineering studies. At the same time, solar developers must apply for local permits and approvals, where they can face extra costs and delays related to local government policies on solar permitting, land use, zoning, and other requirements. Then, after construction and even after commercial operation, solar projects might experience setbacks as a result of, for example, utilities delaying final meter installation or changes to rate structures by states or utilities.

We examine different challenges identified by the survey respondents in greater detail, grouped by which stage of project development they typically occur during. Possible solutions, models, and best practices are highlighted in pop-out boxes throughout.

Upgrading the Grid

Many survey respondents spoke of the need for regulators and policymakers — especially at the state level — to mandate proactive utility investment in electric grid infrastructure and distributed generation capacity, instead of making hodgepodge upgrades in blind response to interconnection applications. "We are paying to upgrade the grid and they're not doing it in the most efficient manner," one interviewee said.

As part of an intentional grid improvement process, decision makers should consider how these investments can reduce unequal access to grid resources. A **recent study** of two utility service territories in California found that hosting capacity for distributed energy, including rooftop solar, tends to be disproportionately lower in census block groups with greater Black-identifying populations and in sensitive and linguistically-isolated communities as identified by the state's **CalEnviroScreen** tool, potentially exacerbating existing **solar adoption disparities**.

Pre-Development

When deciding whether to take up a project, solar developers, installers, and their customers must consider a variety of factors, ranging from state solar incentive programs to electric grid congestion.

Grid Capacity Limits

For some developers — especially those working on larger community solar or commercial systems — lack of grid capacity is among the most fundamental issues they face, forming a critical juncture for potential solar installations. "The roadblocks and barriers and the slowdowns — those things all have a drag on the economic viability of a project," a developer explained in an interview. "But before any of that can even happen, you have to be able to connect these things to the grid."

"We probably have in the neighborhood of 600 megawatts of projects that we cannot build right now due to capacity constraints on the distribution system," reported the same developer, who works largely in the Northeast. Like distribution grids, the transmission system also **needs significant investments** to expand capacity for new power generation.

There's a mismatch between the costs and benefits of grid improvements, and the responsibility of financing them can fall to individual solar developers, who are charged for system upgrades during the interconnection process. "The question is always who pays for it, right?" a developer shared in an interview. "And at the end of the day, it's all of us… Because it's either pay for the infrastructure now or pay the damage caused by climate change later on."

Solar Compensation and Rate Structures

Survey respondents also called out state programs and policies for solar rate structures, including compensation for solar owners and fixed bill charges, as sources of barriers. More than one third of respondents reported unexpected costs from changing state policies on solar rates, and just under one quarter reported unexpected costs from utility rate changes. About two in five survey respondents said that rates penalizing solar customers are obstacles that are unfair or that could be significantly reduced.

"One of the biggest issues is how states allow utilities to value solar," said one interviewee. "The states that allow utilities to say this is just a cost center, that we've received no value, makes it economically just not possible to make [solar] work."

"We have to overproduce in order to be cost effective."

A majority of states require that at least some utilities (e.g., investor-owned utilities) provide net metering at the retail rate of electricity, which averages around **14 cents per kilowatt-hour** for residential customers nationally. However, a handful of states have no state-level mandates. Alabama, for example, **doesn't impose any net metering requirements** on utilities, and Alabama Power, the state's largest utility, charges solar owners **substantial fixed monthly fees** while paying out **under 4 cents per kilowatt hour** of solar energy. As a result, distributed solar installations in Alabama trail behind the other sunny southeastern states. State net metering policies are a frequent lobbying target of electric utilities, such as **Florida Power and Light**, that seek to reduce compensation paid to solar customers. See ILSR's **Community Power Scorecard** for an assessment of state net metering policies.

To make solar installations financially viable after compensation rates fall or utilities add fixed charges, customers may have to increase system size or add battery storage, increasing upfront costs. One rooftop solar installer in Arizona reported that the **phaseout of net metering** by state regulators induced their residential customers to increase the typical size of systems from six to seven kilowatts up to eight to ten kilowatts. "We have to overproduce in order to be cost effective," they explained.

Lower compensation for certain types of solar systems can also impact project development. In Minnesota, for example, state policy allows Xcel Energy to pay community solar subscribers at a different rate than customers with solar projects on their own rooftops, and the rate for community solar subscribers is currently lower than rooftop solar owners. One solar developer in the state said that this difference in compensation makes it impossible for community

Mapping the Grid

To give solar developers better data for planning and selecting project locations, states can require that utilities share **hosting capacity analyses**. California was one of the first of seven states to direct utilities to develop hosting capacity analyses, which has allowed the state to **update its interconnection policies** even as the state continues to **improve the public grid data**.

solar subscribers to fully offset their electric bills even with the maximum subscription size, adding:

> The fact that they are happy to provide additional incentives on top of net metering for homeowners with plenty of capital and solar access, and aren't willing to do the same or even allow people to offset their energy costs for low-income renters is a really big deal, and it makes it hard to develop community solar in a way that is really accessible.

Many states, including **Massachusetts** and **Georgia**, have caps on how much solar capacity is eligible for net metering. "The net metering [cap] basically just stops new projects from even starting and even getting to the issues of the interconnection or bylaws or citing or any of those other issues," explained a Massachusetts solar installer in an interview, adding that caps can also impede projects from being sized large enough to fully offset energy use.

Where Are the Feds?

The main federal solar incentive is the solar Investment Tax Credit. Historically, many solar developers and solar homeowners with low to moderate tax liabilities have been unable to take full advantage of the credit because it can only offset taxes owed to the federal government. The Build Back Better Act, if made law, would make the credit **more accessible** by including refundability for the **residential tax credit** and a direct pay option for the commercial tax credit, which would let households, businesses, nonprofit organizations, tribes, and other entities benefit from the credit even if they owe little or no federal income taxes.

Beyond the tax credit, developers interviewed for this report suggested there are opportunities for federal leadership on solar compensation and other policies. "Until there's standardized federal net metering, there's always going to be systematic problems with solar," one solar installer argued.

Utilities may try to interpret state net metering caps in a way that further restricts local solar. For example, in a move **blocked by the Illinois Commerce Commission**, Ameren attempted to end net metering availability by changing how it calculated the capacity of net metered systems on its grid.

Solar Program Limits

Over half of survey respondents said policy changes to program capacity limits, like net metering program caps, caused unanticipated delays within the past two years. For a question that asked developers to identify the barriers that cause the longest delays and highest costs, program capacity was the most commonly selected response after interconnection rules and costs.

"It makes it hard to develop community solar in a way that is really accessible."

As an example, Colorado allows utilities to restrict the amount of capacity in the **state's community solar program** through a bidding process. Xcel Energy Colorado, the largest electric utility in the state, currently has an annual installation cap of **75 megawatts**. Similar limits apply to community solar programs in Maryland, New York, and other states.

Respondents reported that program capacity constraints have forced some developers out of certain markets despite overt policy intent to deploy more solar and interest from utility customers, such as parts of Massachusetts and Illinois (which recently **passed legislation** to avoid a **solar funding cliff**).

Other state policies create early roadblocks for solar developers as well, like the **single parcel rule** in Massachusetts and the community solar **contiguous county requirements** in Minnesota.

Interconnection Process

Developers pegged the interconnection process as one of the most common and costly barriers to solar deployment, with about four in five survey respondents singling out interconnection as a roadblock that can cause the highest costs or the longest delays.

79% identified interconnection rules and/or costs as barriers that create the highest costs and longest delays.

In particular, survey respondents and interviewees pointed to the veiled nature of the interconnection process, which places a lot of uncertainty on solar developers, who must invest time, money, and other resources into projects without guarantees that they will advance. "There's two places where we spend lots of risk and we don't control it: interconnection and zoning," explained one interviewee. "And zoning at least has a little bit of smoothness. Interconnection is just opaque."

Photo credit: John Farrell

Interconnection Costs and Upgrade Fees

High, unpredictable costs are one class of barrier within the interconnection process. Over the past two years, almost two thirds of survey respondents indicated that they faced unexpected costs due to utility noncompliance with interconnection policies, and just under 60 percent reported unexpected costs as a result of changes to state interconnection policies.

Much of these surprise costs may be a result of high charges for grid improvements, as projects triggering upgrades often must pay for the full price. New solar projects, or groups of projects, can require upgrades to the local distribution grid as well as the transmission grid, which tends to be much pricier. Some distributed solar developers have **objected to funding transmission upgrades**, as their projects connect to the distribution grid and can even reduce the need for new transmission lines in certain cases.

Unpredictable and sometimes significant interconnection fees can result in abandoned projects. Commercial installations, community solar farms, and other larger solar projects more often trigger the need for substantial grid improvements. "The fees are not public or published or standardized," described one solar installer. "You find out it's a million bucks or you find out it's 20 grand," said another interviewee, referring to how widely potential grid upgrade costs can vary for moderate- and large-sized projects, especially when transmission system upgrades are required.

Seeking Interconnection Perfection

State regulators and utility leaders who want to improve the interconnection process for distributed solar projects have resources available to help them design better policies to break down interconnection barriers.

One prime resource is the ***2019 Model Interconnection Procedures*** developed by the Interstate Renewable Energy Council. This document is directed at state regulators, legislators, utilities, and other decision makers, and it includes policy guidance on interconnection applications and timelines, impact study standards, interconnection agreements, public interconnection queues, utility reporting requirements, and other related practices.

The National Renewable Energy Laboratory has also published relevant research on interconnection practices, including ***An Overview of Distributed Energy Resource (DER) Interconnection: Current Practices and Emerging Solutions*** and ***New Approaches to Distributed PV Interconnection: Implementation Considerations for Addressing Emerging Issues***.

One survey respondent suggested that utilities may exaggerate a solar project's responsibility to bankroll grid investments, sometimes requiring developers to upgrade "an entire substation or feeder with equipment the utility should have installed, in some cases, years prior." Other respondents noted that there can be limited transparency and accountability for utility calculations of grid upgrade costs or that certain utilities try to include equipment upgrades that aren't justified by the project.

Furthermore, survey respondents noted that utilities will occasionally request developers invest in infrastructure upgrades or equipment before the utility has even reviewed or approved the interconnection application. Other solar developers have experienced utility changes to interconnection fees or upgrade requirements **after signing interconnection agreements**.

"The fees are not public or published or standardized," described one solar installer. "You find out it's a million bucks or you find out it's 20 grand," said another interviewee.

The frustration with upgrade costs has spilled over in an interesting way in the Northeast. When solar projects fund grid upgrades, the federal government treats that as income for the utility. Although the Internal Revenue Service has specifically exempted the utility from paying taxes on this contribution to the public grid, at least one utility — National Grid — still assesses the tax on solar developers, as explained in the article ***The Return of Taxation Without Representation***.

Interconnection Timelines and Utility Noncompliance

In addition to unanticipated interconnection costs, about seven in ten survey respondents reported unexpected delays in the last two years caused by changes to state interconnection policies. The same proportion of respondents reported delays caused by utility noncompliance with interconnection rules. Community solar and other commercial developers especially pointed to these waits as a challenge, reporting that the interconnection process for their projects can take one year or longer.

Even when states mandate interconnection time frames, utilities can still create delays while remaining in compliance with policies by pausing project timelines or exploiting other loopholes. For example, a **state-ordered audit** of National Grid in Massachusetts

found that during a large influx of applications at the start of the state's **SMART incentive program** the utility placed increasing numbers of holds on projects' interconnection applications. (Under Massachusetts regulations, holds pause the interconnection timeline and are intended to allow utilities to collect additional information from the applicant.) The audit noted that developers believed the utility was employing more frequent and extensive holds, along with a slow response time, in order to delay their project applications.

Sometimes, utilities exceed the interconnection guidelines set by state regulators — by years in the worst instances — with few consequences imposed on the utilities. "[Interconnection] is not necessarily the biggest thing that impacts our business model, but it is definitely the biggest place where it's just blatant contractual noncompliance," shared a community solar developer in Minnesota. "And the only alternative is to sue Xcel, and who wants to do that?"

In written comments, one survey respondent noted that while the required interconnection timeline was under six months, in practice approvals actually took two to seven years. An interviewee described how a utility claimed it took 22 days to process an interconnection application, thus meeting state guidelines, after it actually took 2.5 years, all while charging the solar developer additional fees because of the utility-imposed delay.

One survey respondent noted that while the required interconnection timeline was under six months, approvals actually took 2-7 years. Another said, "It is definitely the biggest place where it's just blatant contractual noncompliance."

Forward-Thinking Regulators Wanted

To improve the interconnection process for distributed solar developers, state utility commissions must be willing to close loopholes in interconnection tariffs and hold utilities accountable for noncompliance with policies. "We need regulators who are available to help intervene," said a developer. For instance, the Minnesota Public Utilities Commission **fined Xcel Energy** $1 million as a result of its interconnection delays, but survey respondents said that the regulator must address these challenges more aggressively and proactively.

State regulators will have to overcome the immense political power of many utilities, especially large investor-owned companies, to succeed. "The utility lobbyists are in the statehouse every day," an interviewee said.

"Customers get very upset, and sometimes think the installer is to blame, when it is the utility company which is not complying with rules," a survey respondent wrote of the impact that delays have on a company's reputation.

The extent of delays and the intent behind them may vary depending on the electric utility in question. One solar developer, who works largely in New York, said they believe that occasional utility delays in the interconnection process outside of state mandated timelines are largely unintentional. Other respondents suggested that the utilities they work with may intentionally or arbitrarily slow down parts of the interconnection process to disadvantage distributed solar developers.

Additional sources of delays during interconnection include engineering study requirements, project queue protocols, and other utility practices.

Engineering Studies

Utility and policy requirements for engineering studies hike up projects' price tags during the interconnection phase. More than half of survey respondents reported unexpected costs over the last two years as a result of public policy changes to study requirements. Just under half reported unexpected costs caused by utility noncompliance with relevant policies.

High engineering study costs can be especially prohibitive for smaller projects, including residential and small business rooftop installations. One interviewee shared how they currently have two small projects right next to each other, for which they will have to complete two separate $4,500 impact studies. "[About] five grand on a small project is actually a lot of money," they said.

"If you have 20 projects in the same feeder queue, project number 20 might be 10 or 15 years back."

Engineering study requirements are also a source of solar project holdups. Group studies — where multiple solar projects are studied together to evaluate their combined impact on the transmission system — in particular can add long waits. "National Grid in Massachusetts has a massive cluster study issue with **hundreds of megawatts** slowed down for years in the SMART program," said one interviewee, adding, "There's people who have, like, millions of dollars in the dirt already." Nearby, customers of Central Maine Power have also seen **long delays** as a result of cluster study requirements.

Long Project Queues

Delays in the interconnection process, such as those caused by cluster study delays in Massachusetts and Maine, can lead to backed-up project queues. Just under half of the survey participants reported unexpected delays in the last two years caused by public policy changes to project queues, and half reported unexpected delays caused by utility noncompliance with those policies.

Sometimes solar projects sit in interconnection queues for a needlessly long time, possibly because of speculative project submissions or because developers are waiting for information from the utility to decide whether to pull the project. "Projects should not take up capacity in the queue forever and they do," wrote one survey respondent. For instance, the **audit of National Grid** ordered by the Massachusetts Department of Public Utilities, mentioned above, found that developers weren't able to get feedback or initial study results from the utility which would have enabled them to drop unfeasible projects earlier in the interconnection process.

How utilities decide to interpret state policies when managing their queues can also create hold-ups.

Photo credit: John Farrell

One example is Xcel Energy's **"on hold" review process** in Minnesota, mentioned above. Under the relatively recent policy, the utility will only review interconnection applications in the queue and finalize interconnection agreements sequentially, instead of conducting parallel reviews once applications are submitted. "Each larger project — you know, let's say 100 kilowatt or larger project — could easily take four or five months to complete Xcel's study process," one developer explained in an interview. "Well if you have 20 projects in the same feeder queue, project number 20 might be 10 or 15 years back."

One community solar developer described a project that experienced a yearlong delay and incurred over $200,000 in extra costs.

Interconnection queues at the transmission level can be particularly long and the amount of time that projects spend in them appears to be increasing. **Research from Lawrence Berkeley National Laboratory** suggests that projects now spend about 3.5 years in the queues of some of the largest transmission grid operators in the country, as opposed to about 1.9 years in the 2000s.

Communication Challenges

Interconnection delays also stem from utilities' failures to communicate effectively and promptly with solar companies. One community solar developer in Minnesota described a project that experienced a yearlong delay and incurred over $200,000 in extra costs as a result of Xcel Energy first failing to respond in a timely manner and then unilaterally pushing the in-service date several months back. The additional costs included a fine that Xcel docked the project for when it wasn't mechanically complete by the original deadline, after the utility itself postponed the in-service date by many months.

The developer has faced similar delays on other projects. "We're being very diligent not only getting the documents into Xcel's hands but also asking for their updates on the process," they said in an interview. "They're not responding, they're deciding they haven't received them, and then there's no response to the fact that they've just caused this delay entirely arbitrarily."

Sometimes it's a matter of having the right connections at the utility company. A solar developer in the Northeast explained how a utility's local engineer — who they had been contacting without response — only replied after the developer emailed a "concierge" that they were connected with on an earlier project. "I got this email address from a rich person who plays golf with somebody…" the developer explained in an interview. "When we used the email last time, we went from having to spend five grand on an impact study to actually skipping through it and doing an install."

Alternatively, interviewees pointed to New York State Electric & Gas (NYSEG) and Ameren Illinois as examples of utilities that can be easier to communicate efficiently with about solar projects under development. "It's been a delight to work with them — very responsive," said one developer of Ameren.

Other Utility Practices and Policies

Alongside the barriers above, respondents named several utility policies that impede solar development, including: requirements that solar installations include safety disconnects, rules on where new meters can be placed, conservative and impractical voltage flicker tests that projects often fail, and classification of certain lines as transmission instead of distribution. Solar developers noted that these requirements vary across utilities, such that neighboring utility territories might have notably different rules.

To complicate matters, utilities and their employees might not consistently interpret or apply their own policies, so solar developers often don't know what to expect on any given project. One solar installer shared how a local electric co-op recently vacillated over whether their policies measure solar system sizes in AC or DC. "It just seems like they interpret it however they want," the installer added.

As a result of these discrepancies, the same solar installer has had a hard time anticipating which forms and documents a utility might request for a solar project. "Now we just provide them every document they've ever asked for in the past regardless of whether it's needed for that application, and that doubles the paperwork," they explained in an interview.

A residential solar installer in Arizona also shared their experience with erratic utility policies. In their situation, utility APS invoked a requirement that solar customers install easily accessible AC safety disconnects for a solar project on a pair of new triplexes — even though they hadn't required disconnects for solar systems on two identical buildings in the development years previously. "I'm sure they don't mind driving up the cost of solar installs," the installer said in an interview.

"Now we just provide [the utility] every document they've ever asked for in the past regardless of whether it's needed for that application, and that doubles the paperwork."

Utilities occasionally modify their policies without informing developers and their customers. "Sometimes they announce changes to their internal timelines or their internal workings," said one developer. "Other times they just make a change, and we only learn about it after the fact or we have to kind of, you know, sleuth it out somehow."

Photo credit: DOE/Laksh Muchhal via Flickr

Costly Consequences

Project lags can impact solar customers' financial returns when the wait causes them to miss out on incentive programs or better rates, noted a few survey respondents. One solar developer explained how a small shared solar system built for a handful of families missed out on higher compensation under a changing state incentive program. "Because of the utility's failure to process their interconnection application, they lost 30 percent of the return," the developer said in an interview.

Several developers interviewed for this report described projects that faced multiple sources of delays, excess costs, and other barriers throughout the interconnection process.

One interviewee shared an example of a small community solar project that eventually collapsed as a result of high interconnection costs, after more than a year of delays and thousands of dollars already invested. Before the developer could even submit an

interconnection application, the utility required them to pay to install a new transformer. After filing the application and waiting longer than the mandated time frame, the developer found out they would have to complete a group study with a project six times larger ahead on the line. In the end, the utility tacked the developer's project with hundreds of thousands in upgrade costs, while the much larger project would only be on the hook for half as much. "It put our project out of business," said the developer. "It's just no way we could cover this cost."

"Because of the utility's failure to process their interconnection application, they lost 30 percent of the [financial] return."

In an interview, another developer described a similar situation where they submitted a 200 kilowatt project for interconnection around the same time that a much larger 5 megawatt system nearby put in its application. At first, the utility said the developer would have to wait two years for the larger project ahead in the queue to finish, but they were able to convince the utility to review the projects concurrently and split grid upgrade costs — estimated around $20,000 to $30,000 for substation upgrades and around $7,000 for local upgrades for the smaller project — to avoid the long wait. In all, the process took several months, including time that the developer had to spend revising financial models and getting approvals from the customer for the additional costs. When the interconnection finally came back, it didn't include the additional $20,000 to $30,000 substation upgrade costs, with no explanation why the utility dropped them. "In general, it's an aberration that it's that bad, but the aberration is 20 to 30 percent of the time," the developer said.

Interconnection challenges are so frustrating to developers in part because there's no practical alternative to working with the local electric utility, regardless of its policies and past performance. One community solar developer explained:

> Obviously we have to go to the utility to get the interconnection service. There's no other person that can give that to us, which is different than most of our business — we're going out and we're procuring panels or equipment, or doing subcontractor RFPs. We can shop around and pick the partner that is the best aligned and best situated… We just have to take what [the utilities] give us basically.

Local Permitting and Approvals

In parallel with the interconnection project phase, solar developers and installers apply for any needed permits or approvals from the relevant jurisdictions and must comply with other local government regulations, a process that can involve challenges of its own.

Almost 30 percent of survey respondents replied that local zoning and/or siting policies (which can restrict where certain types of solar systems can be located) created unexpected delays in the past two years as a result of public policy changes. Participants also pointed to solar-specific permitting, ministerial permitting (such as a building permit), and land use approvals as sources of delays. Almost forty percent of respondents reported that changes to land use policies caused unanticipated costs within the last two years, and nearly one third of respondents replied that changes to government permit fees similarly caused unexpected costs.

Local permitting can delay home solar projects by 2 to 3 months.

The challenges of local permitting and other regulations were particularly top of mind for many of the rooftop solar installers who responded to the survey. One interviewee in Arizona said that meeting local government and utility requirements adds eight hours of paperwork and approximately $1,000 upfront cost to an average residential installation, even though most localities have standard permits. "We spend most of our time here fighting the paperwork and schedules and permitting and all the red tape and bureaucracy, and then our guys go out and — boom — put the solar system in," they added. A different installer in the Midwest reported that they employ a full time staff person to manage local permits and interconnection applications.

Federal Programs Streamline Local Solar Policies

To streamline solar deployment, Gilbert, Arizona, eliminated permitting requirements for many residential solar systems **about a decade ago**.

For the many communities that aren't ready to abandon solar permits, there's another option to ease solar installers' paperwork burdens. **SolarAPP+** is a federally supported online, automated solar permitting tool that cuts processing time and can potentially lower fees. So far, **more than 125 communities** have adopted SolarAPP+, including Pima County and Tucson, Arizona, which have significantly reduced permit processing lengths and **saved more than 1,000 hours** of staff time over several months by reviewing solar permits using the tool.

For local governments that want to do more to streamline solar development, the federally funded **SolSmart program** supports communities in reducing barriers to solar, for example, by revamping zoning codes or increasing access to financing. There are **more than 400** SolSmart designated communities nationwide.

Waiting for local approvals and permit processing can delay residential rooftop solar projects by two to three months, according to the installers we interviewed.

"It could be easily another one to two thousand dollars added to just the review process... so that's 10 percent of the cost right there."

"The checks that we have outstanding for months and months and months that never get cashed, are the permitting checks… There's just no reason for them to move quickly for some reason," said one installer.

The timing of public meetings in small towns also causes delays. Town boards might only meet once a month, and along with requirements like 30-day hearing notices, notification periods for properties abutting a project, and appeal periods, this alone can delay projects for as many as three months, reported a solar installer in the Northeast.

Occasionally, project holdups are due to a lack of local expertise with solar permitting. "We end up having to kind of educate them on what it is, and we have to show them where it is in the code. So that just can take extra time," said one installer.

The wide variation in policies among local jurisdictions in terms of site plan reviews, setbacks and height restrictions, system size limitations, and other requirements further complicates deployment. As an example, one solar installer described how a local town requires developers to conduct a professional land survey and complete other submissions for all systems five kilowatts and above, which often means smaller companies must contract the work to an outside firm. "It could be easily another one to two thousand dollars added to just the review process. That's on top of, you know, a $20,000 project, so that's 10 percent of the cost right there," the installer explained.

Survey respondents also pointed to localities' adoption of the 2017 National Electrical Code, which includes rapid shutdown requirements, and to rooftop access rules for firefighters in building codes. "Many of these modern, architecturally designed homes have the roofs all chopped up into little pieces to make them look expensive — and then you take three feet of space all around the perimeter of that away," said one installer, describing the challenges of a three foot access rule. "Like, sorry, you don't have any room left for solar."

Post-Construction

Unanticipated setbacks aren't limited to the earlier phases of solar project development. Worryingly, about 29 percent of survey respondents reported that utility actions caused delays and/or unexpected costs after commercial operation. About 18 percent respondents said policy changes caused delays and/or costs after that point.

While small rooftop solar installers may be able to put in solar panels in a matter of days, they sometimes must wait for weeks after construction for utility employees to respond to emails and schedule a final meter swap. "With First Energy territory, there have been some times when a month goes by," shared a solar installer in Ohio, who said that long of a wait was common for the utility, leaving their customers with a finished system that isn't producing energy. One of their small business customers even went for months without credits because the utility installed the wrong meter, something that the installer said has happened to a few of their other customers as well.

State programs can also lead to delayed compensation, according to a handful of survey respondents who pointed to the **SMART solar incentive program** in Massachusetts. One interviewee said it took almost seven months after completing construction on a project to get incentive payments approved because of delays from the SMART program and the local utility Eversource.

"They signed a contract to sell electricity at a certain rate… And now they're being told by the utility that they're only going to get that rate for five years."

Occasionally, utilities are allowed to change solar rates or add fixed charges after customers have installed solar. One residential solar installer in the Midwest shared how a local rural co-op, Egyptian Electric Cooperative Association, suddenly ended its one-to-one compensation policy for solar energy. (Illinois policy only requires investor-owned utilities in the state to offer net metering.) Existing solar customers could only continue at the previous rate for five years. "They signed a contract to sell electricity at a certain rate and therefore, you know, had a certain payback on their solar system," the installer said in an interview. "And now they're being told by the utility that they're only going to get that rate for five years"

Survey respondents also pointed to Xcel Energy's planned outages policy as an example of an issue that can occur after commercial operation. Developers in Minnesota reported that the utility's decision to take community solar installations down whenever live-line maintenance is being done on the same feeder line has caused outages as long as two months and tens of thousands in financial losses. "It's just another example of, you know, if the utility wants to find something to use against you, they've got information asymmetry, they've got all these things that they can do," shared one community solar developer.

Conclusion

The *Barriers to Distributed Energy Survey* provides a snapshot of the challenges to development that distributed solar energy faces today. Survey respondents described a wide range of solar roadblocks, from lengthy interconnection delays and eye-popping infrastructure costs to balkanized local policies and capricious utility decisions. Together, these barriers raise the price of solar installations, slow the growth of local clean energy, and contribute to keeping the benefits of solar energy out of reach for many American households.

Despite state attempts to regulate interconnection timelines and incentivize greater solar deployment, a gap remains between intentions and enforcement, which some utilities exploit to the detriment of local solar developers and their customers. A continued conflict of interest between utility companies entrenched in the traditional monopoly model of centralized fossil energy and their customers will make these challenges difficult to resolve.

Further research is needed to shed light on the full extent of the barriers to local solar and to determine the most effective solutions. In the meantime, elected officials, utility regulators, and solar advocates already have many of the tools needed to start breaking through solar blockades. For local governments, this includes SolarAPP+ and other streamlined permitting approaches. At the state level, decisionmakers can require public hosting capacity analyses, establish fair solar compensation rates, and better enforce mandatory interconnection timelines.

Challenges like the climate crisis and rising inequality demand urgent action. "This is not about a technology we need to invent. This is not about some massive change that we need to [make]," a solar developer explained in an interview. "We just need to go do more of what we already know how to do and do it much, much faster."