Research Article

The Inactive System Gap: Customer Experience Impacts of Inspection and PTO Delays in New York Solar

Madina Tulegenova, Project Coordinator, NY State Solar, LLC

New York, USA

M.S. in Business Analytics

Merey Tursynbayeva, Operations Associate, NY State Solar, LLC

New York, USA

M.S. in Business Analytics

Correspondence

Madina Tulegenova, Project Coordinator, NYSS, New York, USA.

Merey Tursynbayeva, Operations Associate, NYSS, New York, USA.

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This research was prepared by Merey Tursynbayeva (M.S in Business Analytics) and Madina Tulegenova (M.S in Business Analytics) and examines The Inactive System Gap: Customer Experience Impacts of Inspection and PTO Delays in New York Solar.

This study investigates a persistent structural inefficiency within New York's residential solar ecosystem: the delay between system installation and Permission to Operate (PTO), driven by inspection backlogs and interconnection processes. While installation capacity in the state continues to expand, these administrative bottlenecks create a critical "inactive system gap", during which completed solar systems remain non-operational and unable to deliver value to customers or the grid.

From an academic and systems perspective, this gap represents a misalignment between deployment speed and operational activation, introducing inefficiencies that distort customer experience outcomes, capital deployment cycles, and realized emissions reductions. The result is not only delayed energy generation but also measurable deterioration in customer trust, satisfaction, and perceived reliability of the solar adoption process.

The significance of this research lies in its focus on the end-to-end customer journey rather than installation alone. By isolating inspection and PTO delays as a distinct phase of system friction, the study reframes these administrative steps as a central determinant of adoption experience and market confidence rather than a peripheral operational issue.

For NYSEIA, this topic is strategically important because it directly affects the pace and credibility of New York's clean energy transition. Even with strong installer growth and policy support, systemic delays in activation reduce effective solar capacity, slow progress toward state climate targets, and introduce avoidable inefficiencies across the value chain. Addressing these bottlenecks is essential to ensuring that installed capacity translates into realized generation at scale.

This analysis is informed by interdisciplinary perspectives on organizational change and customer experience, with advisory input from Dr. Melissa Mitchell (Ed.D., Organizational Change & Leadership)

Abstract

New York City's solar market is booming, yet many customers face a critical challenge: the Inactive System Gap - the period between physical installation and operational activation via Permission to Operate (PTO). During this time, solar systems remain idle, expectations go unmet, and customer trust erodes. This article examines the customer journey, identifies inspection and administrative bottlenecks, and evaluates the financial, emotional, and operational impacts of these delays. It further outlines actionable solutions, including pre-inspection quality assurance, enhanced coordination, process transparency, and proactive communication aimed at closing the gap and improving overall customer experience. Addressing the Inactive System Gap is essential to transforming solar from installed infrastructure into a seamless, high-value energy solution.

Keywords

Solar, NYC, Inactive System Gap, PTO delays, Customer Experience, Inspection, Adoption

Introduction

Solar adoption in New York City has entered a period of rapid acceleration. Supported by strong policy frameworks, financial incentives, and growing environmental awareness, solar energy has become an increasingly common feature across residential and commercial rooftops. New York City has reinforced its commitment to rooftop solar by extending and expanding the

NYC property tax abatement, raising the incentive from 20% to 30%, and the city continues to buck statewide stagnation trends, driven by its strong local incentives and high electricity rates. [1] Customers are not only motivated by sustainability goals, but also by the expectation of immediate financial returns and energy independence.

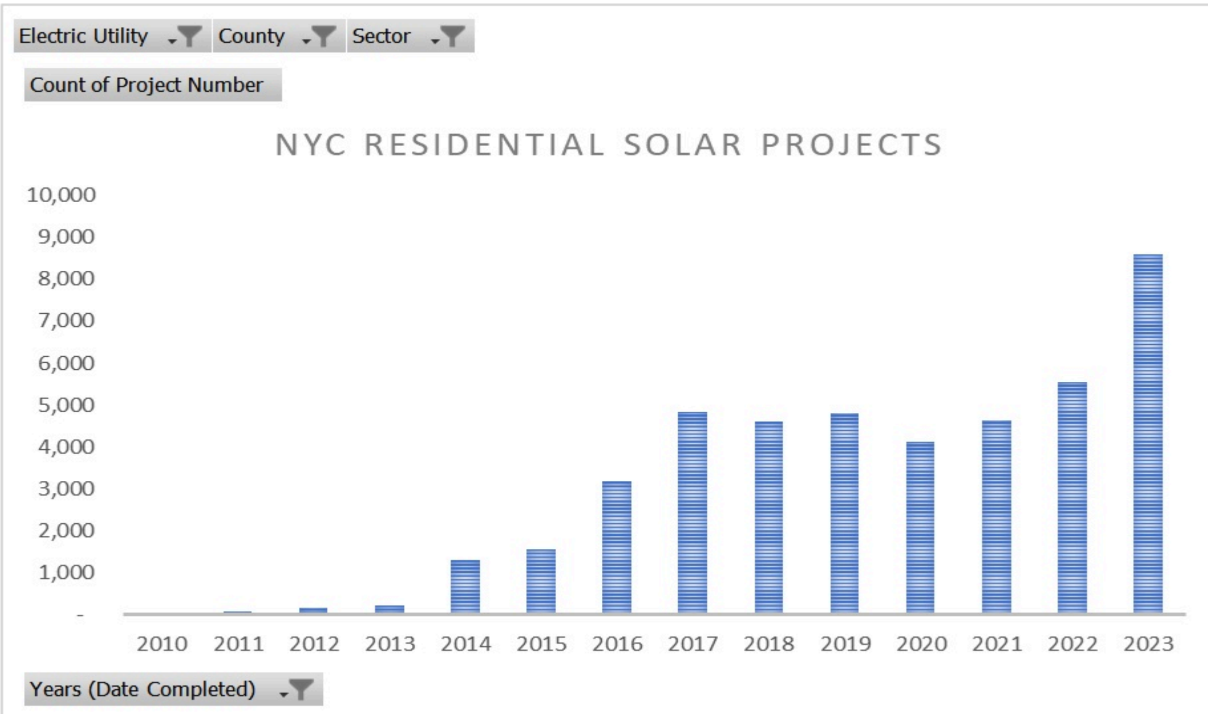

Figure 1. Graph showing growth of New York City residential solar projects from 2010-2023 [1]

However, this expectation is often disrupted at a critical moment in the process. After installation is complete, many systems remain inactive. Visible, installed, but not producing energy. While customers expect fast turnarounds, installers often wait weeks, sometimes months for utility interconnection approvals, frustrating homeowners and eroding confidence before a single kilowatt-hour is ever generated. [2] What begins as an exciting transition to clean energy shifts into a period marked by uncertainty, delayed benefits, and rising frustration.

This disconnect defines what can be described as the Inactive System Gap: the period between physical installation and final system activation through Permission to Operate (PTO) [3]. While often overlooked, this phase plays a decisive role in shaping customer perception. Closing this gap is not only a matter of operational efficiency but a key driver of customer trust and long-term industry growth.[4]

Connecting a photovoltaic (PV) system to the electrical grid is often a lengthy and complex process. These delays can lead to significant time and financial losses for both installers and customers. According to estimates from the Department of Energy, even a one-day delay in connecting all PV systems projected for installation in 2023 would have resulted in approximately $4 million in lost electricity generation across the United States [5]. On a smaller scale, a homeowner in Maryland installing a 5 kW system could lose about $73.48 in energy production for each month their system remains unconnected [5]. Given that many customers experience even longer delays each year, the total financial consequences are considerable. Systems that sit idle while awaiting approval not only burden system owners but also impact utility ratepayers. Delays in interconnection also drive up "soft costs" for PV systems, which include administrative, permitting, and other non-hardware expenses. Research from the National Renewable Energy Laboratory (NREL) indicates that these soft costs can make up as much as 64% of the total cost of a residential PV installation [6]. The causes of these delays are often disputed among utilities, installers, and customers. Utilities may attribute delays to systemic challenges such as incomplete applications, the need for detailed impact studies, and unexpected technical issues, while installers and customers argue that utility review procedures lack transparency and contribute to avoidable processing errors. [7]

Challenges within the interconnection process, especially delays in obtaining permission to operate (PTO), can lead to customer dissatisfaction. PTO is the utility's official approval that allows a solar system to connect to the electrical grid and begin generating energy; without it, a system cannot produce power or send excess electricity back to the grid, even after full installation is complete. [15] Most customers expect to start benefiting from their PV systems immediately after installation, not wait indefinitely for approval. Negative experiences during this waiting period can have broader consequences: homeowners lose patience and confidence, and customer frustration can harm an installer's reputation even when the delays are outside the installer's control. [4] This can reduce referrals and slow overall adoption. Compounding the issue, PTO timelines vary widely across jurisdictions, with some installers reporting waiting periods increasing by as much as 68% in a single year, leaving both customers and installers without a reliable or standardized framework for resolving disputes with utilities. [7]

The Customer Journey: Where Experience Breaks Down

The solar customer journey in NYC plays out in two very different phases, and the gap between them is where most of the frustration lives. The first phase, from contract signing to installation, tends to go well. Customers are looped in on system design, financing, and permitting, and there's a clear sense of forward momentum. Installers are working toward a defined end date, communication is fairly consistent, and customers generally feel like things are on track. Then the system gets installed, and everything stalls.

That moment when the panels go up is the natural finish line in a customer's mind. But in reality, it's the start of a second, murkier phase: inspections, utility approvals, administrative back-and-forth. Review and approval processes associated with more than 20,000 distinct jurisdictions and 3,000 utilities can add weeks or months to the post-installation process, driving up costs that are ultimately passed on to homeowners, and increasing the risk of project cancellations. [9] Progress is harder to see, timelines slip, and updates get sparse. Only 12% of solar businesses maintain a dedicated post-sale support budget, leaving the majority of companies poorly equipped to manage the communication demands that arise after installation is complete, precisely when customers are most likely to lose confidence. [10] Satisfaction, which was often quite high at installation, can drop fast.

The diagram below breaks down the permit and interconnection application process, showing exactly where time gets lost between a completed installation and the day a system actually turns on.

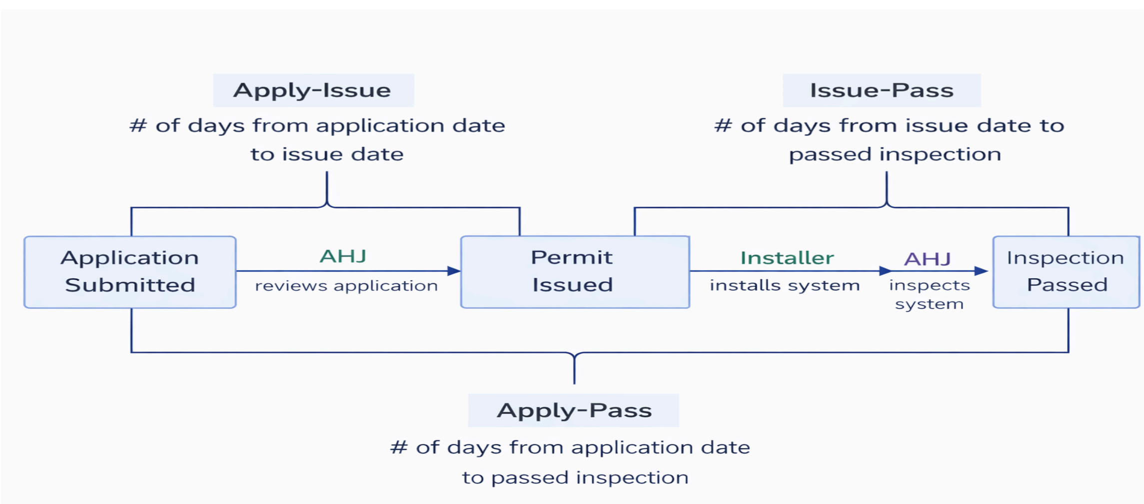

Figure 2. The PV permitting and interconnection process [11]

Inspection and Post-Installation Bottlenecks

The period after installation is where delays tend to pile up, and rarely for just one reason. Some factors are simply external. Weather can pause inspection activity outright; heavy rain, snow, or a cold snap will sideline field inspectors, sometimes for days at a time. But even in good conditions, scheduling is a bottleneck. Demand for inspections in New York City routinely outpaces availability, meaning projects can sit in a queue before anyone shows up to review them. Coordinating access adds another wrinkle, since inspectors and homeowners don't always have overlapping availability. When inspections do happen, they don't always go smoothly. According to NREL data, approximately 23–26% of residential solar installations fail their first Authority Having Jurisdiction (AHJ) inspection, and each failed inspection triggers a reinspection cycle that can delay a project by one to three weeks, depending on that jurisdiction's scheduling capacity. [16] Small issues, such as a conduit out of place, a labeling inconsistency, or a documentation mismatch, are enough to require a reinspection. The fixes are usually minor. The scheduling cycle that follows is not. [16]

Behind the scenes, the administrative side moves on its own timeline. Research from NREL has consistently found that PV installers report utility review processes as non-transparent and difficult to track, while utilities, in turn, cite incomplete or improperly submitted installer applications, creating a standoff that leaves customers caught in the middle with no clear visibility into where their project stands. [17] Inspection results, updated paperwork, and utility approvals don't always sync up neatly, and customers are rarely told where things stand. As NREL has noted, unclear and complicated interconnection standards increase distributed generation soft costs and delay deployment — in part because the absence of transparency creates uncertainty for every stakeholder involved in the approval chain. [18] This is the stage that most often gets described as a black box: progress is invisible, and no one seems to have a clear answer on timing.

Defining the Inactive System Gap

At the center of all this is what can be called the Inactive System Gap, the stretch of time between when installation is complete and when the system actually turns on. This isn't a technical problem. The system works. What's missing is clearance, the administrative, logistical, and coordination steps that have to be closed before the utility will authorize operation.

In New York City, that gap typically runs three to eight weeks, and sometimes longer depending on project complexity and scheduling conditions. During that entire period, the system sits idle, fully visible on the roof, producing nothing.[11]. That's where the perception problem starts. Customers see the panels go up and assume the job is done. When the system doesn't turn on, that expectation breaks immediately, and the longer the wait stretches, the harder it becomes to maintain confidence in the installer, or in solar more broadly.

Customer Experience Impact

The effects of the Inactive System Gap extend across financial, emotional, and operational dimensions. From a financial perspective, each inactive week represents unrealized savings. Research based on installer survey data found that the average residential PV process takes approximately 16 weeks from contract signature to permission to operate, meaning customers who planned around projected savings face an extended period of paying full utility bills while their system sits idle on the roof. [14] This delay in return on investment can be particularly frustrating for those who planned around projected savings.

Emotionally, the impact is often more pronounced. Customers may feel frustration over the lack of visible progress, uncertainty about system status, and concern about potential hidden issues. Trust, once established during the installation phase, begins to erode. Industry research confirms that neglected post-installation support consistently tarnishes installer reputations and erodes customer trust, and that nearly 30% of post-installation support inquiries involve issues outside the installer's direct control, yet customers still hold the installer responsible. [10] In some cases, this leads to increased complaints, negative reviews, and reduced willingness to recommend solar to others. [11]

Operationally, installers bear a significant burden. A survey of 136 small-to-large-scale solar installers found a volume-weighted average contract cancellation rate of 11%, with permitting delays and customer financial strain ranked as the top two drivers, and more than half of all respondents reported charging higher prices in jurisdictions with more burdensome permitting, inspection, and interconnection requirements to offset the added administrative costs. [14] Teams must manage a growing volume of status inquiries, coordinate reinspections, and navigate administrative follow-ups. This reactive workload diverts resources from new installations and process improvements, creating a cycle that can further exacerbate delays.

Closing the Gap: A Process-Driven Approach

Addressing the Inactive System Gap does not require new technology. Instead, it calls for improved alignment across processes, stakeholders, and communication channels. One of the most effective interventions begins before inspection even occurs. A brief pre-inspection self-review, as little as 30 minutes, can prevent reinspection cycles that otherwise delay a project by one to three weeks and add thousands of dollars in soft costs, since permitting-related expenses already average roughly $1.00 per watt on a typical residential system. [16] Strengthening pre-inspection quality assurance through internal reviews, standardized checklists, and proactive issue identification can significantly reduce the likelihood of reinspection.

Equally important is enhancing coordination across inspection workflows. NREL's analysis of the SolarAPP+ platform found that streamlined permitting and inspection coordination, through standardized documentation, automated compliance checks, and shared workflows between installers and authorities having jurisdiction, reduced full project timelines from permit submission to passed inspection by 31%, cutting nearly 14.5 days from the median process. [19] More structured scheduling practices, clearer documentation exchange, and shared expectations between stakeholders can help reduce friction and improve predictability without placing blame on any single entity.[19]

Transparency also plays a critical role. Research on proactive customer communication demonstrates that uncertainty breeds anxiety while information restores a sense of control — and that customers are far more tolerant of delays when they are kept informed. One retail business that implemented real-time status updates saw a 60% drop in customer inquiries, significantly reducing support costs and staff burden. [20] Providing customers with clear visibility into PTO status, including where their project stands, what steps remain, and expected timelines, transforms uncertainty into understanding. [20] Even when delays occur, informed customers are far more likely to remain patient and engaged.

Finally, communication must evolve from reactive to proactive. Industry data show that a homeowner is significantly more willing to accept extended wait times when expectations are set clearly upfront, and that frequent status updates, even when they report no change, make the waiting period feel measurably less frustrating. [21] Regular updates, clear timeline education, and dedicated support channels ensure that customers remain informed throughout the process. [21] In many cases, communication alone can significantly reduce perceived delays, even when actual timelines remain unchanged.

Conclusion

In sum, the post-installation phase of residential solar deployment reveals a critical, yet often underexamined, source of delay rooted not in technical execution but in procedural fragmentation. The convergence of inspection scheduling constraints, reinspection cycles, and opaque interconnection processes produces a systemic bottleneck that extends project timelines well beyond physical completion. This dynamic is encapsulated in the Inactive System Gap, a period during which fully functional systems remain non-operational due to administrative and coordination barriers rather than engineering deficiencies. Post-installation delays represent a structurally significant barrier to solar market development, operating not merely as a logistical inefficiency but as a direct determinant of customer perception and long-term adoption outcomes. [21] The Inactive System Gap identifies the interval between system installation and operationalization as a moment of acute vulnerability. One in which the divergence between projected and realized benefits shapes customer confidence in ways that persist beyond the delay itself.

Existing research substantiates the scale of this problem. The residential solar adoption process requires, on average, approximately 16 weeks from contract execution to system activation, with permitting, inspection, and interconnection procedures accounting for the majority of timeline variance. [11] These procedural delays carry consequences that extend beyond scheduling: they are empirically associated with elevated customer dissatisfaction and measurable increases in project cancellation rates, both of which constrain market growth and undermine the broader policy objectives underpinning solar incentive programs.[14]

The implications of this gap are multifaceted. Financially, it postpones anticipated returns on investment; emotionally, it erodes customer trust and satisfaction; and operationally, it imposes additional burdens on installers, diverting resources and increasing soft costs. Crucially, these effects are not isolated but interdependent, reinforcing a cycle of inefficiency and diminished stakeholder confidence.

However, the persistence of these bottlenecks does not imply intractability. Evidence suggests that targeted, process-oriented interventions—such as strengthened pre-inspection quality assurance, standardized permitting workflows, enhanced inter-agency coordination, and proactive customer communication—can substantially mitigate delays without requiring technological innovation. Rather, the path forward lies in improving transparency, aligning stakeholder expectations, and reducing informational asymmetries across the approval chain.

Attrition risk is further compounded by transparency deficits. When customers lack reliable information regarding delay causes and projected resolution timelines, the probability of investment reconsideration increases substantially. [14] This dynamic is not limited to the customer side of the market. Installers operating in jurisdictions with protracted approval workflows face diminished operational throughput, compressed margins, and, in some cases, selective withdrawal from those markets, outcomes that reduce competitive supply and further constrain consumer access.

Importantly, the interventions required to address these conditions are neither speculative nor structurally prohibitive. Targeted improvements to inspection scheduling, interconnection coordination, and customer-facing communication protocols have demonstrated measurable reductions in delay duration and associated attrition rates. Jurisdictions that have implemented such process reforms exhibit not only improved project timelines but also stronger indicators of sustained consumer trust. [11]. The core objective of closing the Inactive System Gap is the alignment of customer expectations with actual delivery performance. Installed solar infrastructure that remains inactive for extended periods represents both a failure of operational coordination and a missed opportunity to generate the financial and environmental returns that motivate residential adoption.[4] Reducing the duration and frequency of such gaps is therefore not a peripheral concern but a structural prerequisite for the continued and equitable expansion of solar energy adoption in New York and comparable markets.

Key Insight

The Inactive System Gap is not merely a timing issue - it is a perception gap. Closing it is essential to aligning customer expectations with real-world delivery and ensuring long-term confidence in solar adoption.

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