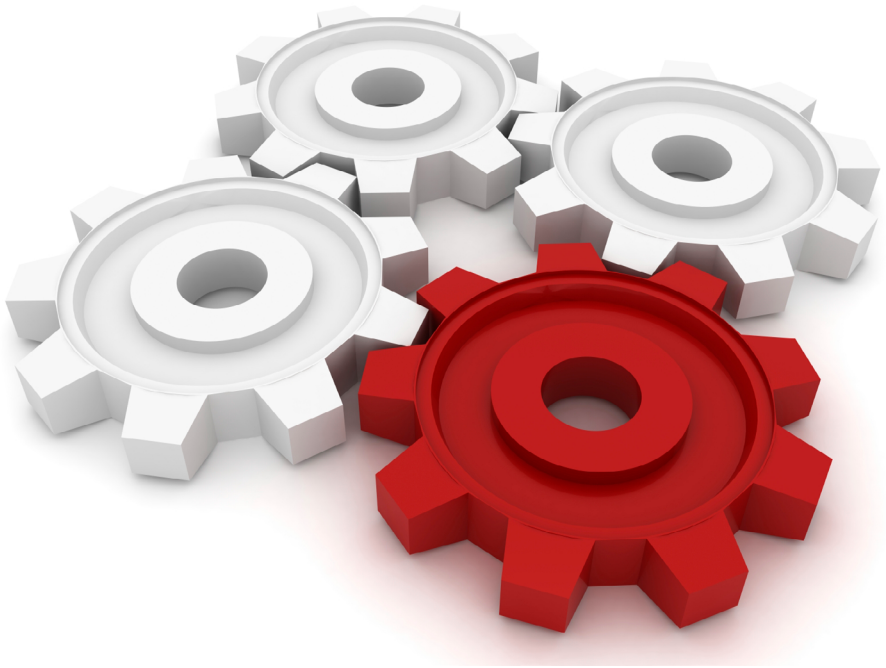
Minimizing Overlap in PV System Approval Processes

Case Studies and Analysis



October 2013

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IREC Interstate Renewable Energy Council

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About IREC

The Interstate Renewable Energy Council, Inc. ("IREC") enables greater use of clean energy in a sustainable way by (i) introducing regulatory policy innovations that empower consumers and support a transition to a sustainable energy future, (ii) removing technical constraints to distributed energy resource integration, and (iii) developing and coordinating national strategies and policy guidance to provide consistency on these policies centered on best practices and solid research. The scope of IREC's work includes updating interconnection processes to facilitate deployment of distributed energy resources under high deployment scenarios, incorporating distributed energy resource growth into utility distribution system planning and operations, and reducing the time and cost for local authorities to permit PV systems.

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Executive Summary

To develop a rooftop solar photovoltaic (PV) project successfully, installers must not only acquire customers and line up financing, but must then navigate multiple approval processes before a rooftop system is connected to the grid and operational. These processes include obtaining an interconnection agreement from the utility, securing a building/electrical permit from the local municipality, and, in some cases, obtaining historic district approval, enrolling in a net metering program, and applying for and obtaining state or local rebates and incentives.

Progress is being made in improving the efficiency of the review and approval processes in each of these individual areas. However, the Interstate Renewable Energy Council, Inc. (IREC) recognizes that exploring the overlap and synchronization of these different processes, in addition to their individual steps, may be key to continuing advancements in the reduction of soft costs for rooftop solar PV.

In this paper IREC examines the steps for obtaining each necessary approval for residential rooftop PV projects in four different markets in the United States to better understand the relationship between the different approval processes and the hitches in each. Through these case studies, and additional conversations with installers and approving authorities in other markets, IREC highlights the manner in which these processes are interrelated in different parts of the country. From this research, we identify how processes across the country could be better sequenced internally and externally to reduce redundancy and improve efficiency for both developers and authorities, while still achieving safe and reliable rooftop solar PV systems.

Section I introduces the need for increased cross-entity coordination and efficiency, and outlines the research strategy IREC used in developing the case studies and supporting analysis. Section II describes how the key processes necessary to obtain approval for rooftop solar systems commonly work across the United States. For each approval, it describes the purpose of the review process, the entities involved, how the typical process works and key variations. The section discusses the processes managed by local governments, including the issuance of building and electrical permits, as well as the zoning and design review process. It also looks at the processes managed by utilities, including obtaining an interconnection agreement and signing up for net metering. Finally, the section looks at how incentives and tax benefits are administered in the United States.

To get a complete look at how the approval processes work and interact with each other in various parts of the United States, in Section III IREC offers case studies covering the following markets: Broward County, Florida; Raleigh, North Carolina; Maui County, Hawaii; and White Plains, New York. Each case study analyzes the process of obtaining approval for grid-tied residential rooftop solar systems with capacities of 10 kilowatts (kW) or less. The case studies focus on the most common route for solar installers in each market by assuming the customer will use the existing net-metering program, apply for available rebates and tax incentives, use the permitting process in the jurisdiction specified, and seek to interconnect with the utility serving that jurisdiction. The case studies walk through the application, submittal and approval processes for each of these different requirements, and identify how the installer and different entities interact with

each other throughout. At the end of each case study the paper identifies key conclusions regarding the efficiency of the process in each market.

Section IV examines how solar installation companies manage their internal staffing in order to obtain the necessary approvals. This section demonstrates the impact that the order and flow of the approval processes can have on the number of staff solar companies employ and when they are able to make equipment purchases. It also shares how installers work to set realistic expectations for their customers about the duration and other aspects of the process of installing solar panels.

In Section V IREC offers some thoughts on the perspective of the different approval authorities: local governments, utilities and state-level bodies. The section identifies some of the challenges they face in processing applications for solar projects. It also looks at some of the factors that may influence the authorities' motivations behind improving the efficiency of their internal process and for coordinating with the other approval authorities.

Using the research gathered in the sections above, IREC takes a look at particular aspects of the approval process in Section VI and highlights those where there appears to be a particular need for greater efficiency. The section combines the installer perspective with that of the approval authorities in identifying areas where improvements might be helpful, and may reduce the costs of solar installations for customers and overseeing authorities. Each subsection covers a different approval process, and first looks at opportunities for improving overlap with the other approval processes and then identifies additional opportunities to increase the efficiency within just that process.

In the analysis in Section VI, IREC finds that there are a few key areas in each of the different approval processes that offer particular opportunities for internal streamlining and increased coordination across processes. First, IREC examines incentive approval processes, and highlights that programs that are administered by separate state bodies rather than directly by the utilities tend to create an additional layer of paperwork and oversight. This might be minimized if the utility were processing incentives at the same time as it was reviewing the interconnection and net metering applications. In addition, IREC finds that the boom-and-bust cycle of certain incentive programs has a significant impact not only on installers, but also on municipalities and utilities who may be flooded by applications during part of the year and need to alter staffing levels to prevent delays. Finally, IREC notes that the number of inspections required in some markets may be duplicative and cross-entity coordination between utilities, municipalities and incentive bodies might be able to narrow the number of times someone has to visit the site to verify system installation.

Looking at the role of municipalities, IREC finds that there continues to be considerable variation across the country in what forms and supporting materials are required for local permit applications. In addition to adopting standardized application forms, IREC suggests that jurisdictions should evaluate whether the additional supporting materials, and the submittal methods, are necessary. We also highlight how regional permitting reform collaborations may be a good vehicle to accomplish this streamlining while also helping to educate municipalities on what is required for a thorough but efficient review of solar systems. The zoning and design review processes, while not required everywhere, add significant uncertainty and delay. IREC recommends adopting clear design standards that minimize the need for individualized review and discretion.

Finally, IREC finds that overall the interconnection process for small PV systems is working fairly efficiently across the country, and is generally well coordinated with the approvals needed for net metering and, in some cases, utility-administered incentives. However, IREC looks ahead to the need to plan for additional coordination as penetrations of distributed generation increase and small systems begin to require greater review, as highlighted in the case study of Maui County. We also discuss finding a simpler way to eliminate the installer's role as a middle-man between the municipality and utility when it comes to informing the utility that the final building permit has been approved.

By taking a close look four specific markets, this paper enables the reader to get a full understanding of the many steps involved in installing a rooftop PV system in the United States and where there may be need for reform. IREC identifies those areas where there is a particular opportunity for increased efficiency. These are just some of the opportunities available, but they all require that there be more communication between municipalities, utilities, state-level entities and installers. Increasing communication and finding ways of sharing responsibility can reduce the drain on each entity's resources while also boosting economic activity and creating a more ecologically sustainable energy future for our communities.

I. Introduction

To develop a rooftop solar photovoltaic (PV) project successfully, installers not only must acquire customers and line up financing, but then must navigate multiple approval processes before a rooftop system is connected to the grid and operational. These processes include obtaining an interconnection agreement from the utility, securing an electrical permit from the local municipality, enrolling in a net metering program, and, in some cases, obtaining historic district approval, and applying for and obtaining state or local rebates and incentives for their customers.

Considerable attention has been paid in the last few years to the soft costs associated with the local permitting and interconnection processes.[1] While progress is being made in each of these areas, Interstate Renewable Energy Council, Inc. (IREC) recognizes that exploring the overlap and synchronization of these different processes, in addition to their individual steps, may be key to continuing advancements in the reduction of soft costs for rooftop solar PV. In many ways, each approving authority looks at a similar set of criteria when deciding whether to approve a project. However, the overseeing authority usually differs for each necessary approval, and in most cases, the authorities do not have a history of coordinating with each other. And yet, the authorities often rely upon proof of at least one other authority's approval before granting the permit, agreement or other necessary authorization. This duplication and lack of synchronization may increase the workload for both solar installers and the approving authorities.

The challenge of coordinating approvals is also burdensome for commercial and ground-mounted projects, but the overall cost impact may be more significant for rooftop projects.[2] Residential rooftop projects generally operate on smaller margins and within more compressed time frames. In addition, there are unique challenges associated with the customer expectations for residential rooftop projects. As a result, delays may significantly impact customer relationships. For example, it is not uncommon for a residential customer to have her system fully installed on her roof but be unable to energize it for weeks as a result of delays in the inspection process of the utility and/or the local jurisdiction. Customers often hold their installer accountable for these delays, even if it is outside of the installer's control.

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1 *See* U.S. Department of Energy, SunShot Initiative, Reducing Non-Hardware Costs, *available at* http://www1.eere.energy.gov/solar/sunshot/nonhardware_costs.html (last updated Feb. 7, 2013); Kristen Ardani et al., National Renewable Energy Laboratory (NREL), *Benchmarking Non-Hardware Balance of System (Soft) Costs for U.S. Photovoltaic Systems Using a Data-Driven Analysis from PV Installer Survey Results* at 6-8 (Nov. 2012) *available at* http://www.nrel.gov/docs/fy13osti/56806.pdf ("The estimated labor costs associated with completing these PII procedures totaled $0.13/W on average. Most installers reported total PII labor per installation within the range of 15–25 hours, or $0.08/W–$0.15/W. The two largest - volume installers (with more than 1,000 annual installations) reported approximately 20 total PII labor hours, indicating no definitive economies of scale between PII processing times and installer volume.").

2 Ardani, *supra* note 1, at 18-20 (comparing the total impact of permitting, inspection and interconnection costs for residential and commercial projects).

To further explore the relationship between the different approval processes, and the hitches in each, IREC has examined the steps for obtaining approval for residential rooftop PV projects in four different markets in the United States. We reviewed the processes in Broward County, Florida; Raleigh, North Carolina; Maui County, Hawaii; and White Plains, New York. Through these case studies, and additional conversations with installers and permitting authorities across the country,[3] IREC has been able to get a clearer understanding of the interrelationship between the processes. We have identified some general concepts about how those processes could be better sequenced internally and externally to reduce redundancy and improve efficiency for both developers and authorities, while still achieving safe and reliable rooftop solar PV systems.

In identifying the markets in which to conduct the case studies, IREC considered a number of factors. We strove for geographic diversity and attempted to look at markets that have not been as extensively analyzed elsewhere. The case studies highlight markets with Investor-Owned Utilities (IOUs) as they cover more customers in America, however, we will touch on how municipal utilities may have an easier time streamlining the interconnection, incentive and building permit approval process as a result of having one centralized authority in control of the processes. Most of the jurisdictions in the markets examined have already begun to streamline their permitting processes to some extent, although none cite to particular advancements in cross-authority coordination.

In each market, IREC began by researching what was available online and in other publications about the various approval processes. Following this exploration, IREC conducted numerous phone calls with municipal staff, utility personnel, installers and others active in the market. In each case, IREC attempts to describe how the processes are intended to work according to official documents and how they actually work in practice, which may be different. In some cases, it was hard to obtain a clear picture of how certain actions are carried out. The intent of the write up of these case studies is not to provide a definitive guide on how to obtain approvals in each jurisdiction, but rather to get a sense of the overall number of steps and flow of each process.

The goal of this effort was to examine four examples of typical approval processes, along with interviews with installers in other parts of the United States, to gain a broader perspective on installers' experiences coordinating the multiple approvals needed for a successful project. This paper analyzes the issues that arose most often in our discussions and identifies the inefficiencies that stood out. While our focus was on examining the synchronization of the different approvals, we also came to a number of conclusions about aspects of each individual process that could be addressed. The conclusions and recommendations at the end of this paper may not be applicable to every market, but should provide some context on what areas might be worth addressing in many markets.

The paper is organized as follows: Section II describes how the key processes necessary to obtain approval for rooftop solar systems generally work across the United

[3] Telephone and email interviews with installers David Kozin (A&R Solar, Seattle, Washington), Pamela Burton (Puget Sound Solar, Seattle, Washington), Lisa Albrecht (Solar Services, Inc., Niles, Illinois), Joy Seitz (American Solar, Phoenix, Arizona), and Anonymous (Cape Cod, Massachusetts) were conducted by Kathleen Kapla during Aug., 2013.

States, and identifies the typical overlaps and problems. With this foundation, Section III outlines the process of obtaining all the necessary approvals for a rooftop PV system in each of the four case study areas. Section IV examines how installers manage their internal staffing in order to obtain the necessary approvals and also looks at how companies manage customer expectations throughout the process. Section V offers some perspectives of the different permitting authorities. Section VI reviews the most common issues for installers, compares the experiences across the various markets we reviewed, and identifies possible ways of improving these problem areas. Finally, the conclusion summarizes the paper's key findings and makes some recommendations for policy makers as the nation continues to expand opportunities for customer-sited PV.

II. Overview Of Key Processes

In the course of designing and installing a rooftop solar system, an installer must undertake a number of application and review processes. The details of these processes, including their timing with respect to each other, vary on a state-by-state (and sometimes municipal) basis. At a high level, however, the path to getting a solar system up and running involve the same basic components.

In this section, we review the common key steps an installer must take: (1) applying for all necessary local permits and approvals, including electrical, building, zoning, and design, each where applicable; (2) applying for interconnection with the applicable utility; (3) applying for net metering; and (4) applying for solar installation or operation incentives. We discuss each process's purpose, and the entities that control or are involved in the process. We then describe the typical components of the process and, to the extent possible, the types of variations that may occur across the country.

A. Local Permitting

At the local level, municipalities can require a variety of permits, depending on their particular local processes. Here we focus on the two local steps most common to rooftop solar systems nationwide: the building/electrical permit and zoning/design review.

1. Building/Electrical Permit

Purpose: The permitting process acts as a mechanism to notice and inform a municipality about a planned installation so that it can ensure that the project complies with public health, safety and design standards. Although we use the term "building permit" here, receiving such a permit usually involves review under existing building, electrical, fire and/or plumbing codes and separate applications may be needed for each. In most cases, although not all, statewide codes apply to solar installations. Often municipalities have the ability to make some modifications to the code at the local level, but for the most part, the underlying technical requirements are highly consistent across the country.

Entities Involved: A local government entity, usually either the city or county government, typically controls permitting.[4] Depending on the local government's structure, the permit review process may involve one or more departments, such as the building department and the local fire marshal, and one or more entities within those departments, such as the plan reviewers and inspectors.

Typical Process: At a high level, the basic process for obtaining a permit is relatively similar across jurisdictions. Before the process begins, some municipalities provide resources for permitting applicants. These may include the permit application form, and checklists or other guidance documents for undertaking the permitting process.[5] In other cases, however, an installer must learn each municipality's process on her own. The process usually starts by submitting a permit application, which may be solar-specific or generic, along with other required documentation, including plans and certain diagrams. These applications usually are submitted in person at the building department office; however, municipalities are starting to allow submission online or via email.[6] Concurrent with the submittal of a permit application, the installer pays a permit fee. Although fees vary considerably across the country, the permit fee should be set at an amount that will allow the agency to recover the cost of reviewing and issuing the permit.[7] The building department then typically conducts a "plan check" and reviews the permit application to ensure that it complies with applicable code and other requirements. Once again, the time and complexity of each review process can vary by jurisdiction, ranging from a few hours to several weeks.

Once the building department completes its initial review, the applicant is given permission to begin construction of the project. Almost all municipalities require one or more field inspections of the project before the permit is final. Usually the installer is required to be onsite for the inspection, and even when not required, installers usually prefer to be there to answer any questions and resolve issues directly. The number of inspections required by each jurisdiction differs. Often jurisdictions require an "in process" or "rough-in" inspection that must occur before the solar panels are secured in place, as well as a "final" inspection.[8] Some jurisdictions require only the final inspection, and sometimes the installer must complete separate building and electrical, and even fire, inspections, rather than having those inspections completed simultaneously.[9]

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4 Herein we will generally use the term "municipality" to describe the cities, counties, special districts and other entities that may be responsible for solar permitting.

5 Posting materials online and having a clear description of the permitting process is one of IREC and Vote Solar's Residential Solar Permitting Best Practices. IREC, *Residential Solar Permitting Best Practices Explained* at 1 (Sept. 2013) [hereinafter *Best Practices Explained*] *available at* http://www.irecusa.org/wp-content/uploads/2013/09/expanded-best-practices.pdf; *See also* Sky Stanfield et al., IREC, *Sharing Success: Emerging Approaches to Efficient Rooftop Solar Permitting* at 20-24 (May 2012) [hereinafter *Sharing Success*] *available at* http://www.irecusa.org/wp-content/uploads/FINAL-Sharing-Success-w-cover-revised-final052012.pdf.

6 *See Sharing Success, supra* note 5 at 33-37; *Best Practices Explained, supra* note 5 at 2.

7 *See Sharing Success, supra* note 5 at 37-40.

8 *See Sharing Success, supra* note 5 at 40-44; *Best Practices Explained, supra* note 5 at 5-6.

9 *Best Practices Explained, supra* note 5 at 5-6 (Requiring no more than one inspection for typical systems is a Best Practice).

Final approval of a project and issuance of a permit does not occur until the inspection process is complete. The process for obtaining final approval also varies. Sometimes the inspector stamps the permit onsite after completing the inspection; in other cases the applicant must return to the building department to obtain the final signed permit, or wait to have it mailed, faxed, or emailed. If an online permitting system or email communication has not been adopted, installers sometimes must make three or more trips to the municipality's offices to complete the permit review process.

Although most municipal processes are comparable, local variations have resulted in a patchwork of permitting requirements and processes nationwide. In many cases, each jurisdiction has a unique application packet and set of procedures that an installer must follow, and installers must become familiar with each jurisdiction's requirements in the region in which they operate. This can be difficult and time-consuming, and can also lead installers to submit incomplete applications because they are not familiar with the nuances of each local process. In recent years, many municipalities have been working to streamline and otherwise improve their processes, sometimes based on models or other jurisdictions' processes, to make their processes more consistent with other municipalities in their region. IREC and the Vote Solar Initiative have identified nine Best Practices that help to identify key aspects of an efficient permitting process[10] and have produced a number of additional resources to aid municipalities in achieving those goals.[11]

2. Zoning and Design Review

Purpose: Though less typical, some municipalities require that solar PV systems undergo review to ensure the proposed installation is compatible with the requirements of the zoning code and in alignment with broader community planning goals, including those for the protection of design character or historic resources. For rooftop PV, this review usually focuses on aesthetic concerns. Many municipalities require such review only for the systems in unique areas, such as those located on historic buildings, in historic districts, or in special use areas.

Entities Involved: As with the building permit, zoning requirements and review is usually controlled by the city or county government. Zoning review also can involve one or more departments, such as the planning department and the local design review board. The state may also affect local zoning rules and processes. In particular, some states have passed Solar Rights Acts,[12] which can limit the ability of a municipality to require zoning

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10 *Best Practices Explained, supra* note 5.

11 For a full list of resources see the Permitting page on IREC's website: http://www.irecusa.org/regulatory-reform/permitting/. Vote Solar's Project Permit website also contains a permitting toolkit and scores jurisdictions on their achievement of the Best Practices: http://projectpermit.org/.

12 Colleen McCann Kettles, Solar America Board for Codes and Standards, *A Comprehensive Review of Solar Access Law in the United States: Suggested Standards for a Model Statute and Ordinance* at 1 (2008) *available at* http://www.solarabcs.org/about/publications/reports/solar-access/pdfs/Solaraccess-full.pdf.

or other design review for rooftop solar systems, although they sometimes allow restrictions for systems on historic buildings or in other unique design districts.

Typical Process: The review process for zoning is more variable across the country than it is for building permits. Most local governments allow rooftop solar as a permitted use in all zones, although special or additional review may be required for special use districts such as those designated for historic resources. In many cases, compliance with the zoning code is verified at the time the building permit application is filed. Where solar is not a permitted use, an installer must submit an application and any other necessary documentation to the municipality for a special use permit or for other requisite approval. Some jurisdictions require that all projects undergo design review. This process often requires presenting the applicant's project to a specially elected or appointed board that evaluates whether the project complies with the community's design standards.[13] Where required, this process generally adds days or weeks to the duration of the local permitting review and also creates more uncertainty where design standards are not clearly articulated. Restrictive design standards can require modification of the system or sometimes outright prohibit installation in certain locations.

B. Interconnection

Purpose: The interconnection process exists to ensure that new grid-connected generators do not impact the safety, reliability, and power quality of the operation of the distribution and transmission grid. It can also serve to allocate costs for any system upgrades required to accommodate an installation, although most residential rooftop solar installations are relatively small and do not require such upgrades.

Entities Involved: The serving utility and the state utility regulatory body are typically the primary entities involved in the interconnection process. In most states, the public utilities commission (or equivalent) that regulates the IOUs determines statewide interconnection procedures. Many of these procedures follow the model published by the Federal Energy Regulatory Commission,[14] but considerable variation exists across the country.[15] The IOUs in each state must implement the procedures adopted by the state. This results in procedures that are generally consistent across a state, though the manner in which each utility processes the applications internally still varies. In some cases, the state legislature may guide the development of these procedures via statute; however, in most cases, the regulatory body develops the interconnection details. In a

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13 *See* A. Kandt et al., National Renewable Energy Laboratories (NREL), *Implementing Solar PV Projects on Historic Buildings and in Historic Districts* at 4-6 (Sept. 2011) *available at* http://www.nrel.gov/docs/fy11osti/51297.pdf.

14 *See* Federal Energy Regulatory Commission (FERC), Standard Interconnection Agreements & Procedures for Small Generators, http://www.ferc.gov/industries/electric/indus-act/gi/small-gen.asp (last updated Aug. 13, 2013). FERC is currently considering an update to these procedures to help utilities better accommodate a growing number of small renewable energy systems. *See* FERC Notice of Proposed Rulemaking, Docket No. RM13-2-000 (Jan. 17, 2013) *available at* http://www.ferc.gov/whats-new/comm-meet/2013/011713/E-1.pdf.

15 For a summary of interconnection programs across the United States and a look at how they compare to each other, see IREC and the Vote Solar Initiative, *Freeing the Grid*, (Nov. 2012) [hereinafter *Freeing the Grid 2012*] *available at* http://freeingthegrid.org/.

few states, such as Arizona,[16] IOUs independently develop interconnection procedures and agreements. In addition, municipal utilities and cooperatives are generally not subject to the jurisdiction of the regulatory commission and therefore set their own interconnection procedures, which may or may not align with the statewide procedures.

In all cases, the utility is responsible for implementing the interconnection process and is the primary contact point for a solar installer. That is, the utility receives and reviews interconnection applications, and determines the requirements for the generator to interconnect to its system according to the procedures that it has adopted, as described in the following section.

Typical Process: In most cases, the installer or the customer must submit an interconnection application to the utility, which increasingly can be done online. The application usually provides certain basic information about the proposed installation, including its size and physical location, as well as an application fee. The utility typically segregates applications into certain "tracks" depending on their size, location and other characteristics. Many rooftop systems proceed through expedited interconnection review, sometimes called "Fast Track" review, because of their size (< 10 kW) and low impact on the utility's system. Many state procedures contain a specific application and simplified process for 10 kW and below inverter-based systems, such as solar PV.[17]

For Fast Track review, the utility usually evaluates the proposed installation using a series of technical screens intended to ensure that the proposed installation can interconnect without negatively affecting the grid or requiring upgrades to the utility's system. The typical Fast Track interconnection process is relatively quick—in many cases taking less than 30 days from start to finish—and requires minimal paperwork. In most parts of the country, where penetration of solar is relatively low, rooftop systems are usually able to pass through the Fast Track process without triggering upgrades. However, as penetration of solar increases across the country, more and more rooftop systems require additional review from the utility. [18] In most states, this additional review process can be quite lengthy and expensive, however, a few leading states have

[16] Although Arizona's utilities currently deal with interconnection independently, the Arizona Corporation Commission has opened a docket in which it is developing statewide interconnection guidelines, which will likely apply to all utilities once approved. For more information, see the Database of State Incentives for Renewables & Efficiency (DSIRE) *available at* www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=AZ09R&re=0&ee=0.

[17] Kevin Fox et al., National Renewable Energy Laboratories, *Updating Small Generator Interconnection Procedures for New Market Conditions* at 20-25 (Nov. 2012) [hereinafter *Updating Small Generator Interconnection Procedures*] available *at* www.nrel.gov/docs/fy13osti/56790.pdf (summarizing the basic 10 kW inverter process that many states use along with suggestions for possible improvements to that process that will help it remain effective as application volume grows and higher penetrations are reached).

[18] The specifics of the full interconnection study process will not be outlined here as it is still relatively uncommon for residential rooftop systems under 10 kW to necessitate full study. As penetration increases, however, this is likely to become more common and could delay project completion by months and render many residential projects unaffordable.

recently updated their procedures to create more opportunities for quick review of systems, even at higher penetrations.[19]

Once an installer completes the interconnection review and signs an interconnection agreement, the utility often requires an inspection, usually after the installer has provided proof that it has received its building permit or other local authorizations. Usually this utility inspection can be done without requiring that the installer be onsite. Only after the local government inspection and the utility's inspection can a system by energized.

Generally speaking, utilities adhere to a cost causation principle with respect to interconnection—an applicant must pay for any costs associated with interconnection that the applicant's system causes. In most states, interconnection applicants pay for the administrative costs of interconnection through their application fee, although a number of states waive such fees for smaller or net-metered systems. For the many rooftop systems that move through a Fast Track process, this is typically the only fee associated with interconnection because upgrades are usually not required. For systems that move through the more intensive study process, however, applicants must pay for the utility's study costs as well as any upgrades the utility's system requires to connect the applicant's proposed installation. Study fees are typically set in the interconnection procedures. Upgrade costs, however, are often not clear until after study has been completed and can sometimes be substantial. Some states, such as California and Florida, waive upgrade costs for net-metered installations.[20] The simultaneous importance and uncertainty of these costs can make the interconnection process difficult to manage from the installer's perspective. As noted above, however, rooftop systems typically do not require significant system upgrades and can proceed through expedited review. If a system does trigger significant upgrades, however, they will often render residential rooftop projects unaffordable.

While most interconnection processes adhere to this basic outline, the actual application and review procedures, and the timing of the entire process, can vary significantly. In addition to variances in state- and utility-adopted procedures, the details and timing of interconnection review can depend upon the location of a project—for example, whether it is on a circuit with a high number of other distributed renewable energy generation—the extent and cost of upgrades, and the internal efficiency of a particular utility's review

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19 *See* California Public Utilities Commission, *Decision Adopting Settlement Agreement Revising Distribution Level Interconnection Rules and Regulations*, Docket No. R.11-09-011, D.12-09-018 (Sept. 20, 2012) *available at* http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M028/K168/28168335.pdf; Massachusetts Department of Public Utilities, *Order on the Distributed Generation Working Group's Redlined Tariff and Non-Tariff Recommendations*, D.P.U. 11-75-E (Mar. 13, 2013) *available at* http://www.env.state.ma.us/dpu/docs/electric/11-75/11-75-Filing-1809.pdf; Hawaii Public Utilities Commission, *Reliability Standards Working Group Independent Facilitator's Submittal and Final Report*, Docket No. 2011-0206, Attachment 4, PV-DG Subgroup Report (Mar. 25, 2013).

20 For more detail on California interconnection procedures, see www.cpuc.ca.gov/PUC/energy/Procurement/LTPP/rule21.htm. For more detail on Florida's order on interconnection and net metering see Florida Public Service Commission, Order No. PSC-08-0161-FOF-EI, at 3-4, available at http://www.fpl.com/residential/savings/pdf/interconnection_and_net_metering_rule.pdf.

process. In a number of states with strong distributed solar markets, such as Hawaii and California, utilities are facing backlogs in their interconnection procedures. In some cases, this has slowed the process considerably, and has driven utilities and their regulators to investigate ways to make interconnection procedures more efficient.[21]

C. Net Metering

Purpose: In 2012, 93 percent of distributed PV installations (both residential and commercial) were net-metered.[22] Net metering allows a renewable customer's electric meter to "spin backwards" as the customer generates energy, reducing that customer's demand for electricity from the utility. If a customer requires more energy than the system produces (for example, at night), then the customer purchases that energy from the utility. If the customer's system produces more energy than the customer needs (for example, in the middle of the day), the utility provides the customer with net metering credits, usually at the customer's regular retail rate, which the customer can use to lower its bill. This program enables a customer to avoid using battery back up for its system.

Entities Involved: The primary entity involved in the net metering process is usually the serving utility, though the net metering program is often mandated at a statewide level. In many cases, the utility coordinates its net metering and interconnection application processes fairly closely.

As with interconnection, the state regulatory commission may specify certain net-metering program requirements, at least for the IOUs and any other utility over which it has jurisdiction. These may be affected by state legislation and may include: eligible technologies; eligible customer types; a net-metered system capacity limit; an aggregate net metering program capacity limit; the treatment of monthly and yearly net excess generation; and ownership of any Renewable Energy Credits (RECs). Though not all states offer net metering, those that do include in their programs net metering of residential solar PV systems. However, some states are nearing their overall net metering program capacity limits.[23]

Typical Process: The precise rules and processes for net metering vary state-by-state and sometimes utility-by-utility. At a high level, however, the process is similar. First, a customer or installer must apply for net metering with the serving utility. Usually a utility requires the submission of a net energy metering (or "NEM") application form and/or an agreement, which may be the same as the interconnection application and agreement, or may be a separate set of forms. The utility may also require other documentation, such as a site diagram, a copy of the customer's most recent electricity bill, and

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21 A recent report published by the National Renewable Energy Laboratories outlines some interconnection procedure improvements that may help utilities handle the increased volume of applications: *Updating Small Generator Interconnection Procedures, supra* note 17.

22 Larry Sherwood, IREC, *U.S. Solar Market Trends: 2012* at 11 (July 2013) [hereinafter *Solar Market Trends*] *available at* www.irecusa.org/wp-content/uploads/2013/07/Solar-Report-Final-July-2013-1.pdf.

23 For a summary of net metering programs across the United States and a look at how they compare to each other, see *Freeing the Grid 2012*, *supra* note 15.

potentially a building permit. In some cases, the utility will need to install a new bi-directional meter, which can often take weeks and may include an additional fee. At this point, the proposed installation generally proceeds through the interconnection process and the system may only start net metering once it has received final approval to interconnect from the utility.

Similar to the interconnection process, states and utilities in strong distributed solar markets are beginning to develop ways to manage the increasing numbers of net-metering applications. In particular, states with net metering program caps have faced pressure to provide information to solar installers and their customers regarding the capacity left under the cap for new applications at any given time. Some utilities simply post this information on web sites whereas some states have come up with more comprehensive management systems.[24]

D. Incentives and Tax Benefits

Purpose: At the federal, state and local levels, governments and other entities have prioritized encouraging rooftop solar installations to varying degrees and have set-up tax credit and incentive programs to allocate public funding toward this goal. The process for awarding incentives is intended to ensure that a particular installation meets the requirement of a given incentive program. Incentives generally fall within two categories: cash that can be applied towards the cost of the system and various tax credits and exemptions.[25]

Entities Involved: Federal, state and local governmental entities can be involved in the incentive process. In some cases, semi- or non-governmental entities run these programs on behalf of the state. In addition, some utilities also run incentive programs, and applications for these may be coordinated, at least to some extent, with their interconnection and net metering programs. A particular installation may be eligible and apply for multiple incentives from multiple entities. The state tax authority generally administers state tax credits, though the local assessor's office may become involved with property tax exemptions. The United States Internal Revenue Service manages the federal tax credit for residential rooftop systems.

Typical Process: While the precise requirements vary by incentive program, an incentive application typically requires information about the PV system similar to that requested in the building permit and interconnection applications. Some programs will require additional action up front, such as the California Solar Initiative (CSI) and many other states programs, which require an energy efficiency audit.[26] Depending on the program,

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[24] Massachusetts' System of Assurance, run by a third-party administrator, is perhaps the most sophisticated current example of a state's management of its net metering queue. *See* Massachusetts System of Assurance of Net Metering Eligibility, *available at* www.massaca.org (last updated Sept. 24, 2013).

[25] DSIRE provides detailed information on incentives available in each state, *available at* http://www.dsireusa.org/.

[26] *See* CSI, Step 1: Energy Efficiency Audit, *available at* www.gosolarcalifornia.ca.gov/csi/step1.php.

incentives may be disbursed before installation and interconnection (e.g., grants, loans, and certain rebates) or afterward (e.g., other rebates, tax incentives, or performance-based incentives). Some incentive programs, such as the Standard Offer PV Program Incentives from the New York State Energy Research and Development Authority (NYSERDA), may also require an inspection to ensure that the installed system meets the program requirements.[27]

III. The Case Studies

To get a complete look at how the approval processes work and interact with each other in various parts of the United States, IREC offers four case studies. In some instances, information was readily available, and in others, obtaining specific information on the timing, necessary documents and other aspects of the process proved challenging. We present these case studies to encourage conversation amongst municipalities, utilities, and state bodies as they evaluate ways to increase renewable energy use in the United States while minimizing the impact to public agencies.

In each case, we analyze the process of obtaining approval for grid-tied residential rooftop systems at or below 10 kW. Though there might be a variety of incentive programs or procurement opportunities available in each state, the case studies focus on the most common route for solar installers in each market. We assume the customer will use the existing net-metering program, apply for available rebates and tax incentives, use the permitting process in the jurisdiction specified, and seek to interconnect with the utility serving that jurisdiction. In all four of the case study states, various tax incentives are available as well. We found that the process for obtaining the credits or exemptions was generally consistent and did not delay the overall installation process, so those incentives are not discussed in detail below although they can be an important part of financing PV systems.

A. Broward County, Florida[28]

Florida is not among the 10 states with the most installed grid-tied PV capacity.[29] It has established a favorable net-metering policy, but its interconnection procedures receive a poor rating under the Freeing the Grid criteria.[30] The state has not established a

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27 *See* NYSERDA, Solar Technologies: NYSERDA Standard Offer PV Program Incentives (for systems 200 kW and smaller), *available at* www.nyserda.ny.gov/BusinessAreas/Energy-Efficiency-and-Renewable-Programs/Renewables/Solar-Technologies.aspx (last updated Aug. 15, 2013).

28 The information provided in this case study was compiled through the following communications: Phone and email communication with Mike Vergona Jr., VB Engineering (Aug. 2013); phone and email communication with Jake Fields, Advance Solar (Aug. 2013); phone and email communication with Ed Strobel, Sunshine Solar Services (Aug. 2013); phone conversations with FPL net-metering representative (Aug. 2013); email communication with Jeff Halsey, Director, Pollution Prevention, Remediation and Air Quality Division, Broward County (Aug. 2013).

29 *Solar Market Trends 2012*, *supra* note 22 at 13.

30 Freeing the Grid 2012, *supra* note 15, Florida.

renewable portfolio standard (RPS) or a solar mandate. In the service territories of the state's IOUs, the growth of smaller PV systems has been driven largely by erratic rebate programs, although some of the municipal utilities have relatively strong programs. The State's average residential retail electricity rate (11.3¢/kWh) is approximately 10 percent below the national average.[31]

1. Building Permits and Inspections

PV installations may follow one of two permitting paths in unincorporated Broward County. The first is the use of "Go SOLAR," an online permitting system.[32] The second is the traditional permitting processes for filing building and electrical permit applications with the County.

The Go SOLAR system is a collaboration of 11 jurisdictions in Broward County that embrace a single permitting process for smaller rooftop PV systems. To use the system, contractors must first register online and be preapproved. Go SOLAR is a fully electronic process where applicants choose from pre-approved and pre-engineered solar-installation designs, and then apply for permits using those designs through an online portal.[33] Broward County estimates that the approval process takes approximately 30 minutes for applications submitted through the Go SOLAR system. After approval, the online portal auto-generates an email message to FPL, notifying the utility of the issuance of relevant permits.[34]

While Go SOLAR holds promise for streamlining the permitting process in Broward County, as of writing no applications have yet been submitted via the online permitting system. There are several potential reasons for the under-use of the system. First, Go SOLAR has accepted online applications only since January 2013. Second, the peak season for solar installations in Broward County commences in October, after FPL offers new annual funding under its PV rebate program. Lastly, some installers in Broward County have indicated that they are content with their own internal processes and are not interested in learning to navigate a new system or to take the required additional steps to become registered contractors via Go SOLAR.

Under the traditional process, the application packet for an electrical permit requires two complete sets of building plans that include a riser diagram and load calculations. These must be submitted in-person to Broward County for review. When a complete application packet has been reviewed—a process that takes on average between 1.5 and six

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31 U.S. Energy Information Administration, *Electric Power Monthly*, Table 5.6.A (June 2013) [hereinafter *Electric Power Monthly, June 2013*] *available at* http://www.eia.gov/electricity/monthly/current_year/june2013.pdf.

32 Broward County, Go SOLAR website, *available at* http://www.broward.org/GoGreen/GoSOLAR/Pages/Default.aspx.

33 *Id.*

34 Broward County, *Go SOLAR Online Permitting System: A Guide for Partner Agencies* at 18 (Nov. 2012) *available at* www.broward.org/GoGreen/GoSOLAR/Documents/HowToUseGoSOLAR%20-%20PartnerADA.doc.

business days, but might take up to 15 business days—Broward County informs the installer that the permits are ready for issue. The installer must come and pick up the permits in person.

In most cases, a notarized Notice of Commencement is also required by Florida law, and must be recorded at the Broward County Records, Tax and Treasury Division prior to construction.[35] A certified copy or affidavit confirming the notice has been recorded must be submitted to the County, and a second copy must be posted at the construction site. Though this Notice may be mailed to the department, it is usually delivered in person.

After permits are issued and system construction has commenced, the inspection process begins. In total, five separate inspections are required. There are two structural inspections required: the progress inspection and the final inspection. Coinciding with the structural inspections are three required electrical inspections: the rack-grounding inspections, the rough-in inspection, and the final inspection. The inspections are individually scheduled by the installer using the online system or by calling for an inspection request. Inspections are generally completed within 24 hours of a request and installers are not required to be, but are typically, present for each inspection. Broward County will send email notification to FPL after a PV system passes the final inspection process.

2. Incentives, Interconnection and Net Metering[36]

The Florida Public Service Commission (PSC) has established interconnection procedures that include a simplified process for inverter-based systems up to 10 kW.[37] These procedures, which apply to the State's IOUs, also provide for net metering. FPL's residential PV rebate program ties together the three separate but related goals of interconnection, net metering, and obtaining a rebate.

FPL's five-year pilot residential PV program offers a one-time rebate of $2.00/W, with a maximum award of $20,000.[38] However, this program is cyclical and supports a limited number of PV installations per year. When the annual application window opens, the program can be fully subscribed in less than one day. As a result, the program has created severe "boom and bust" cycles of PV installations in FPL's service territory;

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35 Broward County, Permitting Process website, *available at* http://www.broward.org/PERMITTINGANDLICENSING/BUILDINGZONING/Pages/PermitProcess.aspx (last visited Aug. 25, 2013).

36 In addition to the FPL rebate, Florida has established a sales tax exemption that applies to PV, which is administered by the Florida Department of Revenue. The incentive is provided at point of sale. In addition, residential PV systems are eligible for a property-tax exclusion for assessments conducted after January 1, 2014. Fla. Stat. §§ 212.02(26), 212.08(7)(hh) (2013); 2013 Fla. Laws 77 (codified as Fla. Stat. § 193.624 (2013)) *available at* http://laws.flrules.org/2013/77.

37 Florida Public Service Commission, *Notice of Adoption of Rule 25-6.065*, Order No. PSC-08-0161-FOF-EI [hereinafter *Fla. Interconnection and Net Metering Rule*] at 3-4, *available at* http://www.fpl.com/residential/savings/pdf/interconnection_and_net_metering_rule.pdf.

38 Florida Power and Light Company, Residential PV Rebate, *available at* http://www.fpl.com/landing/solar_rebate/residential_pv.shtml (last visited Sept. 27, 2013).

these cycles strain the resources of PV installers, who have difficulty operating year-round. However, the annual influx of permitting applications that coincides with the re-opening of FPL's rebate program has not had a major impact on Broward County's permitting office, and the Go SOLAR program expects to be able to accommodate any permitting rush.

To install a small residential PV system under FPL's residential PV rebate program, the applicant first submits a rebate application via an FPL web portal. Within three business days, FPL accepts or rejects via email the application and provides successful applicants with a rebate reservation notice. Once the applicant has received its reservation notice and building/electrical permit, it may commence system construction. FPL reserves the right to conduct a pre-installation verification of the proposed installation site. The system must be installed within 90 days of rebate approval.[39] This creates an overarching timeframe for the installation process.

The applicant must also submit an interconnection application to FPL via email. It is our understanding that this happens after construction has begun for rebate program participants. Unlike many interconnection procedures, as described in Section II, the PSC's procedures do not include technical screens. Rather, the PSC's order simply requires FPL to interconnect systems of 10 kW or less, without any fees or charges, as long as the system does not exceed 90 percent of the customer's utility distribution service rating and meets certain basic design parameters.[40] Pursuant to these rules, once FPL has received the interconnection application, it must notify the applicant within 10 business days to indicate if the application is complete. FPL must complete its interconnection review within 30 calendar days of receipt of a complete application and return a signed copy of the interconnection agreement to the applicant. The applicant must sign the interconnection agreement and return it to FPL at least 30 days before operations, and within a year of receiving the agreement from FPL. FPL must complete any inspection within 30 days of receipt of the signed agreement unless the applicant requests a delay.

After the system is installed and successfully inspected by Broward County, the applicant submits by email or mail to FPL the Rebate Certificate, a signed purchase agreement for the PV system, the anticipated annual electric production of the proposed system, digital photos of the installation and panel nameplate(s), a copy of the contractor's invoice, a completed interconnection agreement and net-metering application, and a copy of the final passed permit by the local permitting authority, the date of issuance of which must be after the rebate reservation date.[41] FPL typically makes a site visit to verify the installation.[42] It then notifies the applicant when all documentation is approved and the final rebate amount is confirmed. FPL installs a new meter within 30 days (actual installation timeframes are usually closer to one or two

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39 Florida Power and Light Company, *Residential Photovoltaic Pilot Program Standards* [hereinafter *FPL Pilot Program Standards*] at 3, *available at* http://www.fpl.com/landing/solar_rebate/pdf/PV_Residential_Standards.pdf.

40 *Fla. Interconnection and Net Metering Rule, supra* note 37, at 3-4.

41 *FPL Pilot Program Standards, supra* note 39, at 4.

42 *Id.*

weeks), and the system may then be commissioned. The applicant receives the rebate check from DEP within six to eight weeks of final approval from FPL.

3. Summary

The approval process for solar systems in Broward County has some strong points as well as a number of areas that could use improvement to make the process more efficient. If applicants choose to use the Go SOLAR program, they eliminate at least two out of the three trips to the city offices, and get permit approval within one day. Applicants who use the traditional permit process, on the other hand, must make a minimum of two trips to the city offices, and wait 7 to 15 days for permit approval. Under either process, the number of inspections is significant, and could create stop-and-start workflow for installers who must repeatedly schedule inspections and wait for inspectors. This many inspections also increase the municipalities' costs for reviewing solar systems. The automatic electronic communication between Broward County and FPL is a benefit to installers and helps remove one step in the process.

For applicants proceeding under the FPL rebate program, it is convenient that all applications can be filed online and that the program is relatively coordinated. However, since FPL processes the interconnection, net metering and rebate applications, the utility might simplify the process by combining all applications into a single application, thereby limiting the submittals an installer must make and FPL has to process. The timing of the local permitting process and the FPL process do not appear to create unnecessary delays.

B. Maui County, Hawaii[43]

Hawaii has a very strong PV market, and for good reason: the state's average residential retail electricity rate (37.0¢/kWh), approximately three times the national average, is easily the highest among all U.S. states, which makes installing solar very competitive.[44] Hawaii ranked seventh among U.S. states in total grid-tied PV capacity installed in 2012 (114 MW) and ninth in cumulative grid-tied PV capacity installed through the end of 2012 (199 MW).[45] Hawaii has an aggressive RPS, offers a robust tax credit that supports residential PV, and also has favorable interconnection procedures and net-metering policy.

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[43] The information provided in this case study was compiled through the following communications: phone and email communications with Steve Rymsha, MECO, (Aug. 2013); phone and email communications with Greg Nakao, Electrical Engineer, County of Maui (Aug. and Sept. 2013); phone and email communications with Brad Albert, Owner, Rising Sun Solar (Aug. 2013); phone and email communications with Elaine Van Patten, Permit and Inspections Coordinator, SolarCity (Aug. 2013).

[44] *Electric Power Monthly, June 2013*, *supra* note 31, Table 5.6.A.

[45] *Solar Market Trends 2012*, *supra* note 22 at 12-13.

1. Building Permits and Inspections

Residential solar PV systems in Maui County must apply for both a building and an electrical permit, although the building permit requirement is waived as long as an engineer or an architect can attest to the roof structure supporting the weight of the installation. Building permit applications are available for download from the municipal website; however, electrical permits must be picked up in person or mailed to the applicant. Electrical permit application packets must be submitted in person, and include one set of project drawings, relevant application forms, a letter, and related forms from an architect or structural engineer licensed in the State of Hawaii verifying that the roof assembly is structurally adequate to support the photovoltaic system, and an interconnection pre-approval letter from Maui Electric Company (MECO). Depending on the project scope and size, the county may require that the project drawings be stamped and signed by a State of Hawaii licensed Electrical Engineer.

The Maui County permitting office may take up to 30 days to review applications for small-scale PV systems. However, County staff state that applications for rooftop PV are typically approved much faster than this maximum amount of time permissible.[46] Once permits are issued to the applicant, they may be picked up at the County offices. The applicant then may commence construction and schedule inspections. Requests for inspections must be submitted at least 24 hours before the inspection is needed. Rough-in and final electrical inspections are required.[47] Installers are not required to be on-site for the inspections, though in practice they often are. Inspection results are noted on the bottom of the request form, and are mailed or faxed back to the electrical contractor. Although MECO staff members are able to verify County inspection approvals by checking the permit inspection history at the County website online, MECO still requires the applicant convey the inspection results directly to MECO.

2. Incentives, Interconnection and Net Metering[48]

The Hawaii Public Utilities Commission (PUC) regulates interconnection procedures and net metering in the state. The procedures for the interconnection of net-metered systems are described in Rule No. 18. These procedures contain a simplified process for inverter-based systems up to 10 kW that enables installers to combine the application and approval process for interconnection and net metering. Since there is no direct rebate program in Maui, rebate applications do not interfere with the other approvals needed.

The distribution grid in Hawaii is approaching unprecedented levels of penetration. Latest estimates indicate that of 132 circuits on Maui, all of the daytime power demands

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46 *Id.*

47 County of Maui, *Hawaii Permit Requirements for Photovoltaic Systems, Wind Turbines and Windmills* (effective Jan. 1, 2009) *available at* http://www.co.maui.hi.us/documents/20/81/83/Permit_Req_For_PhotovoltaicSystems_WindTurbines_Windmills_Dec2009.PDF.

48 Hawaii offers a tax credit equal to 35% of PV system costs, including installation and accessories. For single-family homes, the maximum credit is $5,000 per system. One credit may be claimed for each 5-kW system. Haw. Rev. Stat. §235-12.5.

on 26 of those circuits are supplied by solar energy.[49] Both MECO and state regulators are mindful of addressing potential engineering challenges related to the addition of more PV systems to an electric grid that is becoming increasingly "crowded" in some areas, but it nonetheless is having an impact on the market in those areas.[50] These penetration levels have a significant impact on the duration and expense associated with the interconnection process, even for small rooftop systems.

To interconnect a small residential PV system in MECO's service territory,[51] the applicant first submits an application package that includes a net-metering application; a net-metering agreement; a single-line diagram; equipment manufacturers' specification sheets; and an Inverter Setting Confirmation Form.[52] The application package must be submitted to MECO by mail or in person. Within 15 business days of receiving the application package, MECO informs the applicant whether the application package is complete. Within 15 business days of informing the applicant that the application is complete, MECO performs a technical review and informs the applicant in writing whether the system has passed or failed the review. If the proposed system fails technical review, MECO offers to conduct a supplemental review[53] at its own expense.

If the proposed system passes MECO's technical review, MECO will "pre-approve" the proposed system and notify the applicant via mail or email that the project is accepted. The applicant must provide this pre-approval to Maui County via mail or in person in order to apply for an electrical permit. Once the system has been installed and inspected by Maui County, the installer conveys the county permit number to MECO. Within 10 business days of receiving confirmation of approval by Maui County, MECO conducts an inspection of the system. The installer does not need to be present during MECO's inspection of the system. Within five business days of MECO's inspection, the net-metering agreement is executed. Within 10 business days of executing the net-metering agreement, MECO installs a new meter, and the system may then be commissioned. The applicant must complete system installation within 12 months of receiving pre-approval notification from MECO. The installer must submit all documents to MECO in person or by mail.

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49 Alan Yonan Jr., *Solar Saturation Could Mean New HECO Charges*, Honolulu Star Advertiser (Sept. 6, 2013) *available at* http://www.staradvertiser.com/s?action=login&f=y&id=222652251&id=222652251.

50 MECO provides on its website maps showing highly penetrated circuits. Applicants may submit a "Circuit Penetration Inquiry" via email in order to determine the capacity available for a proposed system. Results are provided within three to five business days.

51 Prior to submitting an application package, the appliance may first submit a Circuit Penetration Inquiry via email to MECO in order to determine the capacity available for potential distributed-generation systems interconnected at a specific location. MECO will provide the results within three to five business days of the inquiry.

52 Maui Electric Company, *Procedures for net energy metering systems 10kW and less* (May 1, 2012) *available at* http://www.hawaiianelectric.com/vcmcontent/MECO/RenewableEnergy/Procedure%20for%2010kW%20and%20less%20for%20cntr%20and%20cust%20appr%20web.pdf.

53 A supplemental study is generally required if aggregate distributed-generation penetration on a distribution feeder is 15% or greater of peak load.

While Rule 18 requires MECO follow the procedures and timelines noted above, the high penetration of distributed PV resources on the MECO distribution system in recent years has limited significantly the number of systems that can take advantage of expedited procedures. This situation has resulted in many projects requiring an Interconnection Requirements Study under Rule 14H, which can take several months to complete and burden small projects, including net metered projects, with uneconomic requirements to pay for upgrades to the distribution system. This backlog exists despite MECO's implementation of a "NEM Express" program to allow a greater number of projects to use expedited interconnection procedures.[54] In addition to NEM Express, MECO, the solar industry and other stakeholders drafted and unanimously endorsed a proposal to more proactively study the MECO distribution system, and better understand the hosting capacity of individual circuits. This proposal is likely to increase the utility's ability to bring NEM projects online using expedited interconnection procedures. However, the Hawaii Public Utilities Commission has yet to act to adopt the proposal. Despite this inaction, MECO has indicated that it will begin to implement the more proactive approach out of necessity.[55] In sum, the interconnection process in Maui is likely to continue to significantly affect the timeline and costs for installing rooftop projects in coming years.

3. Summary

Maui County is the only location we evaluated where proof of interconnection approval must first be provided to the local jurisdiction before beginning the building and electrical permitting process. In light of the high penetration on certain circuits in Maui, it is understandable that the county may want proof that the project will not be derailed by interconnection prior to processing its own permits. However, in light of the interconnection and permitting timeframes, simultaneous review of the various applications would reduce the cumulative wait time for customers. The interconnection process in Maui is the single biggest driver behind the success or failure of residential rooftop systems. As noted above, MECO is working to improve this process in response to the realities of high penetration; however, it is yet to be to be seen how successful these efforts will be.

The Maui County permitting process requires installers to make two different trips to the county offices, and two separate inspections are required. The process efficiency could be improved if electronic permitting or over-the-counter review replaced in-person drop-offs. In addition, completing the entire inspection in one visit would also decrease the

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[54] *See* Press Release, Maui Electric Company, *Hawaiian Electric companies ease path to solar electric power* (Sept. 18, 2012) *available at* http://www.mauielectric.com/portal/site/meco/menuitem.ed4aed221358a44973b5c410c510b1ca/?vgnextoid=4b5cca717095f310VgnVCM10000005041aacRCRD&cpsextcurrchannel=1.

[55] *See* Maui Electric Company, Reducing Time and Cost of an Interconnection Study, http://www.hawaiianelectric.com/portal/site/heco/menuitem.508576f78baa14340b4c0610c510b1ca/?vgnextoid=73b1e21cc3b01410VgnVCM10000005041aacRCRD&cpsextcurrchannel=1; *see also* Alan Yonan, *Solar Saturation Could Mean New HECO Charges*, Honolulu Star Advertiser (Sept. 6, 2013) *available at* http://www.staradvertiser.com/newspremium/20130906_Solar_saturation_could_mean_new_HECO_charges.html?mobile=true&c=n.

time and resources required of installers and the county, resulting in cost savings for all parties.

C. Raleigh, North Carolina[56]

North Carolina has a strong PV market that is dominated by larger systems. North Carolina ranked sixth among U.S. states in total grid-tied PV capacity installed during 2012 (122 MW) and in cumulative grid-tied PV capacity installed through the end of 2012 (208 MW).[57] Much of this growth has been driven by the State's renewable portfolio standard, which includes a solar carve-out, and by robust financial incentives. North Carolina's interconnection procedures are favorable, but its net-metering policy is commonly viewed as a barrier.[58] The state's average residential retail electricity rate (11.0¢/kWh) is approximately 10% below the national average.[59]

Duke Energy Progress (DEP), an IOU, provides electricity in the City of Raleigh and periodically offers a rebate program that supports residential PV. This case study specifically examines the PV-installation process for customers seeking a rebate through DEP's SunSense Solar PV Program.

1. Building Permits and Inspections

Solar applicants in the City of Raleigh are required to submit to the city, via email or in person, an electrical application and a building permit application. Application packets include a City of Raleigh Permit Application, Property Owner's Designated Lien Agent Information (if project cost exceeds $30,000), Documentation for Solar Panels, a plot plan, and an electrical diagram.[60]

Raleigh has established several expedited permitting processes, including Same Day and Next Day permitting which are available for applications for PV installations on existing single-family or commercial properties, provided that the project is not located within an identified flood hazard area or in a Historic Overlay District.[61] When available, Same Day permitting applications submitted via email before 2 p.m. or submitted in-

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56 The information provided in this case study was compiled through the following communications: Email communication with Cornelia Stallings, Technician II, Commercial Permitting, City of Raleigh (Aug. 2013); phone communication with Will Etheridge, Solar Interconnection and Permitting Specialist, Southern Energy Management (Aug. and Sept. 2013); email communication with Jenny Posek, Southern Energy Management (Aug. 2013); phone and email communications with Stew Miller, Yes! Solar Solutions (Aug. and Sept. 2013).

57 *Solar Market Trends 2012*, *supra* note 22, at 12-13.

58 *Freeing the Grid 2012*, *supra* note 15, North Carolina.

59 *Electric Power Monthly, June 2013*, *supra* note 31, Table 5.6.A.

60 City of Raleigh, Building Permits, http://www.raleighnc.gov/business/content/CityMgrDevServices/Articles/BuildingPermits.html (last visited Aug. 22, 2013).

61 *Id.*

person before 4 p.m. will be processed on the same business day, and the permit will be issued the following business day. Next Day permitting applications submitted in-person or via email before 2 p.m. are processed the following business day, and the permit is issued two business days later. The process for notifying an applicant of approved Same Day and Next Day permits is unclear. Some PV installers in the Raleigh area have been able to acquire a Same Day permit in one hour; others must wait two business days before retrieving the approved permit.

The City of Raleigh requires that any exterior change within a Historic Overlay District or to a Raleigh Historic Landmark must receive a Certificate of Appropriateness (COA) from the Raleigh Historic District Commission. This COA is in addition to any required municipal permits.[62] Unless the residential PV system is part of a major project or addition, the City of Raleigh states that this review process typically takes about five business days.

After the City approves the building and electrical permits, the applicant may begin constructing the system. After construction is complete, the final building inspection and electrical inspection can be scheduled within 24 hours of a specified date. For the final building inspection, the PV installer is not required to be on-site for the inspection process, but the installer must ensure that someone is present and that a signed engineer's letter is available on-site for the inspector to collect. The installer must be on-site for the final electrical inspection. The installer can request either a morning or afternoon time slot for the final inspection, and the installer may contact the inspector to arrange a more specific time slot based upon availability.

After the PV installation passes the final inspections, proof of which may have to be picked up at the City offices, the installer then emails or submits in-person a Certificate of Completion to DEP. This certificate notifies the utility that a PV system has passed Raleigh's permitting and inspection process. However, DEP does not issue permission for the interconnection and commissioning of a PV system until the City releases inspection data to the utility officially confirming that the system passed all inspections. The City permitting and inspection system will generate automatically a power ticket with this data, which is then faxed to DEP the next business day. The applicant does not need to take any formal action for the City to generate this notification.

[62] City of Raleigh, Historic Development and Landmarks, *available at* http://www.raleighnc.gov/neighbors/content/CityMgrDevServices/Articles/HistoricDistrictsAndLandmarks.html (last visited Aug. 22, 2013).

2. Incentives, Interconnection and Net Metering[63]

The North Carolina Utilities Commission (NCUC) has established interconnection procedures that include a simplified process for inverter-based systems up to 10 kW. The NCUC has also established a net-metering policy. Both policies apply to the state's IOUs. DEP's SunSense Solar PV Program ties together the interconnection, net metering, and rebate process. The program provides a rebate of $500/kW (AC) and a monthly bill credit of $4.50/kW (AC) for residential systems.[64] However, the residential program is cyclical and limited to an aggregate total of 1 MW (AC) of PV per year. As a result, the program creates "boom and bust" cycles of PV installations in DEP's service territory.

To install a small residential PV system under DEP's SunSense Solar PV Program, the applicant first submits to DEP (via email) a rebate application, including the installer's quote and certain required system information. A separate application is not required for net meter or interconnection. DEP accepts or rejects the application (via email) within five to 10 business days of receipt.[65] If approved, the application is returned to the applicant via email, and system installation may commence. The system must be installed within 90 days of rebate approval; this provides an overarching timeframe for the installation process.

The applicant then files a notarized Report of Proposed Construction with the NCUC via mail and provides a copy to DEP. After system installation and successful inspections by the City, the applicant submits a Certificate of Completion to DEP, typically via email. In addition, Raleigh's permitting and inspection system automatically generates a ticket verifying that the system has passed all inspections, and the City faxes this information to DEP. DEP validates system installation; the installer does not need to be present during system validation. Within about 15 business days of receiving the Certificate of Completion, DEP installs a new meter (for net metering), and the applicant is switched to DEP's residential time-of-use schedule, net-metering rider, and SunSense rider. The system then may be commissioned. The applicant receives a rebate check from DEP

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63 North Carolina offers a generous tax credit for PV systems. To receive this credit, the PV system owner submits the appropriate tax form to the North Carolina Department of Revenue. North Carolina Department of Revenue, NC-478G: Investing in Renewable Energy Instruction Form, *available at* http://www.dor.state.nc.us/downloads/nc478g_instructions.pdf. North Carolina has also established a property-tax abatement for PV systems. The property owner does not need to apply for the abatement, which is granted at the point of assessment. North Carolina Department of Revenue, *Memorandum on Solar Energy Electric Systems* (Feb. 15, 2011) *available at* http://www.dornc.com/taxes/property/memos/solar_energy.pdf.

64 Duke Energy Progress, SunSense Solar PV Program, *available at* https://www.progress-energy.com/carolinas/home/save-energy-money/energy-efficiency-improvements/sunsense/solar-pv.page (last visited Sept. 26, 2013).

65 According to the NCUC's interconnection procedures, DEP must review and verify that the system can be connected safely according to specified technical screens. North Carolina Utilities Commission, *Order Approving Revised Interconnection Standard*, Docket No. E-100, Sub 101, Appendix A at 1, 6-8 (June 9, 2008) *available at* http://www.dsireusa.org/documents/Incentives/NC04R1.pdf.

within six to eight weeks. The monthly bill credit under DEP's SunSense rider is applied the first full billing month after the new meter is set.

3. Summary

The City of Raleigh offers a reasonably efficient permitting process. It is beneficial that applications can be submitted via email and that approval is generally given in fewer than three days. However, it would be more efficient for both the City and installer if the building and electrical inspections could be combined. It is helpful that there is direct communication between the City of Raleigh and DEP about the inspection results; yet it is unclear why installers are still required to submit a Certificate of Appropriateness to DEP. The benefit of this additional step is not apparent, and it may be that it is superfluous. For applicants proceeding under the rebate program, it is helpful that the process is reasonably streamlined, with the NEM, interconnection, and rebate applications processed simultaneously.

D. White Plains, New York[66]

New York has a strong and relatively stable PV market. New York ranked 10th among U.S. states both in total grid-tied PV capacity installed during 2012 (56 MW) and in cumulative grid-tied PV capacity installed through the end of 2012 (179 MW).[67] It offers a strong, long-term incentive program that supports residential PV; this program is funded by an aggressive RPS with a customer-sited renewables carve-out. The state's interconnection procedures and net-metering policy are both very favorable.[68] New York's average residential retail electricity rate (19.31¢/kWh), second only to Hawaii's average, is 54% above the national average.[69] Con Edison, an IOU, provides electricity in White Plains. This case study specifically examines the installation process for customers seeking an incentive through New York State Energy Research and Development Authority's (NYSERDA) Solar PV Program.

1. Building Permits and Inspections

To install a solar system in White Plains, an applicant must submit both an electrical permit application and a building permit application and must complete a design review process. Completed permit applications must be notarized and submitted to the Building

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66 The information provided in this case study was compiled through the following communications: Phone and email communication with Kevin Hodapp, Deputy Commissioner, White Plains Building Department, City of White Plains (Aug. 2013); Phone and email communications with Richard Mecca, Sr. Electrical Code Enforcement Officer, City of White Plains (Aug. 2013); phone and email communications with Jerry Robock, Northeast Smart Energy (Aug. 2013); phone communication with Margarett Jolly, Con Edison (Aug. 2013); email communication with Chris Hale, SunBlue Energy (Sept. 2013); email communication with Frank Mace, NYSERDA (Sept. 2013).

67 *Solar Market Trends 2012*, *supra* note 22, at 12-13.

68 *Freeing the Grid* 2012, *supra* note 15, New York.

69 *Electric Power Monthly, June 2013*, *supra* note 31, Table 5.6.A.

Department office in person between the hours of 9:00 am through 1:00 pm. Application packets must include: copies of trade licenses, four certificates of insurance with the City of White Plains listed as the Holder,[70] notarized application forms, and three sets of site plans.[71]

In addition to proper permit applications, all proposed PV systems must be approved by the local Design Review Board (DRB). DRB approval is required regardless of the siting design or district location of the PV installation. When the permit applications are submitted in-person, as required, the City's permitting office automatically and immediately refers applicants to the DRB. After the referral process, a DRB staff member proactively meets with the applicant to review plans and requirements for approval. The application must then be scheduled for review during one of the bi-weekly DRB meetings. During the meeting, the DRB approves or denies the plans. The building permit and electrical permit are usually issued within three to five business days following DRB approval. White Plains officials state that applications are typically approved upon initial review.

After the permitting office approves the permit applications, and plans are approved by the DRB, PV system construction may commence. Upon completion, final inspections can be scheduled by phone or email within 24 hours of a specified date. White Plains combines the building inspection and electrical inspection into a single site visit. The installer must be on-site. Inspection appointments are scheduled in one-hour increments, thereby minimizing the time an installer must wait. During the final inspection, an oral approval will be given with instructions to finalize all paperwork associated with the permit. The applicant is responsible for submission of a Builder's Affidavit and/or Architect's Affidavit and an Affidavit of Cost once the project has been completed. Affidavits must be notarized and submitted in person to the White Plains Building Department. As a final step, the certificate of completion is processed, signed, scanned and sent to the homeowner.

Following the inspection, the PV installer submits approved permits to Con Edison via Con Edison's online portal. This action notifies the utility that a PV system has passed the local permitting and inspection processes, and is ready for interconnection and commissioning. White Plains does not communicate formally with the utility unless requested to do so by an installer. In such instances, the City will send email notification to Con Edison regarding the permitting status of a project.

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[70] City of White Plains, Building Short Form, *available at* http://www.cityofwhiteplains.com/building/documents/Bldgshortform.pdf.

[71] City of White Plains, Building Permit Brochure, *available at* http://www.cityofwhiteplains.com/building/documents/buildbrochure.pdf.

2. Incentives, Interconnection and Net Metering[72]

The interconnection procedures of the New York Public Service Commission (PSC) include a simplified process that generally applies to systems up to 50 kW.[73] These procedures, which apply to the state's IOUs, also address net metering, and the PSC has issued several orders to implement and expand the state's net-metering policy. NYSERDA's Solar PV Program provides an incentive of $1.40/W (DC) for residential systems, with a maximum incentive amount not to exceed 40% of installation costs after tax credits are applied or $9,800 per system.[74] This incentive program, funded by New York's RPS surcharge, is relatively stable. The process of installing a PV system under NYSERDA's residential PV incentive program requires the installer to navigate simultaneously three separate processes: local permitting, interconnection and net metering, and NYSERDA's incentive process.

First, the customer selects an eligible installer/contractor from NYSERDA's approved list. Only eligible installers/contractors approved by NYSERDA may apply for incentives through NYSERDA's Solar PV program.[75] The installer then conducts a basic energy-efficiency audit of the customer's home, although the customer is not required to implement any energy-efficiency measures. The customer and installer then complete an application package that includes a customer purchase/lease agreement and accompanying addendum, and an incentive application form, which includes certain required system information. The installer submits the incentive application package to NYSERDA online within 30 days of the date of the executed customer purchase/lease agreement.

NYSERDA reviews the application package for completeness and performs a technical review of the proposed system. NYSERDA then notifies the installer directly of approval of the application package, and specifies the incentive amount and the timeframe within which the system must be installed.

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72 New York also offers numerous different tax incentives, including an income tax credit, an exemption for PV from sales and use tax, and two property-tax exemptions. For more information on each of these tax incentives see: http://www.dsireusa.org/incentives/index.cfm?re=0&ee=0&spv=0&st=0&srp=1&state=NY.

73 New York State Public Service Commission, *Standardized Interconnection Requirements and Application Process for New Distributed Generators 2 MW or Less* at 2 (Apr. 2013) *available at* http://www3.dps.ny.gov/W/PSCWeb.nsf/96f0fec0b45a3c6485257688006a701a/dcf68efca391ad6085257687006f396b/$FILE/Final%20SIR%204-1-13.pdf; New York State Public Service Commission, Order, *Conforming and Reforming Changes to Standardized Interconnection Requirements (SIR)*, Case 12-E-0393 – 0398 at 10, *available at* http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY02R&re=0&ee=0.

74 NYSERDA, *Solar PV Program Financial Incentives Summary*, *available at* http://www.nyserda.ny.gov/-/media/Files/FO/Current%20Funding%20Opportunities/PON%202112/2112summary.pdf.

75 NYSERDA's PV incentive is actually paid to the installer/contractor, who must apply the full amount of the NYSERDA incentive toward the price of the system.

Separately the customer and installer complete Con Edison's interconnection application package, which includes a letter authorizing the installer to apply for interconnection on behalf of the customer, an interconnection application, a net-metering application, the signed standardized contract, a three-line diagram of the system, a copy of the manufacturer's data sheet for the equipment, a copy of the manufacturer's verification test procedure, and verification of equipment certification to UL 1741. The installer submits the application package online or via email to Con Edison.[76]

After Con Edison approves the application, the utility sends an executed interconnection contract to the applicant within 10 business days of receipt of the application package. All system components must be delivered to the project site within 120 days of notification of approval by NYSERDA. After delivery, the installer may submit an incentive payment request form for up to 75% of the approved amount. This form must be accompanied by written confirmation by the customer that the equipment has been delivered, a building permit, and proof of other required approvals from White Plains. Installation must be completed within 90 days of the date upon which the 75% incentive payment request form is approved by NYSERDA.

Next, the installer conducts a verification test. Con Edison reserves the right to witness the verification test, but it typically chooses to do so only for newer installers. If Con Edison chooses to witness the verification test, this may add up to 10 business days to the overall installation process. After Con Edison installs the meter, which might take up to six weeks, the utility issues a letter of final acceptance. The system is then commissioned. The installer applies for the final 25% incentive payment from NYSERDA after the system installation is complete. NYSERDA will accept a photo of the approval sticker or inspection certificate and/or the utility's interconnection acceptance letter as final documentation that the system has been installed. However, NYSERDA may also visit the customer's site before, during and/or after system installation. NYSERDA also performs random audits of PV installations.

3. Summary

Significant efficiencies are lost for White Plain installers by having the incentives processed by the state versus directly by the utility. Although the NYSERDA process is designed to ensure reliability and proper use of public funds, it adds additional complications to the process of installing rooftop PV. It may be more efficient to have the state's utilities process and incentive applications at the same time they conduct their interconnection and net metering review. In addition to reducing the number of offices to which applicants must submit applications, the utility could verify system installation when it conducts its site visit, rather than having a separate state entity conduct random inspections of systems.

Furthermore, the local permitting process in White Plains is more complex and time-consuming than seen in the other case studies. For each requirement to submit the permit applications in person, have the applications notarized, and then to have to return to the office to pick them up in person, system costs increase. In addition, the added

[76] Con Edison, Solar Energy - Applying for Interconnection with Con Edison, *available at* http://www.coned.com/dg/solarenergy/interconnection.asp (last visited Sept. 26, 2013).

layer of the Design Review Board review adds time and uncertainty to the process. It is been beneficial, however, that the building and electrical instructions are combined, and that only one inspection is required. It would streamline the installer's timeframes and reduce costs if Con Edison and the city of White Plains communicated directly about the final permit approval rather than requiring the installer to convey the approval.

IV. Installer Staff, Resources and Customer Management

A. Internal Staff and Resources Management

In addition to discussing the way the approval processes work in their markets, we spoke with installers about how they manage their staffing and equipment ordering in light of these processes.

An installer's size and the market in which it operates impact when and how the installer orders solar equipment and materials. Installers in Washington and Illinois indicated that they wait to purchase each system until the system's permits, net metering, and interconnection processes are complete because of the uncertainties presented and fluctuations in the panel market. For Solar Services in Illinois, the utility interconnection and permitting processes are coordinated and tracked by a single employee, who has "touch points" in the company for technical and engineering issues. The PV Manager is responsible for coordinating the interconnection process and has built a relationship with the utility, which helps streamline that process. The PV Manager is also the PV designer, and he orders the PV panels when all the permits are obtained and construction is ready to begin. Ordering at this stage adds about two weeks to the process, but the installer has found that this wait is better than ordering before obtaining permits, when there is always the possibility that a project will not be permitted.

In light of the more consistent market demand in Arizona, American Solar is able to keep solar equipment stock on hand, so that once it has all necessary permits and interconnection approvals, it can go directly to construction. Its construction timeframe is generally 90 days from initial order, and its cost quotes are based on its existing stock and the prices paid for that equipment.

American Solar has a dedicated permitting staff person and a dedicated interconnection employee. Project management, project supervisors, and crew each have their own schedules but those are interconnected, so each team is informed and on track. The company also tracks the permitting processes for each jurisdiction in which it works, so that it can incorporate these timelines in its customer timelines and inform its customers if it foresees potential roadblocks. The permitting staff tracks all permitting applications in a proprietary spreadsheet program, which also tracks design and interconnection steps, and these are shared across departments.

Another American Solar employee manages all front-end communications with Arizona's utilities. Because the utility interconnection process and permitting process occur simultaneously, the interconnection staff person will often send duplicate copies of any local permit to the utility, to ensure that the utility receives appropriate clearance from the local jurisdiction. The company does not rely solely on the jurisdiction to communicate

with the utility, and while this may result in duplicative filings, American Solar is ensured that the utility has the requisite approvals from the municipality.

The Massachusetts installer we spoke with orders the panels and related equipment and begins the permitting process after a customer's rebate application is approved. In Massachusetts, state law has a significant effect on the manner in which installers staff their installations. The law requires that each solar installation have an equal ratio of electricians to laborers on site after the structural elements are in place. For the racking and wiring of a system, the installer must hire one electrician for each laborer, and the electrical supervisor must obtain approval of the completed installation from the local electrical inspector. These staffing requirements increase costs for the solar installation companies and add to the time involved in completing the installation. Once the local electrical inspector has approved the wiring and installation, the solar installer sends to the utility the inspector's approval and waits, sometimes for two to three (or more) weeks, for the utility to install a net meter for the system.

While this is just a picture of how some solar installers handle their internal staffing, it demonstrates that there are often multiple different people on staff that manage the process of obtaining the necessary approvals. Tracking the paperwork and ensuring that each approving authority has been provided the necessary documents requires careful organization by the installer and the complexity of the task increases as the number of handoffs and forms required increases. The installers have shown that they are capable of managing these processes internally, but as the processes become simplified and more consistent that less staff time will be required in each case.

B. Customer Management

In light of the complexities of the approval processes discussed above, IREC asked installers how balancing the various approval processes can impact their customer relationships.

In states where incentives are generally necessary to make system economics pan out, and where the incentives are only available for a limited period of time, communication with customers can be particularly important. Customers may have to wait months before they can begin the incentive application process, and then a number of weeks or even months after that to complete the rest of the permitting and interconnection review. Uncertainty regarding the likelihood that the project will be awarded to a project can frustrate customer relationships.

The duration of the process from initial customer contact to the point where a system can be energized varies substantially across the country. In the Cape Cod area of Massachusetts, and in Illinois, installers cite a start-to-finish timeframe averaging three to four months for a small system and six to eighteen months for a larger PV system. In the Puget Sound area of Washington, installers estimated that the process takes anywhere from 21 to 90 days to complete. In Arizona, the process takes roughly 90 days. In Raleigh installers estimated the process can take between 70 to 90 days.

The companies we spoke with put a particular emphasis on the importance of setting clear customer expectations up front. Installers in Arizona, Illinois and North Carolina all stated that they start the conversation by providing a construction timeline that helps to

set reasonable expectations regarding the duration of the process and the various steps that are involved. These timelines help the customer see that a number of steps involved in the installation are outside of the installer's hands; and they show the approvals needed by the utility, local permitting body and state authority and how they impact the overall timeline. To keep each customer's expectations in check, solar installers in Massachusetts inform customers at the initial call that between the rebate process, permitting, electrical sign-off, and net metering installation, the final connection to the grid may take months. Installers across the country work with their customers to address historic preservation committee issues, file Renewable Energy Certificate (REC) and rebate paperwork, and submit all necessary permits. Installers indicated that the potential for derailment because of historic preservation issues or rebate delays, whether perceived or real, may be a deterrent for many residential customers.

The installers we spoke with all emphasized the special care they must give to communicating with their customers about the length of the approval process. Helping customers understand where their applications are in the process and the source of possible delays can help keep customers' expectations in check. This may also provide customers a better sense of the efficiency of their local government, utility, and state government, and allow them to speak up in favor of more efficient procedures.

V. Approving Authorities Perspective

As described above, the authorities responsible for approving rooftop solar systems include local governments, utilities, and sometimes a state entity. For the most part, these authorities are relatively siloed and do not interact with each other directly with respect to particular systems, or at all.

A. Local Government

Local governments have long had authority over the issuance of building and electrical permits. Municipalities are responsible for ensuring that the homes and businesses within their community are safely constructed in compliance with state and local codes. While inspections are also required by utilities and some governmental entities issuing incentives, the local government inspection, or inspections, can be the most thorough and often are the only inspection designed to ensure safety of the system on a customer's home. This authority, however, is just one of many responsibilities held by local governments in times of constantly decreasing resources.

For most local governments, a building permit or electrical permit for a solar project is no different from any permit they issue for things like home remodels, water heaters, or deck installations. A number of municipal officials we have spoken with expressed the view that, in some ways, the solar installers are just the "new guys," demanding special treatment, without consideration for the other permit applicants that are in front of and behind them in line. Municipalities often also note the high number of inexperienced installers that seek permits. Some jurisdictions have held special trainings for installers because they experienced so many incomplete applications and faulty installs. The central difference from many municipalities' perspective may be the amount of political pressure from the solar industry and state officials to process these permits more quickly

and more cheaply. With many states having adopted RPSs, the burden that falls to local governments to help the state achieve the standards has often been overlooked.

For example, there has been considerable pressure on local governments from the Department of Energy, state governments, the solar industry, and solar customers to lower, and even waive, solar permit fees. Local governments are being asked to process a potentially very high volume of entirely new permits, but not offered compensation for the time and effort required to process these permits in a timely manner. Although IREC, Vote Solar and others strive to make clear that the solar permit fees should be designed to compensate the jurisdiction for its labor,[77] it is understandable that jurisdictions feel squeezed from both sides.

Fortunately, many improvements to the solar permitting process that will benefit solar applicants can also streamline the process for local government staff. However, in the areas of particular interest for this paper, such as communication with utility regarding permit approval and the coordination of the inspection process, the local governments may not see as direct of benefits. As governmental entities seeking to serve their constituents, some local governments are motivated to help make the process more efficient to promote greater use of renewable energy. However, it is difficult for jurisdictions to act if they lack the resources to invest in modifying their procedures.

B. Utilities

Pursuant to federal and state regulations, utilities generally must allow rooftop solar systems to interconnect and, in most states, they must offer net metering pursuant to state law. The ease and speed of these processes, however, are less often mandated by law or regulation, and can vary significantly across the country. State interconnection procedures usually include some timelines for completion of the review process. However, utilities frequently do not to meet those deadlines, particularly in states with high volumes of renewable energy applicants. Further, procedures often do not include timelines for each step in the process. Rarely are there penalties associated with failure to meet the deadlines for either the applicant or the utility. Pressure to process applications quickly and efficiently is usually derived from other sources. In some cases, such as in California and Florida, the state statutes or regulations governing net metering require completion of the application and approval process within a specified timeframe. In addition, utilities experience pressure from their customers who are installing systems, as well as from state regulators who also hear about delays. With increased focus on the soft costs coming from the Department of Energy's efforts, utilities are also participating in conversations about how to make the process more efficient at that level.

Similar to local governments, some utilities may be overwhelmed by the number of applications for small generator interconnections and net metering. The utilities that have been hit hardest have started to develop methods for processing applications more

[77] *Sharing Success*, *supra* note 5 at 36-39; Vote Solar Initiative & IREC, *Streamlining the Solar Permitting Process: Solar Permitting Best Practices* (Feb. 2013) *available at* http://votesolar.org/wp-content/uploads/2013/02/Solar-Permitting-Best-Practices_Feb2013.pdf.

quickly, but this concern is balanced with the desire to still conduct sufficient engineering review to ensure that these systems can be interconnected without resulting in greater impacts to the electrical system or other customers.[78]

As with local governments, developing efficient processes internally can help reduce utility staff time and can thus benefit the utility as well. However, as the popularity of net metering grows, utilities across the country are beginning to question the impact of net metering on their bottom line and on rates for non-participating customers. While it may be too simplistic to assume that this undermines the motivation of utilities to make the process more efficient, it does seem that utilities may be less motivated to streamline their processes for new net metering customers until their concerns regarding the costs of net metering are addressed.

Finally, many IOUs have hundreds of municipalities within their service territories, which can complicate communications about individual solar project approvals. Instead, utilities often rely on installers to relay information regarding municipal approvals. Similarly, for utilities to coordinate their review process so that it lines up carefully with the processes of the many individual jurisdictions in their territory could be challenging unless those jurisdictions are willing to conform to a standard order and timeframe that could be adopted across the utility's territory.

C. State Government

State governments play various roles in facilitating the approval and finalization of solar PV projects. In some cases, the state Public Utilities Commission is involved in some manner in the processing of applications for net metering and/or interconnection, and the commission often establishes the regulations that govern these processes when handled by the utilities. Other state bodies are sometimes responsible for reviewing applications for and issuing state level incentives. Where a state has RPS goals, the state is likely motivated to make the approval process efficient to enable the least expensive achievement of the state's goals. However, the coordinating role of the state is the most complex as it has not only potentially thousands of different municipalities within the state, but also usually more than one utility that it has to coordinate with.

VI. Identifying Inefficiencies and Overlap

IREC has extensive experience with the development and oversight of net metering programs, interconnection procedures, and various types of incentive programs. In addition, in the last few years IREC has worked directly with municipalities to develop more efficient permitting processes that can benefit the jurisdiction and its constituents. Together this work has given IREC a unique appreciation of the need for sufficient oversight to ensure that solar systems are installed safely and in a manner that minimizes impacts on the electrical grid, neighbors and others, while not imposing unreasonable burdens that erode the economic and ecological value of distributed generation solar.

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[78] *Updating Small Generator Interconnection Procedures*, *supra* note 17, at 11.

To understand how the interconnection, permitting, and incentive and net metering processes impact the timing, coordination, staffing, and other aspects of solar rooftop installations, we spoke with five, geographically diverse solar PV installers located in Illinois, Arizona, Washington State, and Massachusetts, in addition to consulting installers in the case study markets. Not surprisingly, coordinating the interconnection, permitting, net metering, and incentive processes was deemed "easy" or "simple" by those installers in states with consistent incentive programs and well-educated permitting authorities. On the other hand, installers who face understaffed or under-educated permitting agencies, or work in states with incentive programs that have limited windows or funds, experience greater difficulty coordinating, staffing, and purchasing for their solar installations.

In this Section, we examine the aspects of the approval processes that stood out from IREC's research into the case study markets and our conversations with installers. We combine the installer perspective with that of the approving authorities in identifying areas where improvements might be helpful and may reduce the costs of solar installations for customers and overseeing authorities. Each subsection covers a different approval process, and first looks at opportunities for improving overlap with the other approval processes and then identifies additional opportunities to increase the efficiency within just that process.

A. Managing Available Incentives

As the case studies illustrate, a variety of different financial incentives are available for solar customers. As the cost of solar hardware declines, system economics are becoming less reliant on incentives, particularly in states with above-average electricity rates. However, for the time being, incentive programs will continue to drive solar installations. In almost all cases, tax credits, waivers and refunds have the simplest and quickest application processes. However, cash incentive programs are common, and in many markets, are necessary to make projects feasible. The manner in which such cash incentive programs are managed however can significantly alter the simplicity of the installation process for customers and installers.

1. Processing Incentive Applications

In most cases, installers tackle the incentive application first, largely because without incentives the customer may not be able to afford the project. In some states, the incentive application process is quite straightforward, requiring only one application form and approval, but in other states, such as New York, it can require the submittal of multiple different documents at different stages in the installation process, as the case studies highlight. Often the timing of these submittals must also be interwoven with the permitting and interconnection processes, as proof of success in those areas can be required.

The installers we spoke with highlighted the importance of the timing of the application process. For example, in Massachusetts, after receiving an initial call from a potential customer, the installer assesses the physical feasibility of the solar installation and then begins the rebate application process. The installer also enrolls the customer in the

state's REC market. According to installers, the rebate approval process may take six to eight weeks, and during this time, the installer's work is generally stalled while customer waits for assurance that it will receive a state rebate before investing in the system.

As the White Plains case study outlines in detail, New York's incentive program is administered by NYSERDA rather than by the utilities.[79] The application process requires numerous steps: The customer must first select from a list of certified installers, then conduct an energy efficiency audit and submit the application packet. After NYSERDA conducts a technical review of the application and issues its initial approval, the customer must proceed with local permitting and interconnection within a specified timeframe. The installer must submit two different payment request forms, one for 75% of the incentive after the system components have been delivered and the building permit has been approved, and another for the remaining 25% after ConEdison completes its work and installs the meter. In addition, NYSERDA reserves the right to visit the site itself and sometimes conducts random audits of PV systems. While this system is certainly designed to prevent fraudulent activity and ensure proper use of incentive funds, the number of handoffs required is certain to raise the overall cost of systems in the state, diminishing the value of the incentive.

The New York experience is contrasted with the incentive programs highlighted in Raleigh and Broward County. There, the utilities administer the incentive programs and, to some extent, combine the approval process for the incentives with the interconnection and net metering approval.

Incentive funds are generally limited, and it is in everyone's interest to see that they are spent efficiently. Programs that reduce the number of document exchanges, contain clear and simple eligibility requirements, and enable quick and certain incentive authorization may make the most efficient use of limited funds and help keep overall costs down. Since all applicants are also required to submit interconnection applications, the case studies and installer interviews suggest that programs administered directly by the utility may offer particular opportunities for reducing paperwork and duplication of effort. Like with the DEP program in Raleigh, applicants might be able to submit to the utility a single application form that covers the incentives, interconnection and net metering approvals. Even if different departments are responsible for reviewing the separate requirements, they could all be processed through a single system simultaneously, requiring less paperwork and a smoother pathway to system installation.

2. The Boom-and-Bust vs. Steady-State Approach

Each installation starts with a telephone call from a prospective customer looking to install solar on her roof. The timing of that call may be driven by a state-offered rebate, as it is in Illinois, Florida and many other markets, or it may come at any time of year in other markets that have more consistently available incentives or where PV systems do not rely as heavily on incentives to be economical.

[79] For information on the NYSERDA program see: http://www.nyserda.ny.gov/Funding-Opportunities/Current-Funding-Opportunities/PON-2112-Solar-PV-Program-Financial-Incentives.aspx.

According to Solar Services, Inc., of Niles, Illinois, since the budget for the Illinois rebate is limited, when the window opens, there is a rush to apply for and receive an initial approval for a solar installation rebate. The incentive cycle translates into a periodic surge in demand for solar installations, followed by a relatively quiet market once the State's funds have been depleted. As highlighted in the Broward County, Florida case study, the situation there is similar – the FPL rebate program has limited funds and often sells out immediately. The effect is that the installers are busy for a few months of the year, but business may dry up during the remainder of the year if system economics are reliant on incentives in addition to existing tax incentives. We have heard of similar experiences in many states where incentive programs are not designed, or funded, so that they are available on a consistent basis all year.

The boom-and-bust experience of installers in Illinois and Florida is contrasted with those in states like Washington, New York, and Arizona where the incentive programs are available on a more long-term basis. In Arizona, installers benefit from the state's tax credit, sales tax waiver and REC incentive program for solar installations. In Washington, a single, state-sponsored production-based incentive rewards the owners of residential systems with a credit on a per-kilowatt-of-energy-produced basis. The program is in effect until 2020, reducing the intermittent market effect of some state rebate programs. All of these incentives keep the market moving and are not dependent on certain yearly windows for installation rebates. The installers we spoke with in states such as these with more consistently available incentives report a smoother flow of projects throughout the year, helping them offer more consistent jobs in the community.

Jurisdictions, utilities, and installers have reported that, in some cases, the boom-and-bust cycle of incentives can also impact interconnection and local permitting processes. For municipalities and utilities, this can mean a flood of applications during certain periods of the year, which can be difficult to keep up with using regular staffing levels. For example, in Hawaii, where there has often been a cyclical rush, installers report greater waits for permit and interconnection review and inspections following the rush. Some jurisdictions have resorted to hiring third-party contractors to conduct plan check and/or inspections during these peak periods. Similarly, projects can clog the interconnection queue and take longer to be processed during peak incentive periods.

Though the structure of an incentive program is driven primarily by the amount of money available, the consensus from installers is that programs that do not result in a flood of installations followed by a drought, would help create a more sustainable market for installers. A more steady-state flow of incentives can also benefit utilities and local governments. These entities could staff their application review teams more effectively if they do not need a large staff for a few intense months followed by months of low productivity and workflow. At the very least, the availability of incentive funds should be transparent and considered in advance so that municipalities and utilities can make sure they have sufficient staff to process the applications when they do come in.

B. Applying for Local Permits

For many installers we spoke to, the permitting process is often where an installation may fall apart or get hung up because not only must a building and electrical permit be obtained, but historic status, zoning codes, and other building authority requirements

may be required, and these requirements can vary significantly within an installer's market.

1. Duplicative and Excessive Inspections

IREC's research discovered significant variation in the number of different inspections that may be required in the approval process. Looking at the four local jurisdictions analyzed in the case studies, the number of different field inspections required ranges from five, in Broward County, down to one, in White Plains, with Raleigh and Maui County both requiring two inspections. Furthermore, the local building department may not be the only inspecting body. As explained in the case studies, there are often multiple site visits by the utility and maybe even by the body responsible for issuing incentives, as in the case of NYSERDA in White Plains. There are also jurisdictions where a separate fire department inspection is required.

Though installers may not need to be onsite for all inspections, they often still need to spend time scheduling them, and it can take time for the utility or other entity to make it out to each customer's site. In addition, the more inspections a municipality, utility or state requires, the more staff and resources they need to have on hand to conduct and coordinate those inspections. While some of these inspections may play a critical role in ensuring systems are installed safely and correctly, there may be some duplication and overlap that could be eliminated. There are a number of relatively easy solutions to addressing multiple inspections from the same body, but the second issue of trying to combine the inspection process across authorities is more complex.

While there are certainly a wide range of climatic conditions between Broward County and White Plains, IREC was not able to identify why five inspections by one jurisdiction for a typical rooftop solar system could be needed in one jurisdiction, while in others only one, or even none,[80] is necessary. Even with savvy and punctual inspectors, this many inspections will slow down the installation process and increase costs. Many jurisdictions have been able to eliminate the need for multiple different inspections through the use of proper training. For simple PV systems, inspectors can be trained to review both the electrical, structural and fire code requirements in most cases. By doing this, the jurisdiction can reduce the number of staff involved and can conduct simultaneous inspections, reducing the number that an installer needs to schedule.

IREC has issued Field Inspection Guidelines for PV Systems[81] and has collaborated with the International Association of Electrical Inspectors (IAEI) on creation of the free Photovoltaic Online Training (PVOT) for Code Officials,[82] which can teach inspectors

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[80] North Carolina Solar Center, *Harmonizing Interconnection and Permitting Processes: Vermont Public Service Board Case Study*, *available at* http://solaroutreach.org/wp-content/uploads/2013/07/Harmonizing-Interconnection-and-Permitting-Processes.pdf (outlining how the State of Vermont has managed to eliminate the need for most small PV systems to undergo local government or utility inspections).

[81] Bill Brooks, IREC, *Field Inspection Guidelines for PV Systems* (June 2010) *available at* http://irecusa.org/wp-content/uploads/2010/07/PV-Field-Inspection-Guide-June-2010-F-1.pdf.

[82] IREC & International Association of Electrical Inspectors, *Photovoltaic Online Training for Code Officials*, *available at* http://www.pvonlinetraining.org/ (last visited Sept. 27, 2013).

how to do a thorough PV inspection, in just one visit. In addition, jurisdictions could consider adopting IREC's Model Inspection Checklist for Rooftop PV Systems or something similar to help ensure that inspectors and installers verify all aspects of system code compliance.[83] Whether they use these tools developed by IREC or other sources, jurisdictions can reduce the number of required field inspections for most small PV systems without significant compromises in safety or quality. Indeed, in the State of Vermont and in much of Germany there are no inspections required for typical systems.[84]

Finding ways of narrowing the total number of inspections across all authorities is more challenging but not impossible. The inspection that appears most ripe for elimination is the one sometimes conducted by an incentive-issuing body. It appears that the purpose of these inspections is to verify that the applicant has actually installed the same system for which the applicant applied for an incentive. In most cases, however, the local building and electrical inspection will have already verified that the system matches the plans that were submitted, as most codes require that the equipment installed match the plans. Thus, rather than having a separate inspection by the incentive body, it could be possible to simply convey the proof of the final building permit approval to the incentive body. In addition, as noted above, if the utility administers the program, it may be able to combine this check with its inspection or verify the system at the time the bi-directional meter is installed.

As mentioned above, in some locations, the local fire district, which may be independent from the municipality, may require an inspection for compliance with code requirements. In this case, it is possible for the fire district and municipality to sign a memorandum of understanding (MOU) that authorizes the building inspector to also inspect for fire code compliance. For example, in Contra Costa County, California, as part of a broader solar permit streamlining effort, the Fire Protection District and the County Department of Conservation and Development (which contains the County's building department) entered into an MOU wherein the County agrees to conduct inspections for compliance with fire safety requirements.[85]

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[83] Sky Stanfield & Don Hughes, IREC, *Model Inspection Checklist for Rooftop PV Systems* (Sept. 2013) *available at* http://www.irecusa.org/wp-content/uploads/2013/09/Model-Inspection-Checklist.pdf.

[84] North Carolina Solar Center, *Harmonizing Interconnection and Permitting Processes: Vermont Public Service Board Case Study*, *available at* http://solaroutreach.org/wp-content/uploads/2013/07/Harmonizing-Interconnection-and-Permitting-Processes.pdf;, Joachim Seel, Galen L. Barbose & Ryan H. Wiser, Lawrence Berkeley National Laboratories, *Why Are Residential PV Prices in Germany So Much Lower Than in the United States? A Scoping Analysis* at 30 (Feb. 2013) *available at* http://emp.lbl.gov/sites/all/files/german-us-pv-price-ppt.pdf.

[85] *Memorandum of Understanding between the Contra Costa County Department of Conservation and Development and the Contra Costa County Fire Protection District for certain plan review and inspection services*, (signed Nov. 27, 2012) *available at* http://www.solarfastrac.org/1/Solar%20PV%20Fire%20District%20MOU.pdf; *See also* California Office of Planning and Research, *The California Solar Permitting Guidebook* at 41 (June 2012) *available at* http://opr.ca.gov/docs/California_Solar_Permitting_Guidebook.pdf ("provides a template agreement between two local agencies to coordinate permit review and approval. It can be used, for example, to streamline review between a local building department and a local fire service.").

The utility inspection and the field inspection by the municipality, on the other hand, are designed to look a different aspects of the PV system and do require different expertise. In theory, however, one individual could be trained to inspect the system aspects on both sides of the meter. The City of Santa Clara, California, has a municipal utility, which has enabled the City to reduce the number of staff reviewing a project. In addition to combining the plan review and interconnection review process,[86] the City was able to eliminate the need for a separate utility inspection.[87] For jurisdictions without a municipal utility, accomplishing this this would likely require use of a third-party jointly authorized by the utility and the locality to conduct the inspection.

2. Managing Variable Requirements

As apparent from the differences among the case studies, the information and materials required for a complete building and electrical permit application still varies significantly across the country. Sometimes the municipality requires that its prescribed forms also be notarized and include a different number or type of site plans, electrical diagrams, and other accompanying materials. In addition to significant variation in application packet requirements, there is also variation with respect to what permits may be needed. For example, in Maui County, the building permit is waived under certain circumstances, while in Raleigh it is always required. In White Plains, design review is always required, whereas in Raleigh it is triggered only in certain cases, and in Broward County and Maui County there is no design review process. Whether or not a building permit or design review is necessary can add a significant cost to projects if there is an additional permit fee, inspections, or review time required.

In Washington State, installers also noted how significantly the permitting experience can vary depending on the jurisdiction. Solar installers count on Seattle installations to proceed fluidly but expect to encounter myriad hurdles in other jurisdictions. Some jurisdictions have not yet addressed permitting requirements for solar installations and installers noted that they sometimes appear to be creating permitting requirements on the spot when approached with a request to permit an installation. Without a reasonable understanding of the structural and electrical impacts of solar rooftop installations, the municipality may require a structural permit, in-depth planning review, or more. Installers have lost projects in cities that have imposed burdensome structural engineering review, electrical upgrades, relocations of electrical meters, and other actions that have driven up costs and reduced the system owner's return on investment. As a result of this variation, Washington state installers expressed the view that streamlined and uniform permitting requirements would greatly benefit the market.

The biggest challenge cited by American Solar in Arizona in connection with the permitting, incentive, and interconnection processes is when a jurisdiction brings in a new expert in solar energy development or adds a new requirement to the process. For

[86] North Carolina Solar Center, Santa Clara, CA: Harmonizing Solar PV Permitting and Interconnection (Sept. 2013) *available at*: http://solaroutreach.org/wp-content/uploads/2013/09/NCSC-City-of-Santa-Clara-CA-Permitting-Interconnection-Case-Study_FINAL.pdf

[87] Information provided by Shelia Lee, Building Official, City of Santa Clara, via email dated Sept. 17, 2013.

example, a municipality recently joined four others in Arizona in requiring that each installation have a $600 structural permit. American Solar must pass this cost on to its customer, which reduces the customer's return on investment. In addition, bringing a structural engineer on site and preparing the permit application lengthens the installation time.

According to Solar Services, the municipalities in its Illinois market also vary greatly in their permitting requirements. In some municipalities, only an electric schematic is required to obtain all necessary electrical permits; in others, the permitting agency requires a full electrician's "work up" of the system. In many instances, when Solar Services approaches a permitting agency, it is the agency's first encounter with a solar installer and proposed solar installation. This creates a need to educate the municipality on the practical aspects of solar installations and what is truly necessary for the electrical system and the structure to support the installation. To this end, Solar Services helped the city of River Forest, Illinois write its guidelines for solar installation permits and it expects to help other municipalities understand solar PV installations and create consistent requirements for solar installers.

American Solar in Arizona highlighted a similar need to often work directly with each municipality to ensure the requirements are clear and the municipal staff understands solar technology. The company has acquainted itself with each jurisdiction in Arizona in order to understand how long each permitting process may take. When there is a shift in elected leadership, the company tries to engage at the appropriate state or local level to ensure policymakers and implementers understand the goals of the solar industry in the state, and then works with policymakers to draft appropriate rules and procedures. The company also tries to educate each jurisdiction about the structural impacts of solar installation to help them see that structural review is often not intrinsically necessary to the safety of the structure. The company believes that its active role in permitting and utility practices has helped it head off potentially disruptive policies that could lead to excessive delays or even derail residential solar development. American Solar also tracks all changes in policy at all levels in the state, so it can inform its customers if it expects delays or issues with the installation.

Though significant progress has been made to increase the availability of standardized application forms,[88] the viewpoint expressed by the installers we spoke to, and as illustrated by the case studies, is that more could be done to reduce variability from jurisdiction to jurisdiction and to ensure municipalities are well informed about the technical aspects of solar installations. In addition to adopting standardized application forms, jurisdictions should evaluate whether the additional supporting materials, and the methods in which they must be submitted, are necessary. Many jurisdictions have shown that they are able to permit projects without requiring notarized applications, certifications from structural engineers, or multiple copies of plans and electrical diagrams. Uniform permitting requirements may enable installers to order panels and equipment in advance and more easily anticipate timeframes for completing each

[88] *See, e.g.*, Bill Brooks, Solar America Board for Codes and Standards, *Expedited Permit Process for PV Systems* (July 2012) *available at* http://www.SolarABCs.org/about/publications/reports/expedited-permit/; Solar FasTrac, http://www.solarfastrac.org/; East Bay Green Corridor: Regional Solar Policy Initiative, http://www.ebgreencorridor.org/solar_policy.php.

installation. Municipalities are more likely to get complete permit applications on the first try if their requirements are similar to those in the surrounding communities. In addition, with the proper training, it is possible that the jurisdiction may find that a simpler application packet may be sufficient to ensure safe systems, while also saving them on review time.

Clearly a key part of achieving this goal will be helping to educate municipalities. The installers in Illinois and Arizona both indicate that they have to invest a significant amount of resources individually in this effort. Regional permitting reform collaborations, such as the GO Solar effort in Florida[89] and those in New York[90] and California[91] can provide good vehicles for providing education and standardization in a collaborative and efficient manner.

3. Historic Preservation and Design Review

Historic preservation and other design review requirements were also cited as a significant hurdle to the local permitting process in many areas of the country. In White Plains, New York, every solar project, without exception, must go through an individualized review by the Design Review Board, which adds at least a week to the permitting process. In some Illinois towns, many homes are located within a historic district (and sometimes the entire town is a historic district). These districts often impose restrictions on the location of rooftop solar panels. The installer and homeowner may have the rebate authorized, interconnection approved, and electrical permit in hand, only to learn that the solar installation is barred by a historic district restriction on street-facing solar panels that will not be waived. In some instances, the installer will lose the sale and with it up to 15 hours of work in such circumstances. The historic status of many homes and businesses in Massachusetts can also add to the permitting timeframe according to installers. Although the state has statutes in effect that are designed to encourage solar development, the time and cost burdens placed on homeowners and installers by historic preservation committees to obtain exemptions from historic preservation rules can be a significant deterrent to development, and have derailed a number of residential installations.

To manage these sorts of requirements, installers must identify preservation districts in advance and learn the process for getting review in those districts. As a result, installers have to start early on in clearing the way for a proposed installation where historic or other design review requirements are in place. While it is not unreasonable to expect installers to learn the local processes, if the design review process is discretionary or the

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89 Broward County, Go Solar Website, *available at* http://www.broward.org/GoGreen/GoSOLAR/Pages/Default.aspx.

90 *See* Nassau County, Long Island Power Authority & Suffolk County, *Long Island Unified Solar Permitting Initiative Program Packet* at 1 (Sept. 9, 2011) *available at* http://www.suffolkcountyny.gov/Portals/0/planning/publications/SCPCLIPAEnergy.pdf.

91 *See, e.g.* East Bay Green Corridor: Regional Solar Policy Initiative, *available at* http://www.ebgreencorridor.org/solar_policy.php; Solar Sonoma County, *available at* http://www.solarsonomacounty.org/About-Us/Who-We-Are.aspx.

standards for approval are not clear, installers may have to invest significant resources before the learn whether a particular project will be allowed to proceed.

It is understandable that communities want to protect their character and historic resources, but even where the jurisdiction believes that some review is necessary, there are ways of streamlining that review to ensure it does not create a bottleneck in the permitting process. Establishment of clear design standards is a starting point. For example, rather than having every project proceed to a design review board, clearly defined standards may filter out projects that are unlikely to pass review.[92] For the remaining projects, ensuring that the design review process is handled quickly and without requiring a significant time investment from the customer or installer will help to prevent residents from being able to take control of their energy use and production.

C. The Interconnection Process

IREC was pleased to find through the case studies and installer conversations that the process for obtaining approval for interconnection of residential rooftop systems in most markets was relatively straightforward and not problematic for installers. The case study states have all adopted simplified procedures for systems 10 kW and below and waived application fees, which reduce the amount of paperwork and number of exchanges required. IREC did identify, however, one particular aspect of the interconnection process that could be better coordinated. In addition, the interconnection issues identified in Maui County may also arise in other states in the coming years and highlight the need for planning ahead for high penetrations of solar.

1. Obtaining Proof of Building Permit Approval

The feature of the interconnection process that the case studies highlighted as a possible area for improved coordination is in the communication between the municipality and the utility regarding the issuance of the final building permit. In all of the case studies, the utility requires this proof and in all locations the municipality is able to, and does, provide that notification directly for some or all projects. Nonetheless, each of the utilities continues to require that the applicant also provide proof of the building permit. While none of the installers we spoke with identified this as being particularly aggravating, it does appear that this additional amount of paperwork could be eliminated. Ideally, once a municipality enters the final inspection results and stamps the permit, they can send email notification to the utility of the final approval at the same time they notify the applicant.

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[92] Communities may want to start this process by reviewing guidance that has been developed by the National Park Service, *available at* http://www.nps.gov/tps/sustainability/new-technology/solar-on-historic.htm; *see also* A. Kandt et al., National Renewable Energy Laboratories (NREL), *Implementing Solar PV Projects on Historic Buildings and in Historic Districts* (Sept. 2011) *available at* http://www.nrel.gov/docs/fy11osti/51297.pdf (report by NREL and the National Trust for Historic Preservation that provides guidance on development of appropriate design standards for Solar PV on historic structures).

2. Managing Application Flow in High Penetration Areas

The only place where interconnection was raised as a particular issue for installers was in Maui County, Hawaii. The high penetration of customer-sited solar on Maui has created a need for HECO to require more systems to undergo full interconnection studies, rather than passing through the expedited procedures that most small systems go through in the rest of the country. For small residential systems, the study costs alone can often undermine a project; and if upgrades are required, it is unlikely that a residential system applicant would chose to proceed. As a result, projects that are proposed on circuits where the solar generation exceeds the minimum daytime load are often unable to move forward.

In light of this high penetration issue, a couple of unique additional steps have been added to the approval process. First, MECO requires that customers contact the utility prior to signing a contract to install a PV system, so that the utility can take a preliminary look at whether there is available capacity on the circuit. In addition, Maui County requires that installers first obtain interconnection pre-approval (i.e. their positive study results, not just this initial contact) from MECO before the county will process a permit application. This helps the county avoid the time and cost of reviewing applications for projects that will not proceed. It also means, however, that installers are unable to keep the interconnection and permitting review processes moving simultaneously – a practice in existence most other places that can cut down on the overall time it takes to complete a project.

While the situation in Maui is currently unique, it is worth considering how permitting and interconnection processes may need to adapt as higher penetrations of renewables begin to arise in other parts of the country. As more circuits reach the point where generation exceeds load, utilities will need to study more of the projects, which can result in significant delays and increased costs for rooftop PV systems. Realistically speaking, utilities do not have the resources to process a significantly higher volume of interconnection studies, particularly because those studies are done sequentially and not in tandem.[93] Thus utilities will need to look at alternative ways to identify which projects require a full study, and address how to manage those studies. Hawaii, California and Massachusetts have all recently made some modifications to their interconnection procedures to reduce the number of projects that must go to full study.[94] These changes can and should be replicated in other states, preferably before the interconnection queue becomes congested. However, as the situation in Maui highlights, there may be a need

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93 *Updating Small Generator Interconnection Procedures*, *supra* note 17, at 13-16.

94 *See*, California Public Utilities Commission, *Decision Adopting Settlement Agreement Revising Distribution Level Interconnection Rules and Regulations*, Docket No. R.11-09-011, D.12-09-018 (Sept. 20, 2012) *available at* http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M028/K168/28168335.pdf; Massachusetts Department of Public Utilities, *Order on the Distributed Generation Working Group's Redlined Tariff and Non-Tariff Recommendations*, D.P.U. 11-75-E (Mar. 13, 2013) *available at* http://www.env.state.ma.us/dpu/docs/electric/11-75/11-75-Filing-1809.pdf; Hawaii Public Utilities Commission, *Reliability Standards Working Group Independent Facilitator's Submittal and Final Report*, Docket No. 2011-0206, Attachment 4, PV-DG Subgroup Report (Mar. 25, 2013).

to go even further and to consider proactive ways of studying circuits and initiating upgrades if the country is going to continue to support customer sited renewables.[95]

VII. Conclusion

As consumer-sited solar energy grows in popularity across the country, approving authorities are becoming increasingly familiar with the technology and what it takes to review projects efficiently for safety, impacts to the grid and other factors. Municipalities, utilities and state-level bodies are sharing their experiences with their peers and these efficiencies are being adopted in more locations. As each of the individual processes improves, the time and costs associated with installing solar systems will fall. Eventually, however, reduction in the soft costs associated with the approval process will plateau in each of these individual areas. Looking for ways to reduce the overlap between the different processes and to ensure they are coordinated in the most efficient manner may be necessary if the nation wants to continue to reduce barriers in renewable energy growth.

IREC undertook the research for this paper with the goal of exploring what those additional opportunities are for reducing costs associated with the approval processes for rooftop solar. While we found that the processes did line up reasonably well in some locations, it was clear that keeping track of all the different approvals is still a very time-consuming process for installers and authorities.

We found that the individual processes in most locations still often involve a large number of back-and-forth document exchanges. Designing these processes so that there are fewer steps can help reduce the paperwork burden on the authorities and the installers. As authorities take the time to look internally at the efficiency of their process, they should also consider reaching out to the other approving authorities to identify whether there are ways to share responsibility, reduce paperwork and minimize the number of site visits required. Adoption of centralized software tools that could be utilized by all the approving authorities provides obvious advantages but may require a lot of downstream training and internal system modification to be successful.

It is clear, however, that even without major software, responsibility for certain tasks could be shared by the approving authorities in order to minimize duplication and reduce the burden on the authorities as well as the installers. Specifically, a single solar application could be developed in each state that could be provided to local governments, utilities and incentive administrators, and cover the details needed for each approving authority. This application could be filed online through one centralized source, or it could be submitted separately.

Relying on the local government to verify system components and installation in accordance with incentive program requirements could reduce the number of separate

[95] *See, e.g.*, Tim Lindl et al., IREC, *Integrated Distribution Planning Concept Paper: A Proactive Approach for Accommodating High Penetrations of Distributed Generation Resources* (May 2013) *available at* http://www.irecusa.org/wp-content/uploads/2013/05/Integrated-Distribution-Planning-May-2013.pdf.

inspections. Local governments could enter into MOUs with fire districts or other entities to eliminate the need for additional inspections. Similarly, rather than having a separate state body administer the application process for incentives, this task could be merged with the utility's process for reviewing interconnection and net metering. By consolidating this responsibility with one primary entity, it is possible that an applicant could submit one single application and have all the separate approving authorities begin their review simultaneously to reduce delays.

Where utilities or incentive providers desire proof of a final building permit, the communication could be streamlined by having the local government communicate directly with the utility and/or incentive provider at the same time it transmits the permit to the applicant.

These are just some of the opportunities available, but they all require that there be more communication between municipalities, utilities, state-level bodies and installers. Increasing communication and finding ways of sharing responsibility can reduce the drain on each entity's resources while also boosting economic activity and creating a more ecologically sustainable energy future for our communities. As the Maui County case study illustrated, there will also be a need to continue to adapt the processes as the market grows and evolves. As penetration increases, technologies change, new ways of financing systems arise, and the methods for selling and using energy generated shift, the processes designed around yesterday's realities will need to evolve as well.