Solar on Multi-Unit Buildings

Policy and Financing Options to Address Split Incentives

Photo Credit: Greenbelt Alliance
4th St Apartments, San Jose, California

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About the NC Clean Energy Technology Center

The N.C. Clean Energy Technology Center is a UNC System-chartered Public Service Center administered by the College of Engineering at North Carolina State University.

Its mission is to advance a sustainable energy economy by educating, demonstrating and providing support for clean energy technologies, practices, and policies. The Center provides service to the businesses and citizens of North Carolina and beyond relating to the development and adoption of clean energy technologies. Through its programs and activities, including the SunShot Solar Outreach Partnership, the Center envisions and seeks to promote the development and use clean energy in ways that stimulate a sustainable economy while reducing dependence on foreign sources of energy, and mitigating the environmental impacts of fossil fuel use.

Disclaimer

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Introduction

Solar installations are on the rise across the country, thanks to falling costs and policies designed to drive the solar market. As a significant part of the housing and commercial property stock, multi-unit buildings present an important opportunity for rooftop solar growth. Local governments play a key role in catalyzing solar on multi-unit buildings by implementing policies and financing options designed to overcome challenges unique to this growing market sector.

What are Multi-Unit Buildings?

Multi-unit buildings come in various shapes and sizes, with many ownership structures and utility metering configurations. This publication covers policies relevant to *residential, commercial, and publicly owned buildings* subdivided into two or more distinct apartments, office suites, retail spaces, or other units. Occupants may be *tenants* or *owners*. Multi-unit buildings may be *sub-metered*, where each unit has its own electricity meter and occupants pay for their own electricity usage, *or master metered*, with one electricity meter for the whole building and the bill paid by the building owner.

Why Solar Makes Sense on Multi-Unit Buildings

Multi-unit buildings present a large opportunity for rooftop solar. With approximately 5.6 million commercial buildings (including 1 million office buildings)[1] and 26.2 million residential renters in multifamily housing (e.g., apartments and condominiums),[2] there is no shortage of multi-unit buildings in the U.S. Many of these multi-unit buildings have large, unshaded, viable rooftop space for solar photovoltaics (PV) or solar water heating systems. The combined energy use of multiple building occupants and common areas often leads to a substantial overall building energy load. The resulting economies of scale associated with installing solar on such a building can significantly reduce the cost of the installation compared with installing several, smaller solar energy systems on separate buildings.

Solar adds value to building owners. As with any other energy upgrade that improves a building's energy performance, a solar installation can improve a building's attractiveness to tenants or condo owners, increase its property value, and reduce exposure to the risks of rising energy costs and building obsolescence, benefitting the owner's triple bottom line.[3] Going solar may provide the greatest value to owners and occupants alike when implemented after energy efficiency retrofits, which typically offer substantial energy savings that allow for a more efficiently-sized solar energy system.

The Problem of Split Incentives

Despite the substantial opportunity for solar on multi-unit buildings, solar adoption has been hampered by split incentives. A split-incentive problem occurs when the costs and benefits of a building improvement fall on different parties. In the case of a solar investment, split incentives occur

A split-incentive problem occurs when tenants desire the benefits of going solar, but the building owner is responsible for the costs of the solar energy system.

in sub-metered buildings where occupants pay their own electricity bills. Occupants who would otherwise go solar are prevented from doing so, since they lack the capability to install solar on the owner's property. Furthermore, if the occupants are temporary renters, they may not remain tenants for a sufficient duration to recoup their costs. While there is no split incentive discouraging building owners from installing solar to offset common area energy use, sizing a solar installation to only offset common area usage would overlook a significant portion of energy use for many multi-unit buildings and fail to address the desire of an increasing number of renters who want to directly offset the electricity needs of their homes or businesses with on-site solar energy.

In addition to copious anecdotal evidence that suggests split incentives are a major barrier, a recent quantitative analysis of solar PV adoption in Connecticut found that even after controlling for socioeconomic, demographic, and political affiliation variables (among others), a higher share of renters in an area was associated with a lower overall solar adoption rate—consistent with the split-incentive problem.[4] Split incentives have similarly hindered energy efficiency measures in multi-unit buildings.[5]

Some multi-unit buildings are master-metered, an arrangement where the building owner pays all of the electricity costs for occupants. While this arrangement creates a split incentive with regards to energy conservation, there is no split incentive for installing solar, as both the costs and benefits associated with solar fall on the building owner. Master-metered buildings are therefore beyond the scope of this factsheet.

Local Policy Options

Local governments can play a key role in addressing the split-incentive problem to facilitate solar adoption in their communities. Table 1 outlines policy and financing options a local government may be able to pursue, depending on state law and whether the city or town is served by a municipal utility governed by public officials. Where these options are not available, local governments can still catalyze solar adoption through targeted education, outreach, and technical assistance to property owners; solar-friendly zoning; and a streamlined process for permitting and interconnection to the grid.

Payments for Solar Electricity Generated

Whereas state public utility commissions have authority over investor-owned utilities, local governments have substantial control over municipal utilities, and thus the rate design, billing practices, and other policies that determine how electricity generated by solar energy systems is compensated. In either scenario, the following policies can be implemented to overcome the split-incentive problem, although local governments have more control in implementing these policies in the latter case.

Enhanced Net Metering

As of January 2015, all but seven states have developed rules requiring investor-owned utilities to offer *net metering*,[6] a billing arrangement that allows customers with solar to have their electricity meter "roll backwards" when they export electricity to the grid at times when they are consuming less electricity than they are generating.

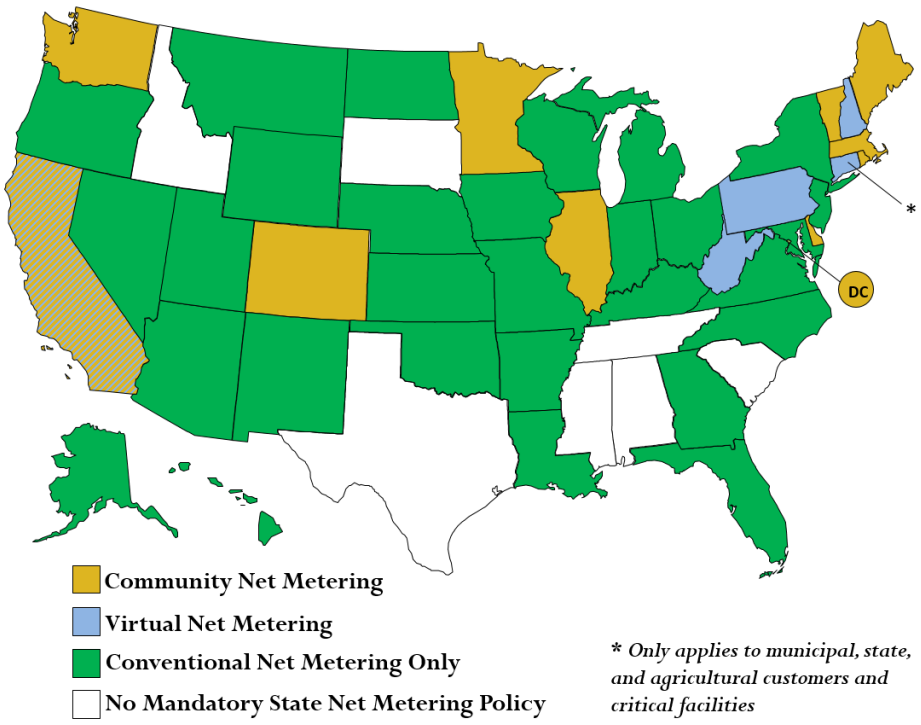
Enhanced net metering (ENM) options expand conventional net metering to allow one solar energy system to offset multiple electricity meters.[7] Two types that specifically apply to on-site solar energy systems installed at multi-unit buildings are *virtual net metering*, where a property owner designates bill credits from a net-metered solar

Table 1: Policy and Financing Options for Addressing the Split-Incentive Problem with Solar on Multi-Unit Buildings[8]

Policy	Description	Benefits	Limitations
Enhanced Net Metering	One rooftop solar energy system offsets electricity use by multiple occupants via separate monthly bill credits	- Allows multiple occupants to directly receive the financial benefits of one solar energy system	- Policy is set through state legislation or state regulators for customers of investor-owned utilities - May be difficult for smaller cooperatives or municipal utilities to implement
Feed-In Tariffs	Requires utility to buy electricity generated by solar energy systems at a fixed rate ($/kWh) for a specified number of years	- All costs and benefits accrue to building owner - Reduced financial uncertainty by creating secure, stable market - Hedge against future electricity prices	- Requires funds or increased electricity rates when tariff is higher than the utility's avoided cost - Difficult to determine appropriate tariff rate
On-Bill Financing	Customers pay for the costs of solar energy systems over time on their utility bills	- Addresses split incentive for residential sector by allowing occupant to both bear costs and accrue benefits of solar - Payment can be tied to electricity account rather than the occupant	- May be administratively difficult to set up with multiple customers - Utilities must be willing and able to participate
Property-Assessed Clean Energy (PACE)	Customers pay for the solar energy systems over time on their property tax bills, and a third-party (e.g., local government) pays the immediate upfront costs of the system	- Property tax increase on owner can be passed on to tenants through rent payments - Payment can be tied to property rather than owner or tenant - Low-cost financing	- Not available in all jurisdictions - Residential PACE programs have been limited in the past due to objections from FHFA - Many programs require consent of a mortgage holder
Green Leases	A clause is added to a property lease to pass on the costs of an energy upgrade to tenants, based on expected energy savings	- Allows for cost-recovery from tenants - Can strengthen landlord-tenant relationship	- Traditionally used in commercial settings - Voluntary, requiring the cooperation of both the landlord and tenant(s)

energy system to different tenant accounts, and *community net metering*, where multiple customers can purchase shares in a single net-metered solar energy system.[9] While both types of ENM result in credits on a customer's utility bill, the main difference between the two is that virtual net metering is nested within a state's conventional net metering rules, whereas community net metering—also known as "community solar," "solar gardens," "shared renewables," or "neighborhood net metering"—generally is a separate policy from conventional net metering and may result in bill credits valued at a different rate.[10]

Figure 1: Enhanced Net Metering Policies



ENM allows multiple occupants to receive the benefits of a net-metered solar energy system—even if the solar energy system is not physically connected to their meters.[11] Under virtual net metering, a building owner designates the percentage of the total output of a solar energy system to be credited to each occupant's utility account. The credits an occupant earns by opting into the arrangement are subtracted from the occupant's consumption during that billing period, reducing the occupant's utility bill. The property owner can recover their capital costs through one of any number of mechanisms, including a flat monthly fee for access to the solar energy or by incorporating the cost into rental rates for new tenants.[12]

Case Study: California Virtual Net Metering

California first instituted virtual net metering through its Multifamily Affordable Solar Housing program in 2009. In 2011, the California Public Utilities Commission expanded virtual net metering to residents and businesses at all multitenant properties in California, including multi-meter condominiums, rental apartments, and multi-meter commercial properties. California's three investor-owned utilities—PG&E, SCE, and SDG&E—are required to offer virtual net metering to any number of customers for solar energy systems up to 1 megawatt in size at multitenant buildings.

Feed-In Tariffs (FITs)

A FIT provides a solar electricity generator with payments based on the amount of electricity he or she generates through long-term purchase agreements (often 15-20 years).[13] The design of a FIT varies across programs, but payments are typically designed to be technology cost-based and therefore substantial enough to incentivize solar energy adoption. Unlike a net metering arrangement, where the owner of the solar energy system consumes electricity generated by the system and exports any excess to the grid, under a FIT, the system owner exports all electricity generated by the system to the grid and separately buys all electricity it needs to fulfill its demand from the utility (requiring two meters). This arrangement is similar to a *value of solar tariff*, which has replaced net metering for residential customers in Austin, TX, and could be an option in the future for customers of investor-owned utilities in Minnesota.

Since building owners accrue all the benefits associated with their investment in a solar energy system in the form of payments from the utility for the electricity generated and realize all the costs of purchasing and maintaining the system, there is no split-incentive problem under a FIT.

State-level FIT programs exist in California, Hawaii, Maine, Oregon, Washington, and Vermont, and voluntary utility FIT incentives are available in roughly a dozen other states.[14] Table 2 highlights several examples of local programs.

Table 2: Examples of Local FITs and "Value of Solar" Tariff Programs

Municipality	Municipal Utility	Description
Austin, TX	Austin Energy	The first-in-the-nation Value of Solar Tariff replaced net metering for residential customers with solar PV systems 20 kW or smaller. Excess credits are carried over month-to-month.
Los Angeles, CA	Los Angeles Department of Water and Power	The Feed-in Tariff Program steps down offered prices as each 20 MW block is subscribed, with 100 MW total for the first phase. Four megawatts are reserved from each block for small projects (30 kW - 150 kW).
Indianapolis, IN	Indianapolis Power and Light	Rate Renewable Energy Production was a FIT pilot program that ended after reaching ~100 MW of renewable energy. It authorized the use of a reverse auction for 30% of solar purchased.

Financing Structures

Local governments can encourage multi-unit building owners to install solar energy systems by establishing policies or best practices for cost recovery and financing.

The rate structure chosen for the solar project will influence which financing option is the most attractive. If occupants receive a financial benefit from the system (e.g., through enhanced net metering), they may be asked to contribute to the costs of the system. On-bill financing, property-assessed clean energy (PACE) financing, and green leases are all mechanisms that can be used to distribute system costs to occupants through additional payments on utility bills or higher rent payments; on-bill financing and PACE are also often attractive options for building owners responsible for the entire system cost. Table 3 provides a summary of these financing and cost recovery options given the ownership structure of the solar energy system.

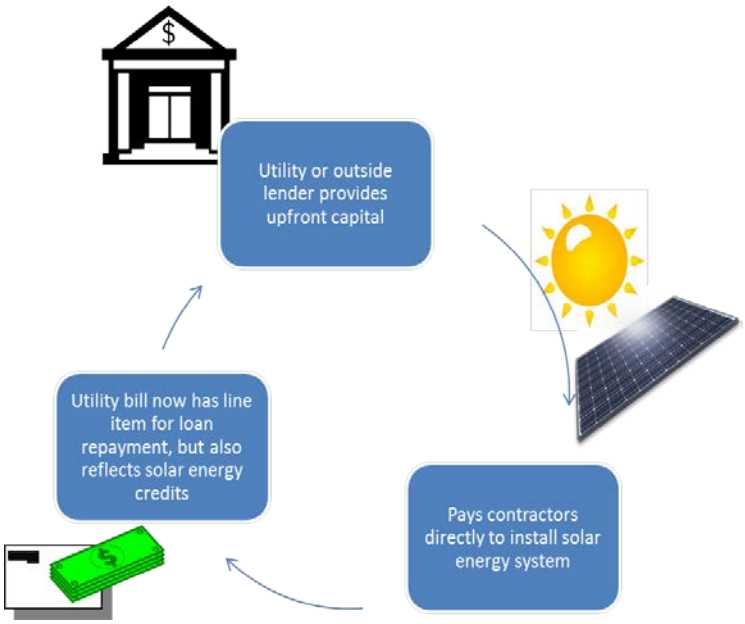
Table 3: Financing Options to Align Costs and Benefits of Solar Energy Systems

Who Realizes Costs and Benefits?	Financing Goals	Description	Financing Options
Building Owner	Low-cost, off-balance-sheet financing	Building owner recoups direct solar benefits, either because building is master metered, system offsets only common area electricity usage, or owner receives a FIT	PACE On-bill financing
Occupant	Cost sharing by occupants	Sub-metered building; ENM allows occupants to receive solar benefits	PACE On-bill financing Green Leases

On-Bill Financing

With on-bill financing, customers pay the costs of an energy upgrade over time on their utility bill. There are several different variations on this model, depending on whether the loan originates from a bank (on-bill repayment) or the utility (on-bill financing),[15] and whether it is structured as a loan tied to the customer or a tariff tied to the meter. Twelve states have authorized on-bill financing through legislation, and utilities in 19 additional states offer on-bill financing programs without state legislation.[16]

Figure 2: On-Bill Financing



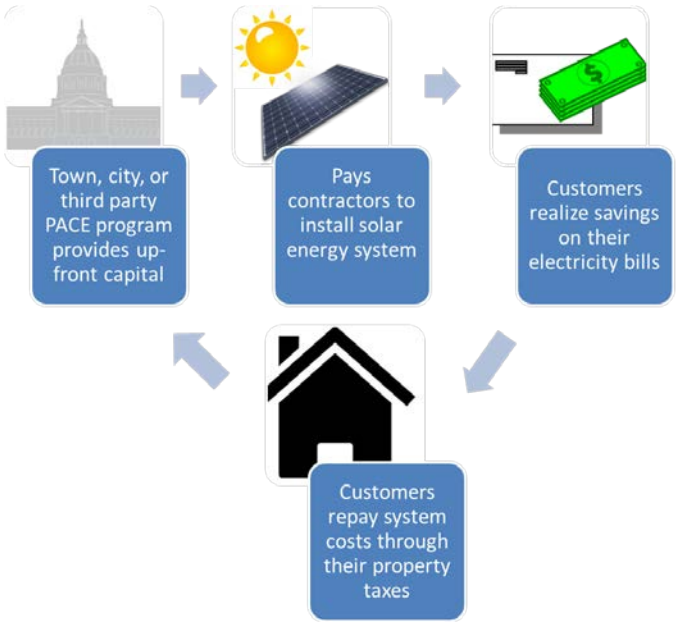
On-bill financing provides a mechanism for occupants in multi-unit buildings to pay their share of costs for upgrades they benefit from. If the occupant is receiving the benefits of solar through energy credits on his or her utility bill, on-bill financing can be particularly appealing in that it allows all transactions to occur for that customer in a single bill. Utilities can create on-bill financing programs or expand existing programs to allow the costs of one system to be distributed among multiple customers. Though not typically identified as "on-bill financing", utility-sponsored community solar programs operate in the same fashion. For example, Seattle City Light's community solar program charges customers a membership in two installments that can be paid through their utility bills.[17]

On-bill financing can also be appealing and straightforward when the building is master-metered and the building owner is responsible for all electricity costs. MPower Oregon is a program designed to assist affordable multifamily housing properties with energy upgrades, financed through additional payments on the owner's utility bill.[18]

PACE

PACE financing allows a property owner to pay the costs of an energy upgrade over time as an assessment on the building's property tax bill. This financing method eliminates upfront costs to the owner, typically carries lower interest rates and longer repayment terms, is tied to the property rather than the owner, and does not appear as debt on the owner's balance sheet. PACE can therefore offer a simple and attractive financing option in instances in which the building owner covers the full cost of the system and recoups the system's value directly. In addition, property taxes are generally eligible as an expense that landlords may pass on to tenants in rent payments or increased building management fees. PACE could therefore be used as a financing mechanism paired with ENM, where tenants would receive credit on the electricity bill for their share of the system's output, and pay their share of costs toward the system as an added item on their rent statement.

Figure 3: PACE Financing



Local governments in states that have authorizing legislation may create a PACE program or join an existing third-party administered program by creating a special assessment district. For extensive resources and information about PACE programs, visit PACENow.org.

Green Leases

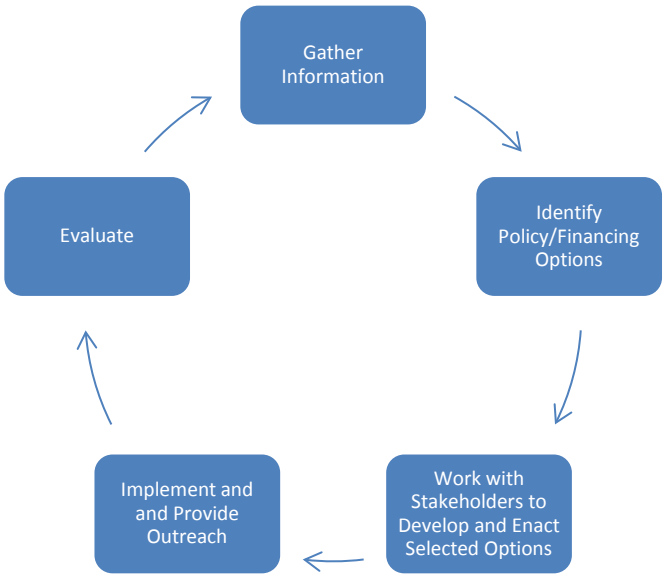
Local governments can also facilitate attractive solar cost-recovery by creating model lease agreements and best practices. ***A Green Lease includes a clause allowing the owner to pass through the amortized costs of the system to tenants, but the cost recovery is often based on the expected energy savings to the tenant.***

New York City has devised a standard "Energy Aligned Clause" to balance the interests of both landlords and tenants based on the recommendations of a working group to address split incentives for energy upgrades in commercial buildings. A workgroup in Boston has similarly developed a "Green Lease Guide" to help attorneys use and advocate for green leases.[19] While developed for energy efficiency upgrades, the format could be modified for an ENM or shared solar arrangement.[20] In some instances, a landlord may be able to recover system costs through rent without negotiating a special lease clause. For example, in San Francisco, landlords of new and vacant properties may allocate electricity from an ENM system to a building's units and include a proportionate amount of the system's cost in rent charged. Landlords must negotiate such rent increases and electricity distributions with existing tenants.[21]

Implementation

Local government policy-makers interested in addressing the split-incentive problem can do so through a series of steps, as illustrated in Figure 4. The first step is gathering information, such as identifying the relevant utilities providing service in the community, the opportunity for solar on multi-unit buildings, and interested stakeholders. Local leaders should research the status of relevant state, local, and utility policies, including net metering, on-bill financing programs, and PACE-enabling legislation or programs. The Database of State Incentives for Renewables and Efficiency (DSIRE) maintains a publicly-available, comprehensive list and summaries of federal, state, local, and utility policies and incentives and can be found at www.dsireusa.org.

Figure 4: The Policy Process



Next, local policy-makers can assess the needs, goals, and restraints specific to the community and identify feasible policy and financing options to address them. Local government can work with the relevant stakeholders and decision-makers, such as the utility, city council, board of directors (e.g., if the community is served by an electric cooperative), state regulators or legislators, and the solar industry, to develop and enact the identified policy and financing initiatives. Upon enactment, local governments can play a key role in facilitating implementation by publicizing the policy and financing options available and providing assistance and outreach to building owners. Local leaders and stakeholders should evaluate the policy and financing mechanisms after they have been utilized. The evaluation may identify more opportunities to improve the policy or program, leading to another cycle of the iterative policy process.

Conclusion

The split-incentive problem poses a significant, but not insurmountable, challenge to accelerating solar adoption on multi-unit buildings. Policies and financing tools that align the costs and benefits of solar are particularly well-suited for overcoming the split-incentive problem. A FIT apportions all benefits to the building owner, who can install and finance the system directly, while ENM paired with on-bill financing, PACE, or a green lease allows solar benefits and costs to be distributed to occupants. For utility service areas where neither a FIT nor ENM are available, local governments can still work with multi-unit building owners to create customized solutions for their properties. Such solutions may include sizing the system to offset the common area electricity usage or rewarding solarized buildings with special recognition or community awards. Regardless of the specific circumstances, local governments play a crucial role in developing and implementing a suite of policies and financing options that can transform the split-incentive problem for solar on multi-unit buildings into win-win opportunities for building owners and occupants alike.

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