



U.S. Department of Energy SunShot Initiative
Rooftop Solar Challenge II

New York City Multifamily Solar Guide

Considerations and Guidance for Installing Solar
Photovoltaics on Multifamily Buildings in NYC

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Document Background

The City University of New York (CUNY), on behalf of New York City (NYC), created Action Area Working Groups in 2012 to improve the NYC solar market as part of the U.S. Department of Energy (DOE) SunShot ‘Rooftop Solar Challenge I’ program. The NYC Financing Options (FO) Working Group team is led by the NYC Mayor’s Office of Sustainability (MOS) and the NYC Economic Development Corporation (NYC EDC), and coordinated by Sustainable CUNY’s NYC Solar Ombudsmen with support from the University Director of Sustainability and additional Sustainable CUNY staff. Working Group members include the New York State Energy Research and Development Authority (NYSERDA), Solar One, and GRID Alternatives.

As part of the NYSolar Smart program, supported by the DOE’s Rooftop Solar Challenge II (RSC II), the NYC FO WG surveyed multifamily buildings and management companies about their knowledge of and interest in utilizing solar photovoltaic (PV) power. The working group found that many stakeholders in NYC’s multifamily building sector, ranging from co-op and condo boards to property management companies to residents, lacked an understanding of the economic benefits of solar power, the feasibility of solar on multifamily buildings, and the challenges of pursuing an installation in the City. As a result, solar installers frequently invested significant time at board meetings and interacting with building managers to complete sales in the sector. The added time and effort raised customer acquisition costs, adding to the ‘soft’ (non-hardware) costs of solar, which already contribute roughly 64% of total solar system costs.

The NYC FO WG developed this guide as a resource for residents, board members, property managers, and other multifamily building stakeholders who are interested in pursuing solar PV so they can understand the benefits of solar, what is required to install solar, and the steps for moving forward. The goal is that this knowledge will streamline the interactions between solar installers and multifamily buildings, creating a more robust market in the sector that can maximize energy savings, environmental benefits, job growth, and local economic development.

It is important to note that there are two types of solar: solar photovoltaic (PV) and solar thermal (sometimes called solar hot water). This guide focuses on solar PV. For information on solar thermal, [visit CUNY’s solar thermal roadmap.](#)

Summary Sheet

Key Takeaways

- **There are two types of solar: solar photovoltaics (PV) and solar thermal (or hot water). This guide focuses on solar PV (“solar” going forward).** For information on solar thermal, [click here](#).
- Solar works in NYC. As of December 2015, the City has more than **58 megawatts of solar installed**, enough to power 8,400 homes.
- Solar systems on multifamily buildings can pay for themselves in **5-10 years** at current incentive levels, sometimes less, while **solar panel power production warranties typically last 25 years** – many panels function for 30+ years.
- **Solar systems can often be financed for \$0 down**, either through a loan or third-party ownership via a lease or power purchase agreement.
- Current incentives and tax credits can **reduce the out-of-pocket costs by 80%**. The process of monetizing state and federal tax credits is more complicated for co-ops and condos than for single-family homes or private management companies, so a tax attorney should be consulted.
- Incentives and tax credits are scheduled to decline in the coming years, so **it can pay to install solar today rather than waiting for further price declines or technological advances**.
- Solar systems can be installed with **2 types of racking: roof-penetrating or ballasted non-roof-penetrating**. A contractor can discuss the options and how they may affect a roof warranty.
- It is important that your roof have at least **15 years of life left** before installing solar.
- **The space on your roof available for solar will be affected by 4 factors:** roof orientation, shading, roof obstructions, and the NYC Fire Code.
- **The electric metering configuration of your building can affect the potential size of a solar system.** Buildings with units individually metered by Con Edison will connect the system to the common meter to offset common electricity needs, such as elevators and lighting, but not consumption of individual units. A master or sub-metered building will be able to offset both common and individual electrical consumption.
- **The electric rate categorization (also called utility tariff) of your building’s electric meter will significantly impact the potential savings and payback of solar.** Solar does not typically reduce [demand charges](#).
- **Going solar can be a complex process for co-ops and condos** because of board decision making and the challenge of monetizing tax credits – be prepared for ups and downs, but the economic and environmental payoffs can be well worth it.
- **Solar can be combined with energy efficiency to reduce the size of a solar system needed to offset your building’s energy usage or to maximize the impact of your investment.**

Multifamily Solar-Ready Checklist

- ✓ Determine if you have space for a solar system using the [NYC Solar Map](#)
- ✓ Determine current metering arrangement (master, sub- or individually metered) and utility rate categorization.
- ✓ Determine the annual energy load (kWh) for the electric meter(s) you will connect to the solar system. If expected solar production (kWh) from the NYC Solar Map exceeds 110% of annual electric load, ask a contractor about connecting to multiple meters or remote net metering
- ✓ Determine who controls the roof space and the process for receiving approval to install solar
- ✓ Make sure your roof has at least 15 years of life remaining
- ✓ Evaluate the building's ability to utilize tax credits and accelerated depreciation (MACRS)
- ✓ Evaluate the level of support for solar among the building's board/management and residents

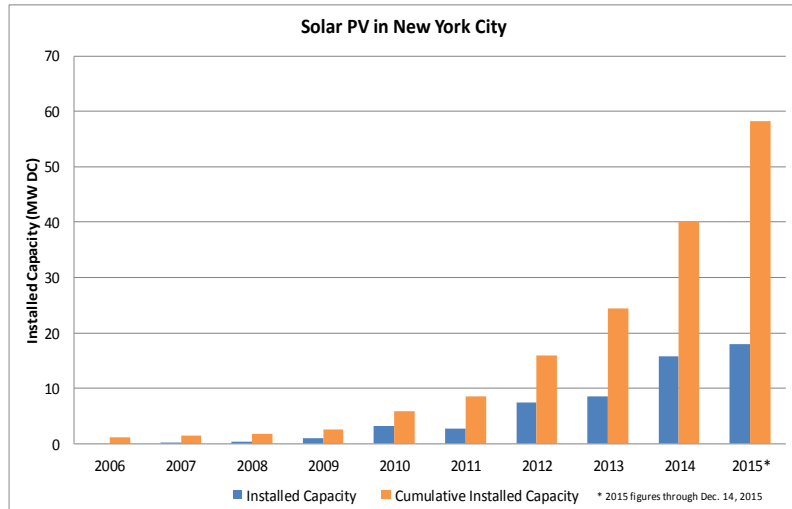
10 Steps to Install Solar

- ✓ [Evaluate](#) the building's solar potential (see Checklist above)
- ✓ Survey building support and identify solar champions among the board/management
- ✓ [Present](#) the case for solar to the board/management
- ✓ Gather energy bills and roof schematic drawings (if available), and [contact solar installers](#)
- ✓ Receive remote and on-site evaluations from contractors to get at least 3 quotes
- ✓ Contact references from solar contractors
- ✓ Evaluate costs and financing options to [decide on direct ownership or third-party ownership](#)
- ✓ Receive necessary board/management approvals to move forward
- ✓ Sign contract with selected solar installer
- ✓ The solar contractor files applications for incentives and permits; the installation moves forward

Why Should My Building Install Solar?

Solar Really Does Work in NYC

It's no secret that New Yorkers pay a lot for electricity. In fact, currently NYC has the highest energy prices of anywhere in the continental United States. As a result, with the availability of various [public incentives and tax credits](#), solar photovoltaic (PV) systems pay for themselves in just a few years by reducing the amount of expensive electricity that a building needs to purchase from the grid.



What about sunlight? New York is not known as one of the sunniest places in the country, but it receives more than enough sunlight to make solar a good investment. In fact, Germany has some of the highest levels of installed solar power in the world, and it receives far less sunlight than New York – even less than Seattle! Even in winter months, snow typically melts off solar panels quickly on its own and therefore does not significantly reduce solar performance.

As of December 2015, **New York City has installed more than 58 megawatts of solar power – enough to power 8,400 typical homes.** Those 58 megawatts are installed primarily on rooftops – over 2,800 of them so far. Moreover, solar has been growing exponentially in the City – roughly 67% per year. The City aims to have at least 250 megawatts installed by 2025.

Solar Is an Investment That Can Save Your Building Money

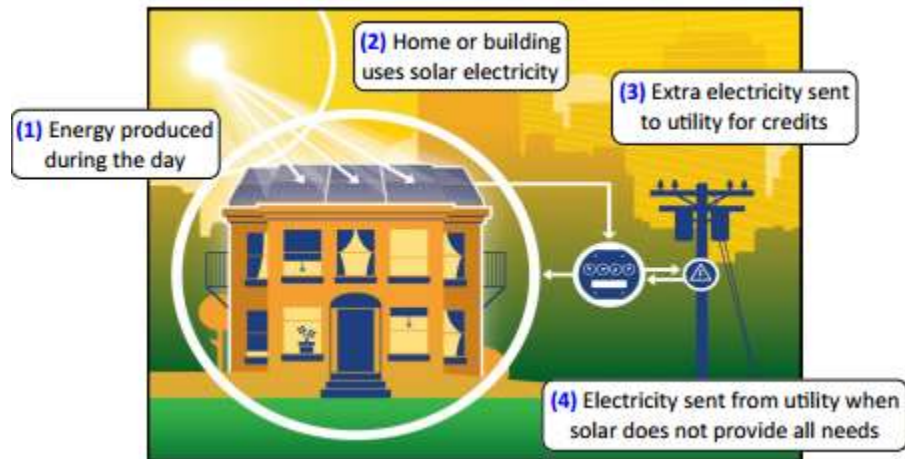
When purchasing a system, installing solar on your building's roof is just like any other investment. There is an upfront cost and over time you get your money back, eventually earning a return, in the form of reduced electricity bills. In most cases, **solar systems on multifamily buildings can pay for themselves in 5-10 years** at 2015 prices and incentive levels.

Currently, solar customers do not need to pay the entire cost of the solar system because there are [tax credits and other government incentives](#) available that significantly reduce out-of-pocket costs. **The ability to utilize all of these incentives will significantly affect the payback period.** If all of them can be monetized, then the payback is often 5 years or fewer. But if the tax credits cannot be used fully because not enough co-op tenant shareholders or condominium management association members can absorb their share of the credit, then the payback will be longer. Without monetizing any credits, they payback can be upwards of 20 years.

In recent years, the availability of [new forms of financing](#) has greatly increased the ability of multifamily buildings, particularly co-ops and condos, to pay for solar incrementally over time, rather than all at once. **This makes solar much more affordable, as it can be treated more like an operating expense than a capital investment.** Popular financing mechanisms include [third-party ownership via solar leases and power purchase agreements](#) ("PPAs"), and increasingly [loans](#).

How You Save

Solar PV reduces a building's energy costs by producing electricity that can be used on site or exported back to the local electric grid. This reduces the amount of electricity that must be purchased from the utility. **After the initial investment in a solar array is recouped, the energy it generates is essentially free.**



In the case of systems owned by a third party via a lease or PPA, savings are achieved because the regular cost a building pays to the third party for solar energy is less than the cost a building would pay the utility for the same amount of energy from the grid. This often allows immediate savings with \$0 down, although the total accumulated savings over the life of the solar system are not as great as with direct ownership via a cash purchase or loan financing.

After a PV system is installed, the building will continue to purchase energy from the electrical grid as needed. This is essential because the energy output of the solar array will vary over the course of the year and throughout any given day, depending on the season and the weather. The solar array will not produce any electricity at night. Additionally, most multifamily buildings do not have enough roof space for a PV system that would power the entire building. The connection to the grid ensures the building will always have power (except during power outages), regardless of how much energy the solar PV produces.

If the solar array does produce more energy than can be used on site, it will be exported back to the grid, allowing the building to save through a process called "net-metering." The building's energy meter monitors both the amount of solar energy produced and the energy consumed from the utility (Con Edison, in New York City). On each monthly bill, the customer will pay for the difference, or net, of the energy consumed from the utility minus the energy the solar PV system produced. **In a given month, if the solar system produces more energy than the building consumes, the utility provides net-metering credits that can be used to offset energy usage from the utility in future months. You can think of it like rollover minutes on a phone plan.** Con Edison has an introductory video [here](#).

What Is Solar, How Does It Work, and How Does It Attach to a Building?

Solar Photovoltaic technology converts light from the sun into useable electricity. Solar photovoltaic (or simply, PV) panels are typically mounted to a building's roof, and absorb sunlight to generate electricity, which can be used to supply the energy needs of the building.

Because solar PV systems have no moving parts and operate automatically, they are relatively simple in design and require minimal maintenance. They are made up of 5 primary components:

1. Solar PV panels (or modules) which when connected together are collectively called an “array”
2. A power inverter, which converts the electricity generated from the PV array from direct current (DC) into alternating current (AC) for use in the building
3. Racking, which mounts to the roof’s structure to secure the PV array in place
4. Wiring and electrical conduit piping, to connect the system’s components with the building and electric grid
5. Performance monitoring systems, to track the energy produced by system and to identify any equipment malfunctions

Solar PV systems can be installed on a roof using two different methods of racking:

1. **mounting that penetrates the roof membrane**
2. **a ballasted set-up that does not penetrate the roof**

The choice of racking depends on the individual building, but it can impact the roof’s warranty (even though once installed solar PV systems will often extend the life of a roof by protecting it from the elements). For a full discussion, read [this section](#).

Solar PV systems and components come with a variety of warranties that vary by brand and manufacturer. Commonly, **solar panels typically come with two types of warranties:**

1. **The production or output warranty** guarantees that the panels will produce at a specified percentage of their nameplate power rating after a given amount of time, since PV panels typically degrade overtime – about .5% per year on average. The production/output warranty is most commonly 80-90% production at 25 years, which may be supplemented by a separate warranty that covers degradation after a one-year “burn-in” period.
2. **The materials or equipment warranty** covers equipment failure from manufacturing defects, durability, exposure to the elements, and other factors. These warranties are most commonly 10-12 years, although some manufacturers offer longer coverage.

Warranties are also available for the solar system’s inverter, which converts direct current (DC) electricity into alternating current (AC) the standard current in the U.S. Warranties for standard “string” inverters, which involve a single inverter for the array of panels, are commonly 10-12 years. However, warranties for microinverters and power optimizers, both of which operate at the panel level rather than the array, are often 25 years.

What Challenges Can I Expect?

While solar energy has thrived in other parts of the country, its massive potential is just beginning to be tapped in New York City. There are several challenges that remain, particularly for multifamily buildings:

- Many of New York City’s buildings are old and present unique challenges to installing solar. If the roof is in poor condition, it will need to be repaired or replaced prior to solar installation.
- **Compared to other property types, cooperatives and condominiums have a difficult time taking advantage of the tax credits that help make solar such a good investment.** Both state and federal solar tax credits can be claimed by condo owners or co-op shareholders on a pro rate basis. For example, if a co-op has 1000 shares, and if the solar system on their building is eligible for \$100,000 in total tax credits, then \$100 in credits can be claimed per share. However, unlike a

single-owner building, multiple shareholders will need to be educated, convinced, and coordinated in order for the tax credits to be filed correctly in the necessary timeframe. Further, if the tax credits are to be aggregated to help pay down the cost of the system, then the co-op will need to put in place a mechanism through which such remuneration can occur, be it through short-term adjustments to maintenance payments for those who received credits, or by some other means of collection. The process required for such coordination can be a very complex, time-intensive undertaking. Each co-op's capacity and willingness to take it on will depend on its own unique circumstances, membership, and governance structure. **Additionally, in most multifamily co-ops or condos, not all shareholders or owners pay a sufficient level of income tax to fully avail the tax credits.** In the case of the example above, if only 70% of the co-op's 1000 shares are owned by shareholders who pay high enough income taxes to utilize the tax credits, then only \$70,000 of the maximum \$100,000 can be claimed against the total cost of the system. Determining the collective tax equity of all owners or shareholders upfront is essential to determining the system payback and return on investment, but adds up-front complexity to the overall process. Given the many other responsibilities that volunteer boards and management bear in order to ensure the day-to-day operations and long-term maintenance of their buildings, the overall effort required may prove too daunting, and ultimately dissuade them from seriously considering solar. Discuss your options with a tax attorney and if monetization is a problem, you may need to consider [third-party ownership models](#).

- **Taller multifamily buildings will often incur higher costs** because of the added expense of lifting panels to the roof with large cranes. The ability to use service elevators for bringing the equipment to the roof can reduce construction costs. At the same time, taller buildings have less available roof space for solar relative to their overall electricity needs. This means that tall multifamily buildings may end up paying more for a solar system that may only cover a small share of their energy needs, limiting the attractiveness of the investment. Higher costs will typically become a factor above 3 stories, although they may only be in the range \$0.05-\$0.15 per watt. If your building is tall, discuss your options with a contractor.
- There are fewer financing products available to multifamily buildings than smaller residential customers or larger commercial/industrial ones. Multifamily buildings have tended to fall in between these two large markets and so it can be more challenging to access financing. **Be sure to ask your contractor about the [financing options available to your building](#).** You can also consult the [New York City Energy Efficiency Corporation \(NYCEEC\)](#), an independent, non-profit financial corporation established by the City of New York that provides custom-tailored solutions to close financing gaps for buildings and clean energy project developers.



Dumont Green in East New York: 8-story, 176-unit, low-income rental building. 80.5 kilowatt solar system provides power to cover 80 percent of the laundry facilities, elevators, common areas, and security systems.

Other Benefits of Solar

There are some benefits of solar that go beyond dollars and cents. As a carbon-free technology, **solar reduces our City's contribution to climate change.** It can also improve the reliability of our energy-delivery system by providing additional power in areas of high electricity demand and

reducing strain on the grid. In fact, solar arrays greater than 200 kilowatts can receive [additional incentives](#) if they are located in areas of high electricity demand where they are most beneficial to the electric grid. Solar can also be combined with energy storage batteries or special inverters to enhance New York's resiliency to extreme weather and subsequent blackouts. **Resilient solar systems can provide energy in the aftermath of natural disasters or other emergencies which disrupt energy delivery, such as what was experienced during Hurricane Sandy.** As of 2015, combining solar with battery storage is a relatively new proposition in NYC, but [Con Edison incentives](#) may be available for battery systems that provide [energy demand](#) reduction. Ask your contractor about whether this option could work for your building.

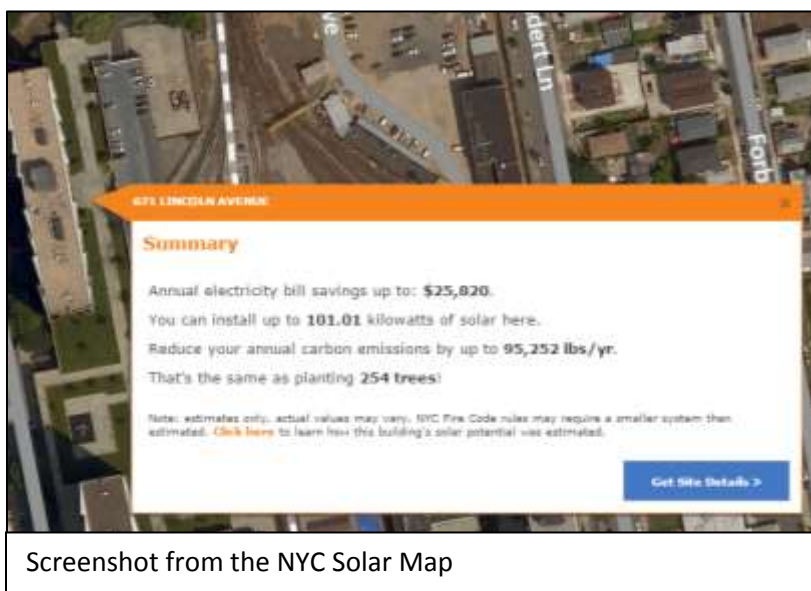
Is My Building a Candidate for Solar?

Determine If You Have Space

The first place to consider installing solar on a multifamily building is the roof. **As a starting point for evaluating your roof, visit the [NYC Solar Map](#)**, which will provide an estimate of your building's solar potential measured in kilowatts of solar PV that can fit on the roof. You will eventually need an in-person site assessment from a solar contractor to confirm the Map's assumptions, particularly because premium, high-efficiency panels can generate more power in a smaller amount of space. These high-efficiency panels can make a project more viable if your roof's space is constrained. (The NYC Solar Map will be incorporated into the [New York State Solar Map and Portal](#), which will be launched shortly)

The Map uses an algorithm to account for the factors that might limit the size of a solar array. There are typically four factors that have the greatest impact on solar in NYC:

1. Orientation, such as whether the roof allows panels to face south
2. Shading, such as shadows from trees or other buildings
3. Obstructions, such as vents, pipes, and bulkheads
4. Fire Code regulations



When setting your expectations for a solar installation, it is important to understand how these factors may limit your available space for solar.

- **Orientation:** The tilt angle and direction of your solar panels determines the amount of energy they generate, both at different times of the day and the year. To maximize total annual production in New York, panels would be oriented South with a tilt angle equal to the City's latitude (40 degrees). However, the layout of a building's roof and other engineering

considerations often make this design impractical. As a result, panels are sometimes oriented Southeast or Southwest and tilted at angles closer to 10-15 degrees. On flat roofs with limited space, panels are sometimes installed flat so they can be placed closer together. This reduces annual energy production per panel but often allows for more panels to be installed for greater total output. West-facing panels can maximize production later in the afternoon when electricity demand is often higher. A solar contractor will help you determine the best orientation of solar panels for your roof. If a system is designed so that it produces 20% less than what is considered optimal, its incentive from NYSERDA's [NY-Sun Incentive program](#) will be reduced proportionally.

- **Shading:** Your roof may appear clear of any shade, but **shadows need only to appear for part of the day to impact the production of a solar system.** As the sun sweeps across the sky, shadows will move, and even a building down the block may shade part of your roof enough to make it unfit for solar. Microinverters or DC power optimizers used on individual panels can reduce shading impact on the overall array by isolating the effects to specific panels.
- **Obstructions:** **It may be unsafe or against building and fire codes to install panels over small pipes or exhaust vents, depending on their temperature and the racking system chosen.** Other rooftop obstructions can cause similar problems, requiring panels to be installed around rather than over them.
- **The NYC Fire Code:** **The Fire Code has certain rooftop access requirements so that firefighters can effectively land on and navigate a roof in the case of an emergency.** For flat-roofed buildings less than 100' in height, the code requires a 6-foot by 6-foot unobstructed landing zone for every 12 feet of frontage building edge. There must also be one 6-foot wide clear path for every 100 feet of building length that connects these landing zones and travels from the front to the rear as well as between both sides. Additional clearance is required around doors and fire escapes. The full Fire Code can be read [here](#), but the significance for your evaluation is that these clear paths and setbacks limits space for solar panels. For example, a **10,000 square foot roof would require at**



Example of required clear paths to comply with the NYC Fire Code. The red indicates clear paths on one section of the building but note that clear paths are required on each part of the “H”-shaped roof.

least 1,164 square feet (11 percent) for fire access. Smaller buildings will have a higher percentage of roof space reserved for fire access paths.

If your roof does not have enough space for solar, you could explore other locations, such as a parking garage or carport if they are available.

Determine How Large a System Can Be Installed

A typical individual solar panel is slightly smaller than 5.5' by 3.5' or 6.5' by 3.5'. The amount of power a single panel generates varies by manufacturer and model, but typical panels as of the year 2015 are rated between 230-275 watts DC with higher efficiency panels reaching 327-345 watts DC. As a result, **power density typically ranges from 10 to 20 watts per square foot**. A 30-kilowatt system on a multifamily building might require 2,000 square feet. Panel technology and efficiency is consistently improving. In a few years, a 400-watt DC panel might be developed to use the same amount of space as today's panels.

Check Your Zoning

New York City's zoning laws affect the installation of solar panels. The "[Zone Green Text Amendment](#)" passed in 2012 provided greater flexibility for solar installations, allowing them to exceed maximum allowed building height in certain cases. Despite these changes, zoning will still need to be considered for any installation. For example, a **Landmark building or a building in a Historic District will be subject to specific requirements that may increase costs and restrict where on the roof the panels can be installed.**

- Find your building's zoning by using the City's [Zola zoning and land use map](#).



Check Your Utility Bill for Energy Consumption

The size of the solar system you can install depends not only on available roof space but also on your building's electric load. **Your solar array will need to be interconnected to a utility electric meter** (Con Edison in NYC) in order to receive NYSERDA's [NY-Sun incentives](#) and qualify for net metering, which allows excess energy generated to be sent back to the grid in exchange for electric bill credits.

Additionally, to qualify for the NYSERDA's NY-Sun incentive, the solar array must be expected to produce energy equal to no more than 110% of the total kilowatt-hours (kWh) consumption from the previous 12 months of electric usage through the associated meter. **Most multifamily buildings connect their solar array to the meter for common areas, such as hallways, elevators, and the lobby.** For these cases, it is important to keep the 110% of consumption limit in mind. For example, if your building uses 20,000 kWh per year in common electric load, it could not receive an incentive for a solar system larger than one expected to produce 22,000 kWh per year. **For taller buildings, with a high**

Your electricity charges	
These charges are for the electricity you used (supply) and getting that electricity to you (delivery). Rates are based on a 30 day period. When your billing period is more or less than 30 days, we prorate your bill accordingly.	
Electricity you used during this 29 day billing period from Dec 01, 2009 to Dec 30, 2009	
Rate: EL1 Residential or Religious	Meter# 7030113
We measure your electricity by how many kilowatt hours (kWh) you use. One kWh will light a 100 watt bulb for 10 hours.	
Dec 30, 09 actual reading	19209
Dec 01, 09 actual reading	-18550
Your electricity use	253 kWh

ratio of electric load to roof space, this is generally not an issue because the energy production from the largest solar array that can fit on the roof would be much smaller than the common electric load. But it could be a problem for buildings with greater roof space and smaller electric loads. **It is possible to connect a solar system to multiple electric meters to avoid this problem, but this requires the permission of the account holder of each meter.**

Although most multifamily buildings will offset common electrical consumption, **master-metered or sub-metered buildings are able to offset both common electric consumption and individual unit electric consumption.** Master metering can thus facilitate a larger solar array, due to the 110% rule mentioned above, if roof space allows it.

Additionally, it is important to consider the [utility tariff](#), or rate classification, that applies to the meter connected to the solar PV system. Most multifamily buildings are on a tariff that requires paying the utility for both consumption charges (kilowatt hours or kWh) and demand charges (kilowatts or kW).

- **Consumption charges** are based on the total number of kWh used.
- **Demand charges** are often based on the highest level of electricity supplied over a 15 or 30 minute time period in the billing cycle, a.k.a. 'peak demand.'

It is important to note that peak demand usage and thus demand charges are rarely reduced with solar. For more information, view CUNY's [Commercial Net Metering FAQ](#).

Make Sure Your Roof Is Ready for Solar

Once you have determined how large a solar system your building can install, it is important to make sure your roof is ready and able to host the system. The most important factor is the roof age. Most solar systems are warranted for 25 years, and many last even longer than that. **If your roof needs to be replaced during the lifetime of the solar system, the cost of removing and reinstalling the panels will need to be incorporated into the economic analysis of your solar array.**

As a general guideline, there should be at least 15 years of remaining life in the roof before installing solar panels. If there are less than 5 years left on the life of the roof, your building could replace the roof and then install solar or wait until the end of the roof's life when it must be replaced anyway. If the roof has between 5 and 15 years of remaining life, your building could also consider repairing it to extend its life before installing solar. Even if a roof has a significant lifetime remaining, its condition should still be evaluated prior to installing solar. It is prudent to consult a roofing professional.

Solar can be installed on a roof in two ways:

1. Roof-penetrating racking
2. Ballasted racking

Roof-penetrating racking will anchor the system to the roof using screws or bolts that pass through the roof and attach to internal structures, such as rafters. Ballasted racking systems use weights to secure the PV panels to the roof, meaning few to no roof penetrations will be required. Ballasted racking is only possible on flat roofs. Each option has advantages in different circumstances, which can be discussed

with your solar contractor. However, building management should consider how each option would affect the roof and its warranty.

A ballasted system may add significant weight to the roof, so your contractor or a professional engineer will need to perform an evaluation to ensure that your roof is capable of holding the extra weight. NYC requires a NYS Professional Engineer or Registered Architect to assess the added load in order to receive a building permit. Ballasted systems typically restrict panel angle to 10-15 degrees, which impacts performance. Ballasted racking is also more challenging to arrange around obstructions, such as vents, that could be built over with a penetrated system on elevated racking.

Roof-penetrating racking goes through the membrane of the roof, and may void existing roof warranties. The language of any roof warranties should be consulted to evaluate the impact of installing a solar PV system. Roof warranties can either cover the materials themselves, which is often provided through a manufacturer's warranty, or the workmanship of the contractors who installed the roof. You should also consult your solar contractor on additional workmanship warranties they may provide for sealing the penetrations from the racking and preventing future leaks.



Ballasted Racking

© [Steve Wilson](#), 2010 [CC License](#)

Once a solar system is installed, it can reduce wear and tear on a roof because it protects the roof from the sun, weather and elements. Regardless of the racking, your contractor's structural engineer will likely want to look at structural drawings and schematics of the roof to ensure it can carry the load of a solar system. Having these ready for a contractor will be a big help.

Check Who "Owns" the Roof Space

If your roof is ready for solar and you have sufficient space, the next step is to determine who has controlling rights to the roof space and whose permission is required to install a solar array. While these questions are straightforward for buildings owned by a single entity, the situation may be different for cooperatives and condominiums. The rooftop of many co-ops and condos is a common resource shared by all owners and shareholders, but in some cases the owners of the top-floor unit(s) have exclusive roof rights for a roof deck or other specific uses.

Even in the case that the roof is a common resource, the process for approving a solar installation can vary depending on the type of building and its bylaws. For example, New York State's Condominium Act stipulates that if proposed alterations would make changes in the permanent character of the building then this must be voted on by the entire community, rather than just the board.¹

¹ New York Law Journal. Volume 248, No. 90. Nov. 12, 2012. <http://www.stroock.com/sitefiles/pub1253.pdf>

To ensure all legal factors relevant to the use of the roof for solar are taken into account, it is important for co-ops to check their certificate of incorporation, by-laws, and proprietary lease and for condos to review their declaration and by-laws. Ultimately, the solar array will need to connect to at least one utility meter, so your building should also determine which meter(s) will be used and their account holder(s).

What If My Roof Is Not a Good Fit for Solar?

If you find your roof is not a good fit for solar, an alternative is to evaluate other parts of the building's property, such as parking lots or garages, to see if they could host a solar array. Although it is rare in New York City because of small lot sizes and shading from other buildings, if your building has unshaded space in its lot, you could also consider a ground-mounted solar array. Ground-mounted systems are often mounted on poles installed in the ground.

As long as the solar system can connect to a utility electric meter, it can take advantage of net metering. In fact, if building management has a meter in the same name on a different property, a solar array could be interconnected to this meter and any excess net metering credits could be transferred to the other property's utility account through a process called Remote Net Metering. To learn more about

this, read CUNY's [Commercial Net Metering FAQ](#).



Multifamily Performance Program

Credit: NYSERDA

If it is still impractical for your building to install solar after considering its roof and surrounding property, solar is not a feasible option right now. However, **your building should still consider energy efficiency improvements as a way of going green and saving money.** NYSERDA's [Multifamily Performance Program](#) (MPP) offers expertise, technology and incentives to permanently improve a multifamily building's energy performance through proven technologies.

Shared Solar and Community Net Metering

“Community shared solar” programs, “[Shared Renewables](#)” or “Community Distributed Generation (DG),” allows individuals and businesses to purchase or subscribe to portions of a large solar array based off-site and managed by a third-party.

These programs have been developed in several states as a way to provide access to the economic benefits of solar to renters, residents of multifamily buildings, and others who cannot install solar on their rooftop. **New York State's Community Net Metering policy**, which was [approved](#) by the NYS Public Service Commission in July 2015, allows the output of a single solar array to be distributed as credits to multiple utility bills. This allows residents of a multifamily building with a roof that is not a good candidate for solar the opportunity to “subscribe” to a portion of an off-site solar array and receive credit for its energy production on their electric bill. Community shared solar projects must have at least 10 subscribers, and each member must receive 1,000 kWh of net metered credits per year – not to

exceed their historic average annual consumption. Subscribers with an average monthly peak of 25kW or greater cannot account for more than 40% of project credit allocation.

There are two phases to the **NY-Sun Community Distributed Generation** or ‘Shared Renewables’ program.

Phase 1 began on October 19th, 2015, whereby projects may interconnect to the grid if they fall within a “Community DG Opportunity Zone,” which are designated by each Investor Owned Utility (IOU), or have at least 20% of its subscribers be low-income residential customers, which are defined as a customer participating in a State or utility energy assistance program. [Con Edison DG Opportunity Zone](#) | [Con Edison’s Community DG tariffs](#)

Phase 2 opens to all IOU customers regardless of income level or location within a Community DG Opportunity Zone on May 1, 2016. Community shared solar subscribers must reside in the same utility and NYSIO zone where the project is located. [NY-Sun Community DG webinar](#)

Community Distributed Generation policies only apply to Investor Owned Utilities, and thus do not apply to PSEG Long Island utility customers. PSEG Long Island has indicated that it will develop its own shared renewables program.

What Are the Options for Paying for Solar on a Multifamily Building?

The Cost of Solar

The cost of solar is typically measured in dollars per watt of power installed. In NYC, the average price of systems larger than 25 kilowatts was \$4.66 per watt in 2014, meaning a 25-kilowatt project would cost \$116,500 before incentives, depreciation, and tax credits are accounted for – which can reduce the net cost by more than 80%. However, this **average price obscures large variation in prices between boroughs and individual projects.**

There are numerous factors unique to a given multifamily building that will affect the price, so it often easier to think about payback time until you obtain a quote from a contractor. **Payback periods of 5-10 years are typical for buildings able to utilize all tax credits, and some buildings can even see quicker paybacks. If your building’s owners or tenant-shareholders are unable to monetize tax credits, the payback will likely be closer to 15-20 years.** However, [third-party ownership financing models](#), such as power purchase agreements and leases, can help to utilize tax credits and provide immediate savings but the overall lifetime savings to the building owners/tenant-shareholders will be less than if the solar array is purchased outright. If your building is



managed by a company that controls several buildings, **installing solar on the entire portfolio can often save costs and reduce the payback time.**

Lowering the Cost of Installing Solar with Incentives

As of 2015, the Federal Government, New York State, and New York City each provide financial incentives supporting investments in solar PV systems. Below is an overview of the incentives available for multifamily buildings in NYC. Many of these incentives are tax related, and their availability will always vary from case-to-case. The authors of this guide do not provide tax advice. You should consult your tax professional to verify your eligibility for tax benefits. **Most solar contractors will assist customers in understanding and filing for the available incentives, when applicable.**

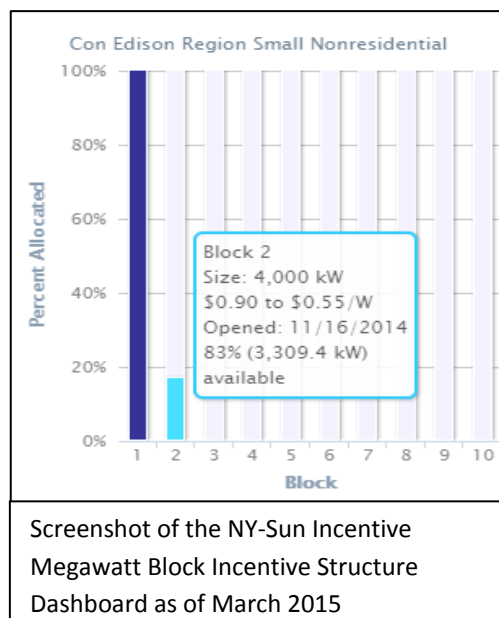
It is also important to note that these incentives and tax credits are each scheduled to decline in value or expire in the coming years. To take full advantage, your building will need to act quickly.

Federal

- **Federal Investment Tax Credit (ITC):** Building owners are eligible for a tax credit worth 30% of the installed cost of a solar PV system (after the state NY-Sun Incentive is applied). Individual members of cooperative housing corporations and condominium associations are both eligible for their proportionate share of this tax credit when their buildings purchase solar PV systems. If the tax credit exceeds an individual’s federal income tax liability the year the system was installed, the individual may carry the tax credit forward to the next year. This incentive is available through 2016, after which it is set to drop to 10% for commercial applications and expire for residential applications. Due to the potentially high number of residents and disparity of incomes, splitting this tax credit among co-op and condo residents is a logistical challenge. Read [this section](#) for more details.

State

- **New York State Tax Credit:** Residential building owners who install solar are eligible for a tax credit for the lesser of 25% of the installed cost of the solar energy system (up to 50 kW on net-metered systems) after the NYSERDA incentive, or \$5,000. Tenant stock-holders in cooperative housing corporations and individual members of condominium management associates are eligible for their proportionate share of this tax credit for the corporation/association’s eligible expenditures. Be advised that the federal government considers this state tax credit taxable income. Due to the potentially high number of residents and disparity of incomes, splitting this tax credit among co-op and condo residents is a logistical challenge. Read [this section](#) for more details.
- **NY-Sun Incentives:** New York State’s NY-Sun Initiative provides incentives for installing solar electric systems sized 200 kilowatts or less per electric meter. Incentives are distributed through three regions – Con Edison, PSEG Long Island, and The Balance of the State (Upstate) – with two sectors per region (“Residential” projects up to 25 kilowatts and “Non-residential” projects 25-200 kilowatts). Most



multifamily buildings will be considered “Non-residential” because their projects are likely to be greater than 25 kilowatts. Under the [“Megawatt Block” incentive structure](#), each region and sector is assigned a series of MW installation targets at certain incentive levels, referred to as “blocks.” As incentive applications are submitted, the incentive for the current block is applied to these projects. When the MW target for that block is reached, the block is closed and a new block, with a new target and a lower incentive level, is started. Once all of the blocks for a particular region and sector are filled, an incentive for that region and sector will no longer be offered. View real time available incentives by block on the [Megawatt Block Incentive Dashboard](#). In 2015, the NY-Sun Incentive for a typical multifamily building in NYC would cover approximately 15-30% of the installed cost of a PV system. The NY-Sun Incentive is paid directly to the installing contractor and passed to customers in the pricing quote. Due to the complex ownership and metering arrangements for many multi-family buildings, NYSERDA reviews solar PV incentive eligibility on a case-by-case basis.

- **Sales Tax Exemption:** New York State grants exemption from sales and compensating use taxes for the sale and installation of residential solar PV systems. In addition, New York City has granted exemption from local sales and uses taxes for residential solar PV systems (although not for commercial systems). Co-ops, condos, and multi-family buildings are considered residential for this incentive.

City

- **New York City Property Tax Abatement:** Building owners who place a solar energy system into service from January 1, 2014 through December 31, 2016 are eligible for a four-year Property Tax Abatement (PTA) of 5% per year of the installed cost of the system for 4 years (total of 20%) after the NY-Sun Incentive. Abatements are capped at \$62,500 per year or \$250,000 total. This tax abatement may not exceed one’s property tax liability for any given year. For systems installed on condominiums, the tax abatement is to be divided among all tax lots within the building. For more information, visit: [NYC DOB Property Tax Abatement](#). **As an example**, the PTA calculation for a 25 kilowatt solar installation that costs \$112,500 and receives a \$22,500 incentive from NY-Sun Incentive would be:

Example:

$$\begin{array}{r}
 \$112,500 \text{ Gross solar system cost} \\
 - \underline{\$22,500} \text{ NY-Sun incentive} \\
 \$90,000 \text{ Net cost after NY-Sun} \\
 \times \quad 20 \% \text{ NYC PTA percentage} \\
 \hline
 \$18,000 \text{ Total NYC PTA over 4 years} \\
 \div \quad 4 \text{ Years} \\
 \hline
 \$4,500 \text{ NYC PTA Per Year for 4 years}
 \end{array}$$

Other

- **Modified Accelerated Cost Recovery System (MACRS):** The U.S. tax code allows for a tax deduction for the recovery of the cost of tangible property over the useful life of the property. Established in 1986, the [Modified Accelerated Cost Recovery System](#) (MACRS) is the current depreciation method for most property, including qualifying solar energy equipment. A business’ investments in solar are recovered, for tax purposes, over a specified time period through annual deductions according to the following schedule:
 - **Year 1:** 20%
 - **Year 2:** 32%

- **Year 3:** 19.20%
- **Year 4:** 11.52%
- **Year 5:** 11.52%
- **Year 6:** 5.76%

Since 2013, a 50% bonus depreciation in year 1 has been available, although it was scheduled to expire at the end of 2014 and received a retroactive extension in December 2014. The depreciation basis is typically 85% of the total installation costs. Because MACRS is a deduction, its actual value in each year will depend on the business’s tax appetite and tax rate. IRS Publication 946 on how to depreciate property can be found [here](#). For a multifamily building to take advantage of MACRS, it must be a business and clearly show that the solar power you are generating is for business use. Always consult a tax expert.

Financing and Ownership Models

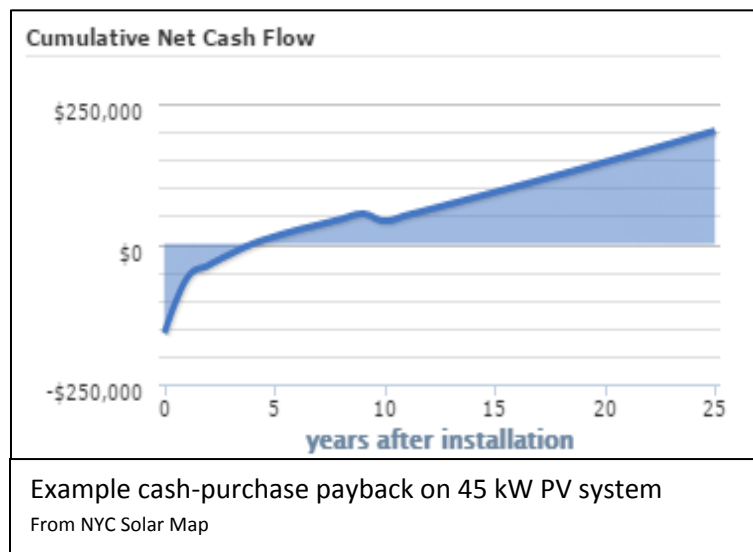
PV financing methods can be placed into two categories: direct ownership and third-party ownership.

1. **Direct ownership** financing allows customers to purchase and own PV systems through bank loans and other debt-based financing mechanisms, often with no upfront cost and repayment over a fixed term.
2. **Third-party ownership** models, in contrast, enable customers to lease a PV system or purchase the power produced from a third-party who is the legal owner of the system.

Depending on the ownership structure of a multifamily building, financing can be one of the biggest challenges to installing solar. **There are generally fewer financing mechanisms available to multifamily buildings than small residential customers and larger commercial businesses.** Additionally, cooperatives and condominiums can sometimes have difficulties qualifying for loans, depending on the state of their finances.

Cash and Financing: Direct Ownership Models

The simplest method of purchasing a solar PV system is to pay cash. **Although cash purchases require the highest out-of-pocket costs and thus the longest payback, it will generally provide the greatest savings and return on investment over the lifetime of the solar system (25 years or more)** because there is no loan interest to be paid. Other direct ownership mechanisms typically include traditional loans and credit enhancement options offered by banks, credit unions, and public institutions, giving access to low cost financing for long-term payback periods.



An increasing number of loan products are specifically designed for the purchase of solar PV systems and provide \$0-down financing.

Another direct ownership model that is not yet available in NYC is Property Assessed Clean Energy (PACE) financing. In PACE financed solar PV, local governments raise money by issuing bonds or other sources of capital to fund projects on behalf of property owners, who pay their obligations through a special assessment attached to their property taxes. The advantage of this model is that solar energy savings can more than offset the cost of the special assessment each year, and the PACE assessment is transferred to the new owner if a building is sold.

Currently, PACE financing for residential solar PV programs are on-hold in many parts of the US, including NYC, but this financing option may be available in the future. PACE financing for commercial projects (C-PACE), which many multifamily buildings would qualify for, is available in a growing number of jurisdictions across New York State through the [Energy Improvement Corporation's Energize NY Finance](#) program. However, **PACE financing is not yet available in New York City.**

Leases and PPAs: Third-Party Ownership Models

There are two primary solar PV third-party ownership models: solar leases and power purchase agreements (PPAs). In both cases, a third-party company will install, own, and maintain the solar equipment for the term of the agreement. Additionally, **a third-party owner can facilitate tax credit monetization.**

- **Solar lease** customers pay an agreed monthly fee to use the electricity produced by the system.
- **Power purchase agreement (PPA)** customers pay for the actual power produced at an agreed per-kilowatt-hour rate, which is typically fixed over the course of a long-term contract.

Solar Leases and PPAs can be advantageous because they are designed to remove most, if not all, upfront costs to the customer, who sees immediate savings by paying a monthly rate lower than their previous energy costs. In both cases, the third party remains the legal owner of the solar PV system, which simplifies the incentive and tax benefits (removing the customer from the process), as well as maintenance and performance concerns. Many leases and PPAs include an option for the customer to purchase the solar PV system for a depreciated cost or return it to the third-party at the end of the term. **The use of a third-party owner for monetizing tax credits is commonly considered for co-ops and condos, which can have a difficult time monetizing the credits on their own.**

While the primary upside of third-party ownership models is the lack of upfront cost and simplicity from the customer's perspective, the downside is that these models typically provide a lower return on investment than loans or cash purchases over the life of the solar PV system. For example, a PPA might provide an electric rate that is several cents per kilowatt-hour lower than the utility rate, but it does not provide the "essentially free" energy of purchasing a solar system, once the investment is paid off. Additionally, because a third-party owner will monetize the [Federal Investment Tax Credit \(ITC\)](#), the building is not able to take advantage of this tax credit directly (although some of its value will be incorporated into the per-kWh PPA rate or per-month lease rate paid by the building).

While solar leases and PPAs are potentially viable financing models for multifamily solar projects, system size is an important criterion. Many developers aim for a system size of at least 100 kW, which many multifamily buildings in New York City cannot support. While developers focus on larger-scale projects

due to their cost effectiveness, these third party financing models may become more common in smaller scale projects as demand increases and the market grows.

Understanding Terms and System Performance

As with any contract, it's important for multifamily buildings considering any financing option or third-party ownership model to fully understand the terms of the agreement, and that the expected performance of the PV system will deliver what is required to be financially viable. Some [common terms](#) to understand include:

- **Buyout Options:** Many lease and loan financing contracts allow the customer to pay off the remaining balance as a lump sum after a certain point in the term of the agreement.
- **Contract Term:** Most third-party financing terms are 5-20 years, but the warranties of solar panels often extend to 25 years.
- **Escalation Clause:** Many contracts include a clause that increases the monthly payments over time to account for inflation or increases in energy prices.
- **Building Ownership Transfer Provisions:** It is important to note the allocation of obligations in the case of a transfer of building ownership.
- **Minimum Production Guarantees:** Because the value of solar leases and PPAs is based on the output of solar energy, many of these agreements include annual production guarantees. If the solar system produces less than the guarantee, the contract will typically require the third-party owner to compensate the customer on a per-kilowatt-hour basis.
- **Operations and Maintenance:** The third-party owner of a solar system typically covers operations and maintenance over the course of the contract term, but it is important to determine what the contracted responsibilities are.
- **Pre-Payment:** This option is similar to a buyout, but it often allows for a full pre-payment upfront to allow the customer the operations and maintenance benefits of third-party ownership without the monthly payments.
- **Production Estimates:** Because the value to a customer with a lease or PPA contract depends on the output of the system, it is important to closely examine the estimated production of the system.
- **Utility Rate Projections:** Regardless of the financing or ownership model, many solar contractors will project savings based on a projected escalation of utility energy prices. Historically, this rate has been about 3% annually.

Combining Solar with Energy Efficiency

While generating clean and renewable energy on your home provides cost savings and sustainability benefits, it is important to consider combining energy efficiency in tandem with going solar. Energy efficiency measures may include installing upgraded lighting, heating systems and insulation, or major appliances (TVs, air conditioners, refrigerators, and laundry machines) that consume less energy to do the same job. Often referred to as “low hanging fruit”, energy efficiency measures are straightforward ways reduce energy consumption and costs, and will ensure that you get the maximum financial gains out of your solar PV system; with a smaller baseline energy footprint, your solar system will provide a higher percentage of your energy needs and costs.

To learn more about energy efficiency programs offered to multifamily buildings in New York, please visit [NYSERDA's Multifamily Performance Program \(MPP\) website](#).

What Are the Steps to Installing Solar on My Building?

Build a Coalition to Support Solar on Your Building

Once you have determined that you can have solar on your building and there is sufficient space and energy load, the next step is to evaluate the level of interest in your building for installing a solar array. You can start with one-on-one conversations and move to an informal poll on a building message board or online listserv.

Your fellow residents are likely to have many questions, so you should share the information you have gathered, including this guide, and explain that more information will be gathered before any decisions are made. For example, **you will need a site evaluation and quote from a contractor before you can discuss financial investment and potential savings in detail, but you can use the [NYC Solar Map](#) as a guide for rough estimations.** When discussing solar with fellow residents or issuing a poll, it is important to clearly lay out the potential benefits of solar:

- An investment that can provide significant savings over time
- A hedge against fuel cost and electricity price changes
- A way to make the building “greener”
- A way to make the building more resilient to power outages, if combined with a battery back-up system

Different people will be more interested in some reasons than others, but most of all they will want to know the immediate financial impact and potential risks. As

you may not have all of this information yet, you can offer to involve them in the information-gathering process if the building decides to reach out to contractors for an evaluation and quote.

Research has shown that people are up to 200% more likely to go solar if their neighbors have gone solar. Even if no buildings in your immediate vicinity have solar installed, one of the most effective ways of building support is to talk to residents of other multifamily buildings in the City who have.

If there is further support for pursuing solar, it is time to discuss the idea with your board or management company.



Kips Bay Tower in Manhattan: 20-story condominium building. 54.28 kilowatt solar system provides 57,000 kWh per year.

How to Talk to the Board About Solar

Once you have found there is support among residents for exploring solar power, it is time to discuss it with the building's board or management. Schedule a timeslot in a regularly scheduled board meeting. In advance, it is helpful to:

1. **Find a “solar champion” on the board.** This could be someone on the board who is particularly passionate about sustainability, or someone who understands the economic benefits of solar power. Having someone on the board who can explain the benefits of solar will help you make the case.
1. **Lay out your building's case for solar.** Prior to the meeting, it may be helpful to prepare a presentation that outlines what you have found in your investigation so far, explaining potential benefits and risks. Include a list of resources so that board members can do follow up research after the meeting.
2. **Prepare to deal with dissent.** Some board members will likely be skeptical of your proposal. They may have the perception that solar is too costly or that there are too many risks associated with construction on the roof. It is important to remember that questions like these are legitimate and should be answered with data whenever possible. If you do not yet have data available on potential savings from a solar array on your roof, you can explain that there are potential savings that may be worth exploring. Most solar installation contractors will perform site assessments free of charge. CUNY's Solar Ombudsmen are also available to answer questions at nysolar@cuny.edu.

Contact a Solar Installer to Perform a Site Assessment and Provide a Quote

If the board or management company decides to pursue solar, the next step is to engage a contractor to perform a site assessment. This assessment may be done partially through aerial imagery, such as the NYC Solar Map, but will likely also involve an in-person visit to your roof. **The contractor will evaluate the structure and your energy bills to evaluate whether solar is technically feasible, taking into account available space and potential shading, and economically beneficial.** Once they have performed a site assessment, they will be able to provide quotes and potential [financing options](#), including \$0-down power purchase agreements, leases, and loans. **It is typically recommended to get at least 3 quotes before choosing a contractor.**



How to Select a Contractor:

1. **Evaluate the list of Participating Installers for the NY-Sun Incentive Program.** This [list](#), which can be narrowed by county, includes all contractors who are eligible to provide incentives from New York State's NY-Sun Program, which supports solar in New York.

2. **Examine other certifications and qualifications.** To be listed as a Participating Installer for the NY-Sun Incentive Program, contractors must have a certification from the North American Board of Certified Energy Practitioners (NABCEP), the International Brotherhood of Electrical Workers (IBEW), or Underwriters Laboratories (UL). [NABCEP](#) is the most widely recognized certification organization for North American solar professionals, and the NY-Sun Eligible Installer List will indicate whether the contractor has NABCEP-certified personnel.
3. **Evaluate contractors' geographical location.** You may find that once you have clicked on your county to narrow the NY-Sun Eligible Installer List, many contractors will be listed as working from offices that are far from your location. Some installers have a wide geographic scope, while others may not, so it is important to determine if contractors you reach out to will serve your area. It is also beneficial to evaluate the number of installations and amount of experience they have in the multifamily sector, particularly in New York City. New York City has unique permitting requirements and processes that may be challenging for solar contractors to navigate if they do not have experience with them.
4. **Ask the right questions.** The U.S. Department of Energy produced a [consumer guide](#) to solar that includes a list of common questions to ask installers:
 - What experience and certifications do you have?
 - How long have you been in business?
 - What do you know about zoning, electrical requirements, and codes?
 - Are your installers NABCEP certified?
 - Do you handle paperwork for federal and state incentives?
 - Do you offer maintenance service?
 - Are you a member of any solar trade organization, such as the Solar Energy Industries Association?
 - What warranties do you offer and what do they cover?
 - What payment options do you offer?
 - Do you offer packaged systems?

Additionally, it may be useful to ask specific questions related to multifamily buildings in New York City:

- What experience do you have working on multifamily buildings?
- What financing options do you offer?
- What are the pros and cons of your third-party ownership options and direct-ownership options?
- Does your firm file for permits with the NYC DOB in house or does it use a sub-contractor? How much experience do you have in this regard?
- Do you offer solutions for constrained roof space (if applicable), such as special mounting or high-efficiency panels?

5. **Ask for References.** Previous customers are often a good indicator of a contractor's level of customer service and satisfaction. Do not hesitate to ask for specific references, particularly references for other multifamily buildings the contractor has worked on.
6. **Get Multiple Quotes.** In order to feel confident in your contractor selection, it is advisable to solicit at least 3 quotes. By speaking with multiple installers, you may come across certain challenges or solutions that would not have been apparent with a single bid.

Be Prepared for Bumps in the Road

Once you reach out to a solar contractor and receive a site evaluation, you may receive the unfortunate news that your building is not as well suited to solar as you had thought. Before you give up on your goal, consider the following:

1. **Ask the contractor about combining a solar installation with energy efficiency measures.** Many "low-hanging fruit" energy efficiency measures have a quicker payback time than solar and combining them can reduce the overall payback time of your investment.
2. If your building decides to pursue energy efficiency on its own, **NYSERDA's [Multifamily Performance Program \(MPP\)](#) offers expertise, technology and incentives to permanently improve a multifamily building's energy performance through proven technologies.**
3. **If a solar PV system is unfeasible, ask the contractor about a solar thermal system.** Solar thermal systems use energy from the sun to provide the building with hot water, rather than electricity. On some buildings, these systems can work better than solar PV.
4. **If roof access or fire set backs are a concern, ask your contractor about a solar canopy.** A canopy will raise the solar array above the roof level so that residents and fire fighters can move freely underneath. A canopy will add significantly to the cost of the system, but it may allow for more panels to be installed on the roof. Your contractor will have to take careful consideration to ensure the canopy is compliant with all zoning and fire code regulations and that it is structurally sound. Strong winds on the roofs of taller buildings may preclude these buildings from pursuing canopies.
5. Some of your fellow residents may ask if "building-integrated" solar, often called BIPV, is possible. With BIPV, solar PV systems are partially or fully integrated with building materials, either complementing them or replacing them as part of the building's structure. **BIPV has been successfully implemented on several new-construction multifamily buildings in New York City, but it is very expensive and more challenging to achieve on existing buildings.**