



Virtual Net Energy Metering at Multitenant Buildings

I. Summary

This paper describes the opportunities and challenges to establishing solar photovoltaic (PV) and other renewable energy projects that utilize virtual net energy metering (VNM) on multitenant properties in Pacific Gas & Electric's (PG&E's) territory, and more generally, in California. More specifically, the paper: (1) introduces the concept of VNM and its benefits, (2) describes key VNM program details, and (3) identifies challenges to implementing VNM projects. In addition, the appendix includes a review of other forms of virtual metering in California and similar policies in other states, as well as a sampling of interconnection diagrams and a fact sheet that explains VNM to rental property owners and homeowners' associations.

This material was prepared by San Francisco's Department of the Environment under a U.S. Department of Energy SunShot Initiative Rooftop Solar Challenge grant managed by SolarTech.¹ The paper is intended as a primer on virtual net energy metering for local governments, condominium and cooperative homeowners' associations (HOAs), rental property owners, residential and commercial tenants, and other solar industry stakeholders.

II. Introduction

Approximately 250,000 households – two thirds of all households in San Francisco – live in multitenant buildings, and yet nearly all residential solar energy systems in San Francisco have been installed on single-family homes. This disparity is due to numerous factors. First, installing multiple renewable energy systems, one for each individual meter/tenant in a building, is cost prohibitive and often physically impossible. Second installing one renewable energy system for a common area load cannot offset the load of the whole property and is thus not economically efficient, nor is there a means to ensure distribution of the generation to each occupant. Third are the "split incentives" that arise when a landlord must pay for a renewable energy system that benefits all tenants by lowering total building costs but the landlord can't easily pass on the costs of the system to tenants. The advent of VNM addresses these problems. VNM increases access to renewable energy to many homes and businesses that previously could not directly benefit from a renewable energy system, such as renters. VNM helps occupants of multi-metered residential and commercial buildings receive direct benefits of the building's renewable energy system, rather than all of the benefits going to the building owner. VNM also improves the economy of scale of renewable energy systems by spreading the costs and benefits of larger systems among more beneficiaries.

¹ SolarTech is a non-profit solar PV industry association chartered to streamline industry business practices that hinder the market growth and adoption of solar PV through hidden costs and delays. SolarTech is one of 22 awardees of the DOE SunShot Rooftop Solar Challenge, leading a team comprised of City & County of San Francisco, Solar Sonoma County, East Bay Green Corridor and Clean Coalition. This team is focused on lowering the costs and burdens of permitting, inspection, interconnection, and finance for solar systems in the greater Bay Area. Visit www.solartech.org to learn more.

VNM describes the allocation of electricity, generated from a single renewable energy system at a multitenant property, to multiple utility accounts located at that property, as described in California Public Utilities Commission (CPUC) Decisions 11-07-031 and 08-10-036. VNM allows for less expensive solar installations because you do not need separate bidirectional meters, inverters and wiring for each unit, and it creates greater flexibility because the system owner can administratively reassign shares of energy from one unit to another. VNM is an offshoot of net metering (or net energy metering), which credits customers for on-site renewable energy generation against their onsite electricity use, at full retail electricity rates (i.e., including generation, transmission and distribution fees, and other fees and taxes paid based on usage). Critically, under VNM, the electricity produced on-site is allocated to multiple on-site customers' bills without requiring the renewable energy system to be physically interconnected to each tenant's electricity meter. Instead, the generation is credited to benefitting accounts administratively, using electronic billing software.

VNM was first allowed in investor-owned utility territories in California in 2009 as a design feature of the Multifamily Affordable Solar Housing (MASH) program, and was soon added as an option to affordable housing properties utilizing the state's New Solar Homes Partnership (NSHP) program. Both programs provide lump-sum rebates for the installation of solar photovoltaic (PV) systems on multifamily affordable housing properties —MASH supports solar at existing buildings and NSHP at new buildings. Some MASH and NSHP projects use solar energy to offset solely common area electricity loads, while others utilize VNM to offset tenant loads in addition to, or instead of, common area loads.

In 2011, the California Public Utilities Commission (CPUC) approved two significant changes to VNM rules. First, the Commission broadened the physical boundaries for VNM projects receiving MASH program funds. Previously, the rules limited VNM to customer accounts served by the same "service delivery point" (SDP) as the renewable energy system. The SDP is the demarcation between the customer-owned electrical system and the utility distribution system.² This proved to be a significant constraint on the use of VNM because many affordable housing developments contain multiple buildings that connect to the utility distribution system at multiple SDPs. The new rules allow VNM to allocate bill credits across "all of the real property and apparatus employed in a single low income housing enterprise on contiguous parcels of land."³ The rules allow parcels to be divided by streets or other public thoroughfares so long as they are part of the same enterprise and under the same ownership.

The Commission's second modification was to expand VNM to all multitenant properties in California, both market rate and low income, regardless of their participation in the MASH program. This was a big step forward in opening up VNM to a much wider pool of potential projects across the state, such as multi-meter condominiums, rental apartments, and multi-meter commercial properties. Significantly, however, the CPUC decided to limit non-MASH projects to a single SDP, as had previously been required of MASH program projects. By increasing access to solar power for residents and businesses at all multitenant properties, VNM also makes statewide incentive programs for solar more equitable. Since all ratepayers are helping to fund solar incentive programs through their electricity bills, it is fair that all ratepayers – market-rate and affordable, single-family and multifamily – are able to take advantage of them.

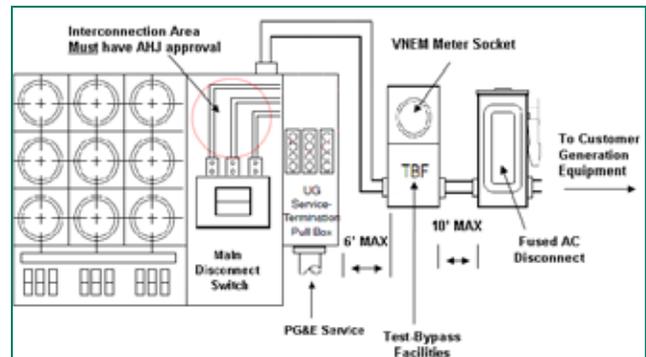
² Pacific Gas & Electric, "Electric Rule 16: Service Extensions," (2003) 21. http://pge.com/tariffs/tm2/pdf/ELEC_RULES_16.pdf

³ Pacific Gas & Electric, "Electric Schedule NEMVMASH: Virtual Net Metering for Multifamily Affordable Housing with Solar Generator(s)," (2012) 2. http://www.pge.com/tariffs/tm2/pdf/ELEC_SCHEDS_NEMVMASH.pdf

III. VNM Program Details

VNM projects have unique attributes that differ from traditional net metered projects. Below is important information about how to complete and operate a VNM project. While the details are specific to PG&E's service territory, in most cases it is similar to the attributes of VNM programs in the other investor-owned utility territories in California.

- **VNM generators are sized to load.** Like traditional net metering customers, a VNM generator is sized to load. Thus the nameplate capacity of a VNM generator cannot exceed the combined load of the benefiting accounts in the VNM arrangement, up a maximum of 1 Megawatt.
- **Interconnecting VNM projects.** A key difference between a VNM project and a typical net metering project is that a VNM project cannot be connected to a meter that also has electrical loads tied to it. Consequently, a VNM project requires a separate meter solely for generation and exports all power to the utility grid. In addition, the system must be connected "above" (i.e., to the PG&E line side) all other meters at the property so as to be unaffected by any of the individual tenant or common area electricity use. At the same time, the interconnection cannot be made in any PG&E sealed sections. Consequently, VNM interconnections are more challenging than typical net metering interconnections and normally require a site visit from PG&E to determine if an upgrade to the property's electrical service panel is necessary. PG&E advises that all renewable energy system installers contact PG&E's interconnection staff at gen@pge.com, and complete the VNM application and interconnection agreement, prior to beginning installation of any VNM project. Applicants must be approved for interconnection by PG&E before operating the system for the safety of utility personnel.
- **Generator, benefiting, and default accounts.** The owner of the VNM project must establish a *generator account*, which must be comprised of only the renewable energy system and not be tied to any electrical loads at the property. The owner must allocate electricity generated by the renewable energy system to *benefiting accounts* at the same SDP (or the same affordable housing development, if using MASH program funds); VNM rules require there be at least two benefiting accounts. Benefiting accounts can include tenant or common areas. Finally, the owner may elect to designate a specific benefiting account as the *default account*, which receives kWh credits when another benefiting account is closed and those credits become unallocated. The default account will most often serve common area load.
- **Determining and modifying generation allocations among benefiting accounts.** As part of the VNM application and interconnection agreement, the owner must submit a list of all benefiting accounts (including PG&E account numbers), and the percentage of total output that each benefiting account is to receive. Allocations are made based on the percentage of total output. The owners of non-MASH/NSHP projects may allocate different percentages of output to different benefiting accounts and may modify the allocations of electricity as frequently as needed (although PG&E charges the generator account \$3 for



Example of interconnection inside main switch for underground service

changes made more frequently than once per year). The owners of MASH and NSHP projects face different rules. Owners of these projects must initially decide the percentage of output to split between common area loads and tenant loads. Once established, the owner cannot change that split within the first five years. Furthermore, the percentage of electricity allocated to each residential unit must be “in proportion to the relative size of each unit.”⁴

- **Crediting to benefiting account utility bills.** Benefiting accounts are provided a full retail credit for kWh of renewable generation as a line-item on their electricity bill in the same manner as traditional net-metering customers. Benefiting accounts are billed monthly for their net consumption of electricity (kWhs consumed minus kWhs allocated from on-site renewable energy system), which means the renewable electricity is valued at the full retail rate, including offset transmission & distribution fees, and other fees and taxes charged on a per-kWh basis. If a benefiting account receives more bill credits than consumed in a given month, they are applied to another month’s electricity charge within that annual billing year. If, over a full billing year a benefiting account receives more generation than it consumed, then the account will receive payment from PG&E in accordance with rules for Net Surplus Compensation.⁵

- **Monitoring VNM performance and allocations to benefiting accounts.** As detailed in CPUC’s response to PG&E’s Advice Letter 4130-E,⁶ PG&E will be providing owners of VNM projects with a monthly report. The report includes the VNM project’s total electricity production, as measured by the generator account, and the allocations to benefiting accounts, which should be equal to the system’s production. The image here is an illustrative example.

Generator Account		
Measured kWh		
1,000		
Benefiting Account		
Service Address	Allocation Percentage	Allocated kWh
123 ABC ST	50%	500
123 ABC ST, APT 101	10%	100
123 ABC ST, APT 102	10%	100
123 ABC ST, APT 103	10%	100
123 ABC ST, APT 104	10%	100
123 ABC ST, APT 105	10%	100

- **Allowing landlords to recover cost of renewable energy system from tenants.** In a new or vacant building, a landlord can recover the cost of investing in a renewable energy system by allocating electricity to all or some units, and factoring the system’s cost into the rent charged to new tenants. In an existing building with established tenants, a landlord cannot force an existing tenant to accept an allocation of electricity through VNM. Consequently, for existing multitenant buildings, VNM must be an opt-in program. As existing tenants sign up, the landlord can negotiate the terms of a rent increase to compensate the landlord for the cost of the renewable energy system. As individual units become vacant, a landlord can require new tenants to receive an allocation of electricity as a condition of their rental agreement. Building owners should confirm that they are in compliance with all state and local laws. In particular, providing electricity must conform to the requirement of the California Public Utilities Code sections 218, 2826, and 2868. Condominium and cooperative HOAs may face fewer of these barriers to establishing a VNM

⁴ Pacific Gas & Electric, “Virtual Net Energy Metering Application and Interconnection Agreement for the Building Owner of Multifamily Affordable Housing with a Solar Generating Facility of 1 Megawatt or Less,” (2012), 10. http://pge.com/tariffs/tm2/pdf/ELEC_FORMS_79-1109.pdf

⁵ “Net Surplus Compensation.” California Public Utilities Commission, 4 Oct. 2011. Web. 1 Feb. 2013. <http://www.cpuc.ca.gov/PUC/energy/DistGen/netsurplus.htm>

⁶ Randolph, Edward F. “PG&E Proposal for Providing Billing Data to Owners of Projects Taking Service on Schedule NEMV, in Compliance with Ordering Paragraph 8 of Resolution E-4481.” Letter to Brian K. Cherry. 27 Nov. 2012. http://www.pge.com/notes/rates/tariffs/tm2/pdf/ELEC_4130-E.pdf

arrangement. The HOA, acting on behalf of all owners in the community, can decide whether to install a VNM renewable energy system, how to recover its cost among the owners, and how to allocate the bill credits to participating benefiting accounts.

- **VNM with community choice aggregation customers.** Community choice aggregation (CCA) is the term for a law in California that allows local governments to procure electricity on behalf of customers within their jurisdictions. PG&E's virtual net energy metering electric rate schedule allows for CCA customers to utilize VNM in accordance with both PG&E's and the CCA's rules for net metering.

CASE STUDY: VALENCIA GARDENS

Valencia Gardens is a 260-unit mixed income affordable housing development built in San Francisco's Mission District in 2006. The development has 17 buildings that span five acres and house 740 people within three programs of Public Housing, Section 8 Housing, and Affordable Units, along with providing services such as mental health therapy.



Early on, the project's owner, the Mission Housing Development Corporation (MHDC), installed a solar system to serve some of the development's common areas. In 2011, MHDC decided to dramatically increase the property's solar capacity by installing a 570 kW (AC) solar photovoltaic system. The project utilized MASH program funds and uses VNM to allocate electricity to the 260 individual tenant meters. Per MASH program rules, units receive their share of the total electricity produced each month in accordance with each unit's relative size. MHDC plans to have a system in place by April 2013 to bill tenants for the electricity they receive from the solar system.

IV. Challenges to implementing VNM projects

In conducting research and interviews with PG&E, solar installers, and multitenant property owners, the following challenges to VNM projects were identified.

- **Many solar installers lack experience with VNM projects.** VNM is a relatively new program in California, which means most solar installers have not worked on VNM projects. While some solar installers have completed a handful of projects and have developed VNM expertise, there appears to be a general lack of knowledge among solar installers about the requirements of VNM.
- **Multitenant property owners lack awareness of VNM opportunities.** Just as many solar installers lack a detailed understanding of how to complete VNM projects, most multitenant property owners are unaware that the opportunity for a VNM project even exists. Furthermore, to the extent that property owners are aware of VNM, most have questions about the VNM process, such as how to structure

payments from tenants.

- **Standard methods for cost-recovery are not yet developed.** Most multitenant property owners are not motivated to install solar without an ability to recover the costs of the installation. Since VNM is so new, there is little experience with developing fair and legal cost-recovery mechanisms. As described above, condominium, tenancy-in-common, and cooperative properties will likely have an easier time recovering costs. At rental properties, cost-recovery could be more challenging. Options to be explored include a fee for access to the solar system that is paid monthly with the rent check, or, as mentioned above, integrating the capital costs of solar into rental rates for new tenants.
- **Service delivery point restriction adds costs and complexity.** Non-MASH/NSHP projects must limit allocations of electricity from each solar installation to tenants at the same SDP. However, larger housing developments may contain multiple SDPs. This means that owners must install a separate solar installation at each SDP. This adds costs and complexity to VNM projects because it is usually cheaper and easier to install one large solar system than multiple smaller systems.
- **Interconnection can be time consuming and often requires upgrades to electrical service equipment.** The requirement that VNM projects interconnect outside of any PG&E sealed service sections yet above any load-serving meters can require upgrades to the owner's electricity service panel equipment. The details of these upgrades vary greatly from building to building depending on the particulars of how the building is designed and how electrical service is delivered to the property. As a result, VNM projects can require extra communication with PG&E to work through interconnection details, and they often need upgrades to electrical service equipment.

V. Conclusion

VNM is a useful tool to expand use of solar energy at multitenant buildings, which constitute the majority of residential housing in San Francisco and 31% of housing across the state.⁷ As of December 2012, there were 574 PG&E customers in San Francisco benefiting from VNM. However, this represents only 50 multitenant buildings (40 affordable and 10 market-rate) and 0.2% of San Francisco's households in multitenant properties. To increase use of VNM, utilities, advocates, and local governments should increase outreach efforts to educate solar installers and property owners about the VNM program and make program guidelines and procedures transparent and readily available.

⁷ "California QuickFacts from the US Census Bureau." N.d. Web 29 Jan. 2013. <http://quickfacts.census.gov/qfd/states/06000.html>

Appendix I: Other Forms of Virtual Metering

This definition of VNM is distinct from other forms of metering that have “virtual” features, namely community shared solar and aggregate net metering. **Community shared solar** is very similar to VNM except that it typically describes solar energy systems that supply electricity to customers spread over a broader geographic region than a single building, such as a county or utility territory.⁸ Numerous community shared solar programs exist in the United States, including one in California run by the Sacramento Municipal Utility District.

Aggregate net metering is also similar to VNM except that the electricity output of the renewable energy system is allocated to multiple meters all belonging to the same customer, even if those meters are not at the same building as the renewable energy system. Since 2010, local governments in California have been allowed to aggregate accounts for net metering through the Renewable Energy Self-Generation Bill Credit Transfer program.⁹ The RES-BCT program allows projects up to 5 MW in size and provides bill credits to participating benefiting accounts that offset the generation rate component of the electrical charges. In 2012, the California Legislature passed Senate Bill 594, which will allow net metering customer-generators with multiple meters to aggregate the electrical load of the meters located on the property where the generation facility is located and on all property adjacent or contiguous to the property on which the generation facility is located, if those properties are solely owned, leased, or rented by the eligible customer-generator.¹⁰ Net metering aggregation will likely be subscribed primarily by agricultural, commercial, industrial, institutional, and government customers who typically have several meters located on one property under single ownership.

The following states allow some type of virtual metering, including community shared solar and aggregate net metering:¹¹

- **Colorado:** “Community solar gardens” program allows electricity produced at a solar installation in investor-owned utility territories to be credited to multiple customers in the same county; Colorado also allows single customers with meters on contiguous properties to aggregate their meters.
- **Delaware:** Allows for multiple customers to receive virtual net metering from the electricity generated by a single renewable energy system, but also allows the utility to opt-out of VNM and make a single payment to the generator-host of the renewable energy system; Delaware also allows single customers to apply net metering credits to multiple meters at multiple properties.
- **Illinois:** Utilities may choose to allow meter aggregation among multiple customers.
- **Maine:** Up to ten customers can receive net metering credits from a single renewable energy system, so long as each benefiting customer is a part owner of the system.
- **Maryland:** Individual agricultural, non-profit, and municipal customers are allowed to apply net metering credits to multiple meters.
- **Massachusetts:** “Neighborhood net metering” rules allow net metering to multiple customers from a single renewable energy facility. The rules require that at least ten residential customers participate in a given project, but non-residential customers are also allowed.

⁸ For more information on community shared solar, download our paper here: http://www.sfenvironment.org/sites/default/files/editor-uploads/energy_renewable/pdf/sfe_re_communitysharedsolar.pdf

⁹ “Renewable Energy Self-Generation Bill Credit Transfer Program.” *Renewable Energy Self-Generation Bill Credit Transfer Program*. California Public Utilities Commission, 7 Oct. 2011. Web. 29 Jan. 2013. <http://www.cpuc.ca.gov/PUC/energy/DistGen/RES-BCT.htm>

¹⁰ “Bill Document SB 594.” *Bill Document*. California Legislature, 1 Oct. 2012. Web. 29 Jan. 2013. http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=sb_594&sess=PREV&house=B&author=wolk

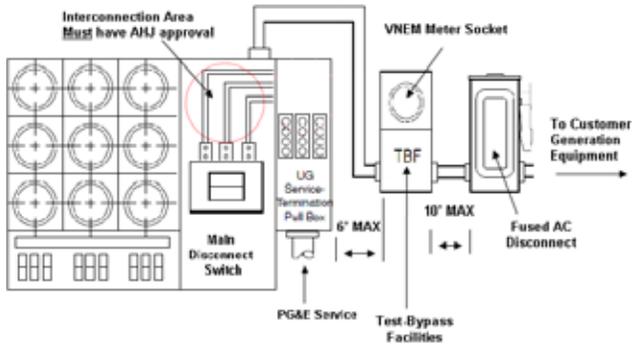
¹¹ DSIRE: Database of Energy Efficiency, Renewable Energy Solar Incentives, Rebates, Programs, Policy.” *DSIRE USA*. North Carolina State University, 2013. <http://www.dsireusa.org/>

- **New York:** Remote net metering for farm and non-residential customers allows crediting to multiple meters on properties owned or leased by the same customer.
- **Oregon:** Allows a single customer to apply net metering credits to meters across contiguous properties.
- **Pennsylvania:** Allows a single customer to virtually net meter to properties within two miles of the renewable energy system so long as those properties are owned or leased and operated by the same customer.
- **Rhode Island:** Meter aggregation is generally allowed, and special provisions exist to accommodate meter aggregation for farm-based systems that serve facilities in close proximity to each other.
- **Utah:** Allows for virtual net metering to multiple meters at the same or adjacent location as the renewable energy system.
- **Vermont:** “Group net metering” allows multiple customers or a single customer with multiple meters to apply net metering credits within the same utility territory.
- **Washington:** Allows a single customer to apply net metering credits to multiple meters within a single utility territory.
- **West Virginia:** Allows a single customer to apply net metering credits to multiple meters within two miles of the point of generation.

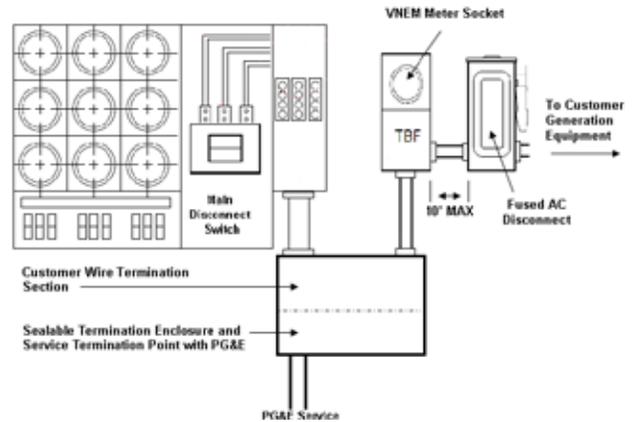
Appendix II: Points of Interconnection

Below are four sample diagrams of interconnections on VNM projects.¹²

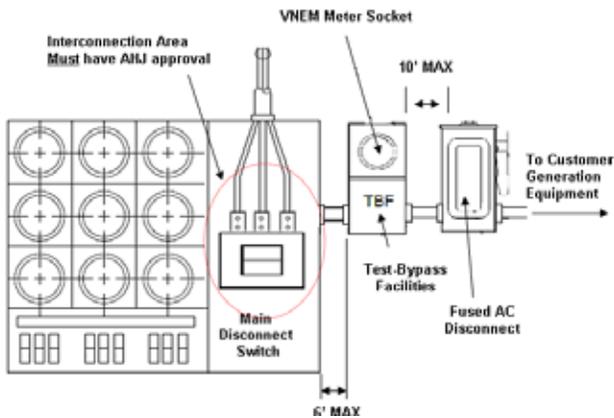
Point of Connection inside Main Switch for Underground Service



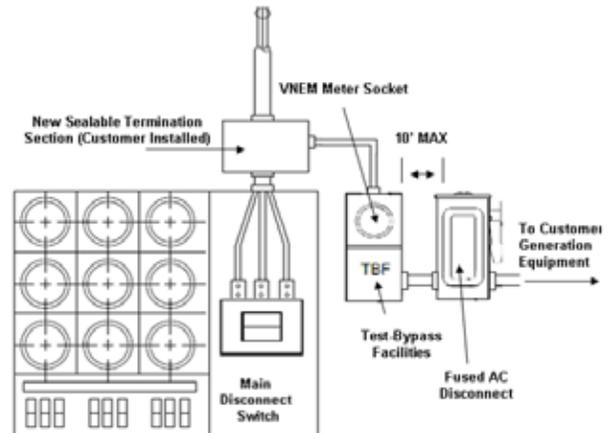
Point of Connection with Termination Enclosure for Underground Service



Point of Connection inside Main Switch for Overhead Service



Point of Connection inside Sealable Termination Section for Overhead Service



¹² Pacific Gas & Electric, "Utility Bulletin TD-6999B-005: VNM Installation Requirements," 2012.

Appendix III: Fact Sheet – Solar at Multitenant Buildings: Virtual Net Metering

[Fact sheet on following two pages.]



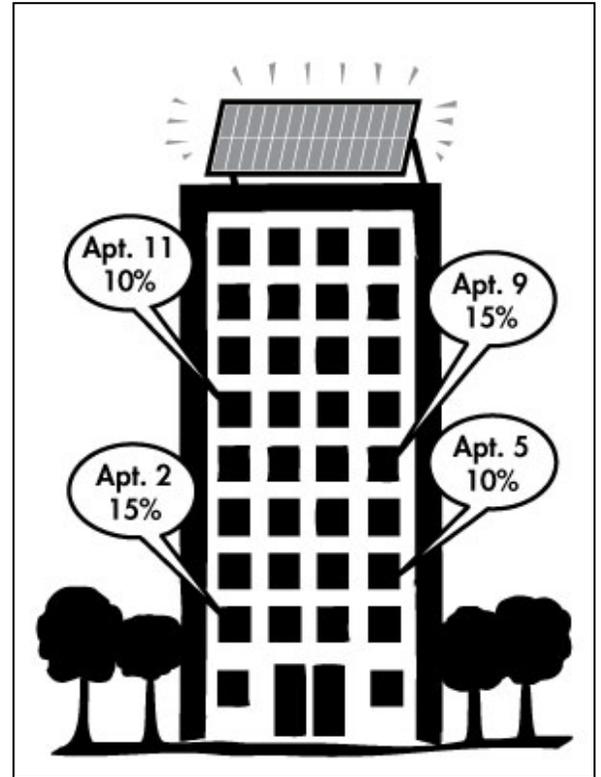
Solar at Multitenant Buildings: Virtual Net Metering

Thanks to a new program called “virtual net metering,” multiple tenants at a property can share the electricity produced by a single solar energy system. This makes it easier for residential and commercial rental properties to reduce tenant utility bills and create a revenue stream for landlords. It also makes it simpler for condominium and tenancy-in-common owners to share the benefits of an on-site solar system.

Facts about virtual net metering

Below are important details to know before you get started:

- **The solar system must have an owner.** Every virtual net metering project requires an owner, such as a landlord or HOA, who is in charge of the *generator account*, a dedicated meter to which the solar system is connected.
- **Participating tenants get credited on their PG&E electricity bill.** Tenants benefit from the solar electricity by receiving a credit directly on their PG&E bill. The system owner gives PG&E a list of participating tenants, known as *benefiting accounts*, indicating the percentage of the system’s output to be credited to each tenant.* For example, if the solar system produces 1,000 kWh of electricity in a month, and Apt. B has a 10% allocation, then Apt. B receives a credit of 100 kWh on their bill, which reduces their “net” electricity usage, and thus their utility bill. Utility accounts that serve a building’s common areas are also allowed to be credited.
- **Allocations of electricity credits can be changed as frequently as needed.** The system owner can instruct PG&E to change the allocation of electricity whenever a participating tenant leaves or a new tenant joins the program. (PG&E charges \$3 when there is a change to a single benefitting account more than once per year.) When there are periods that less than 100% of the electricity is allocated, the owner can designate a *default account* that receives unallocated credits.
- **Existing tenants cannot be forced to participate.** A landlord cannot force an existing tenant to accept an allocation of electricity. Consequently, for existing multitenant buildings, virtual net metering must be an opt-in program. As individual units become vacant, a landlord can require new tenants to receive an allocation of electricity as a condition of their rental agreement.



*Affordable housing properties must allocate electricity to every unit at the property based on each unit’s relative size. Market-rate properties are free to provide electricity to as few as two tenants, and can allocate electricity in any proportion.



- **The system owner arranges with tenants to recover the costs of the solar system.** PG&E is not involved in any payments from tenants to the system owner (landlord or HOA) to pay for the costs of the solar system and compensate for the generated electricity the tenant is receiving. These arrangements are made privately between the system owner and tenants. It is advisable for payments to be structured as a flat fee (e.g., \$/month) rather than based on actual electricity delivered (\$/kWh). With an HOA, participating homeowners may prefer to simply split the upfront system cost.



Incentives & financing for solar energy systems

A solar energy system is a significant investment. Fortunately, incentives and tax credits can reduce the cost. San Francisco's GoSolarSF program (solarsf.org) offers cash incentives to install solar power. State rebates (pge.com/csi) and a 30% federal tax credit are also available. In addition, these financing tools can make it possible to go solar without large up-front costs:

- **Solar lease & power purchase agreement:** Under these arrangements, a third-party owns the equipment and you pay a monthly fee for the use of it (a lease) or a set price for the electricity generated (a power purchase agreement or PPA).
- **GreenFinanceSF** (commercial property only): This is San Francisco's property assessed clean energy (PACE) financing program that allows commercial property owners to finance and repay the loan through their property taxes. Visit greenfinancesf.org.
- **Loan or line of credit:** A business or real estate loan or other secured line of credit is a more traditional way to go solar without high up-front costs.

Next steps

1. Visit the SF Solar Map (sfenergymap.org) to find the solar potential of your roof, and use the calculator to estimate the financial return.
2. If your building is currently occupied, survey the tenants to gauge their interest in sharing electricity from a solar energy system.
3. Get bids from multiple solar installers and consider your financing options.
4. Identify system owner, participating tenants/units, cost and payment structure for participants, and allocations by meter.
5. Install system in accordance with PG&E's Virtual Net Metering guidelines (contact gen@pge.com).

Additional information

- Read SF Environment's paper on virtual net metering at tinyurl.com/SF-virtualnetmetering
- Learn more about solar financing options at sfenvironment.org/article/solar/solar-financing-options
- If you have questions, contact SF Environment's renewable energy staff at renewable@sfgov.org

