

SASH Program Analysis
City of Richmond Case Study

By

Bettina Baylis & Audrey Copeland
Sustainable Energy Management
December 10, 2014

TABLE OF CONTENTS

THE PROBLEM

Low-income single-family households in the City of Richmond do not have equitable access to solar energy.

The goal of the Single Family Affordable Solar Housing (SASH) program is to provide low-income families with access to solar. Several market failures are present, resulting in a program that provides an incomplete mechanism for achieving the desired comprehensive access.

Using the City of Richmond as a model, the following provides an analysis of how the SASH program can be improved to deliver on its objectives. A financial, sustainability, and social analysis were conducted to compare the SASH program as it stands today with a set of invented solutions that also address solar access to low-income families in the City of Richmond. The solutions are compared across a matrix of defined criteria, resulting in an integrated solution recommendation that maximizes financial, sustainable, and social benefits.

RESEARCH & EVIDENCE

Introduction

The California Solar Initiative's (CSI's) SASH program provides financial assistance for the installation of rooftop photovoltaic systems to low-income home-owning customers of California investor-owned utilities (IOUs). The goal is twofold: to increase the adoption of solar energy in California, and increase access to solar for low-income homeowners. The $108.34 million annual SASH program is implemented by GRID Alternatives (GRID). Grid is a nonprofit organization focused on installation of solar and offering jobs and job training in the solar industry to underserved communities("SASH Program," 2014).

The SASH program defines low-income homeowners as those with income at or below 50 percent of the area median income. In the City of Richmond, a city with a population of more than 100,000, it is estimated there are roughly 7,000 SASH eligible low-income homeowners ("Richmond (city) QuickFacts from the US Census Bureau," n.d.). Low-income homeowners typically spend a disproportionately large percentage of their income on utilities, with little to no discretionary spending dollars available for investment in solar.

GRID has installed roughly 150 solar projects to date in the City of Richmond, which is about 2% of the 7,000 eligible houses. Marin Clean Energy (MCE) would like to see this figure rise drastically to help meet its aggressive renewable energy targets[1]. MCE offers its customers options for 50% or

---

[1] MCE is California's first Community Choice Aggregation (CCA) program and the City of Richmond is a member of it. Residents and businesses located in the City of Richmond use the local IOU, in this case Pacific Gas and Electric (PG&E), for billing, electric delivery, and maintenance services while relying on MCE to purchase the power mix.

100% renewable energy power mixes. Currently, this is accomplished through procurement practices and renewable energy certificates (RECs). However, there is increased desire to accomplish these targets via local generation efforts. The SASH program helps accomplish this.

Why the Problem Exists

The problem statement identifies the inequitable access to solar energy for low-income single-family households in the City of Richmond. Solar energy often requires a significant capital outlay for the system itself, which is not economically feasible for people of low-income. Even with no capital outlay required, as is the case with some solar leasing models, the reduction in monthly bill payments often isn't enough to pay for the solar system over its useful life. This is a result of existing rate support for low-income homeowners through the California Alternate Rates for Energy (CARE) program, which reduces low-income eligible rates by 30-35% ("California Alternate Rates for Energy," 2014).

The SASH program helps to overcome the capital outlay required for a solar system by providing the funding necessary for each solar install. However, "gap funding" sometimes persists. Gap funding is defined as the capital necessary to cover any remaining costs associated with a solar install beyond the money provided through SASH. In many cases, local governments and foundations provide funding to bridge the gap.

The need for gap funding originates from two key issues; poor roof conditions and electrical upgrades. Approximately 30-50% of low-income homeowners have roof conditions that don't meet the 10-year life remaining requirement set by SASH (Conversation with GRID, Oct. 2014). Solar panels are expected to last more than twenty years, thus, it wouldn't be ideal to install a set of panels on a roof that isn't expected to last half the useful life of those panels. The estimated cost of a roof upgrade is $11,000, nearly doubling the cost of the solar installation.

Electrical upgrades are another driver behind gap funding. A large proportion of Richmond's low-income housing stock is older, and requires upgrades to main electrical service panels and supply cables. Without these upgrades, the energy generated from a solar installation cannot be fed back into the grid for consumption outside of the home. Electric service panel upgrades can cost upwards of $2,000-$3,000 and cable upgrades upwards of $5,000 (Conversation with GRID, Oct. 2014).

Most roof repair and electrical upgrade costs are being passed through to the SASH program. But as previously mentioned, they are not always covered in full, thus arising the need for gap funding. Additionally, roof and electrical upgrades require permitting, which can stop some project in their tracks. Older housing stocks can have past improvements that are not properly permitted and are without city inspection. A homeowner in this situation may not wish to subject themselves to inspection violations, stopping a solar project for good. It's estimated that nearly 10% of eligible SASH homes are concerned over permitting (Conversation with GRID, 2014). Table 1 on the following page demonstrates how these additional costs reduce the number of homeowners who can qualify for SASH funding.

Table 1: Estimated SASH Homes for Targeting[2]	
Starting SASH Eligible Homes	7,000
Minus Roof Repair	30-50%
Minus Electrical Upgrade	0-10%
Minus Permitting	0-10%
Minus Shading and other Obstructions	0-10%
Final SASH Targeted Population	**3,000**

What is Currently Being Done

The SASH program provides financial assistance to low-income homeowners for the installation of solar. Financial assistance is provided for full ownership of solar systems. In some cases, SASH provides the capital outlay AND gap funding, to fulfill the entire outright purchase and install of solar by the homeowner. However, the current funding structure for SASH is being completely reconsidered as annual budgets are expected to be cut by roughly half starting sometime in 2015 (Conversation with GRID, Oct 2014).

So what is the fate of SASH with a slashed budget? With the recent success of solar financing models, as exemplified by solar companies like SolarCity, SASH may need to look to similar leasing models as a replacement for their current solar ownership model. The goal of SASH is to provide solar for low-income homeowners, not to make money off of each solar investment. Essentially, these are sunk costs for SASH. With a lease model, while the investments still result in a sunk cost, it is expected that each dollar could go further, helping to stretch the impacts of a reduced budget. Going forward the following nomenclature will be used to make the distinction between these two models:

- SASH 1.0 = solar ownership model
- SASH 2.0 = solar lease models

Market Failures at Play

With the intersection of partnership and investment at the public and private level, it is not surprising that several market failures[3] are at play. The key market failures present for the SASH program and

[2] These figures are subject to debate and should only be used for directional purposes instead of taken as fact.

[3] Defined as an inefficient allocation of goods and services.

all the public and private players involved stem from tax benefit issues and outdated metering policies, resulting in barriers to entry and negative externalities from subsidization.

Failure to Capture Tax Benefits

Under SASH 1.0, SASH funds up to 100% of the solar system because the program cannot take advantage of the federal tax and depreciation benefits that add up to roughly 55% of system's cost, so they are left unclaimed. This is because the low-income homeowners, as owners of the systems, don't have a tax appetite: they don't owe enough income tax to make use of the federal Investment Tax Credit (ITC), and they can't claim the depreciation expense for the system since they aren't businesses ("Go Solar California," n.d.).

With a solar lease model the amount of SASH funding needed could drop to 30-50%, since solar system ownership would be sold to an entity with a tax and risk appetite (such as a large investment bank), and the resulting payment would reduce the system cost by just under half[4]. Funding would now also come from the low-income homeowner, who as the leasee, would be required to pay 20-25% of the system cost through small monthly lease payments on their utility bill[5].

It is important to note that the current federal Investment Tax Credit won't be around forever. But even though this particular tax benefit is expected to be reduced or even eliminated by 2016, Sash 2.0's lease model could still stretch each dollar of SASH funding so that it went twice as far as before. This would help mitigate the CPUC's 50% cut in SASH funding planned for 2015.

Outdated Net Energy Metering Policies

Taxes aren't the only market failure. There is a major issue present around outdated policies, specifically pertaining to Net Energy Metering (NEM). Under NEM, the electric meter keeps track of how much electricity is generated, how much is consumed, and how much is sent back into the grid over a 12-month period. The homeowner only pays for the net amount of electricity used after subtracting all the electricity generated. This is often described as "spinning the meter backward." If the homeowner produces a surplus of electricity, the utility doesn't compensate them for it. This keeps many homeowners with good insolation from capturing their full rooftop solar resource. It also increases the cost per kW of capacity each installation, since there is a substantial fixed cost associated installing solar, independent of the installed capacity.

In addition to issues related to implementing a NEM policy, not all homes have the metering infrastructure in place to participate. NEM programs require direct hardwiring of the solar system through the homeowner's meter, so they cannot be applied "as is" to multi-unit dwellings and community solar partnerships.

Virtual Net Metering (VNM) policies aim to address this market failure, but are limited in its current scope. VNM allows for the allocation of one installation's solar benefits to be shared by multiple customers through the use of the billing system rather than the electric meter itself. The CPUC

---

[4] Estimated at 48% now (ITC is now 30%), and 17% for 2016 onward (when ITC drops to 10%).

[5] The lease payments would be sized to never exceed 85% of monthly savings due to solar electricity NEM.

currently allows VNM for all multifamily housing, using the Multifamily Affordable Solar Housing (MASH) program (the sister program to SASH), but doesn't extend it to SASH. The CPUC currently limits aggregation to multi-unit homes instead of multiple homes in a local development, for example. VNM would allow even those homeowners with a poor or non-existent solar resource on their roofs to be able to participate in the SASH program.

SCENARIOS

Based on the research and evidence section, the following outlines four different scenarios for consideration. All four scenarios consider the impact of the 50% reduction in SASH funding that will occur in 2015.

Scenario #1: Roof top ownership model (SASH 1.0)
In this scenario the SASH program will continue to cover 100% of the solar installation costs. To date this model has been relatively easy to implement because the homeowner doesn't have to take on any financial burden. The downside is that the number of installations administered by GRID will drop precipitously, due to the planned cuts to SASH program funding.

Scenario #2: Rooftop lease model with current NEM policy (SASH 2.0)
In this scenario GRID would replace its 100% SASH rebate with SASH-subsidized leases. This would provide a mechanism for delivering the same amount of solar access after the SASH program has its funding cut by 50%. Table 2 below provides a summary of program implementation.

Table 2: Program Overview- Rooftop lease model with current NEM policy

- SASH rebate would subsidize installations by up to 50%.
- Lease financing would include:
  - SASH or another government entity would guarantee the lease payments, so that they and the associated tax benefits could be aggregated and sold to third party investors with a tax appetite (private bank, private limited partnerships, community development bank) who will agree to finance the aggregated leases, and would do so at a reduced interest rate.
  - The lease payment would not exceed 85% of the avoided electricity costs, so that a net credit will appear monthly on the home's utility bill.
  - Homeowner's utility (either PG&E or MCE) would manage on-utility-bill lease payments, reducing the lease default rate, since utility bills are rarely left unpaid.

Some potential considerations with this model include obtaining sufficient support from private investment banks and homeowners. Private investors may be reluctant to lend at an acceptable rate, since low-income homeowners are traditionally considered a poor credit risk. For their part, the homeowners may be reluctant to assume the financial responsibility of a lease, because the low annual net dollar savings would be small, at least in the near term.

Solution #3: Rooftop lease model with expanded NEM (variant on SASH 2.0)
Updating California's NEM policy, so that homeowners could utilize a VNM program, would greatly expand local solar access, enabling SASH to more efficiently use the City of Richmond's limited stock of qualifying rooftops.

This change to the NEM policy would encourage homeowners to install additional capacity, beyond what is required to net out their electricity use. The surplus generation would then be made available to a SASH-qualified neighbor, whose home GRID has found unsuitable for solar. Allowing hybrid NEM and VNM would reduce costs of the average install by 5%, due to economies of scale, making SASH funding go farther. Table 3 below provides a summary of implementation, assuming rooftop installs increase by 1 kW.

Table 3: Program Overview- Rooftop lease model with expanded NEM
• 1 kW would increase the size of a SASH Richmond rooftop install by 4 panels. • These extra panels would be leased separately by a neighbor, and the approximately 1450 kWh of excess electricity generated annually, valued at $145, (based on current CARE customer $.10/kWh rate) would be virtually net metered on the neighbor's utility bill. • The roof-owner will benefit from lower lease payments due to a 5% lower cost of installation.

The SASH program, the City of Richmond, and GRID program administrator would need to encourage the CPUC to change NEM policies as part of "SASH 2.0" implementation. As a first step the CPUC could test expanded NEM, by allowing GRID to run a pilot project in the City of Richmond.

Changing NEM rules and caps may be difficult due to PG&E resistance. PG&E is concerned that expanding residential solar generation and retail net metering rates will threaten its business model, as the current NEM structure disproportionately favors homeowners with solar since they don't have to pay for their fair share of the transmission and distribution costs. The CPUC would need to decide how to balance its obligations to equitably regulate PG&E and at the same time implement the state's transition to a resilient electrical grid, capable of handling a high percentage of distributed renewable generation.

Scenario #4: Community shared solar model with VNEM (Short-lease-ownership-flip model)
Adopting a community solar model as an alternative to rooftop installations would provide solar access to low-income City of Richmond homeowners with unsuitable roofs. The economies of scale associated with this model would also allow SASH funding to go further.

According to the National Renewable Energy Lab (NREL) the three popular community solar models currently in use are Utility-Sponsored, Special Purpose Entity (SPE), and Nonprofit ("A Guide to

Community Shared Solar: Utility, Private, and Nonprofit Project Development, DOE-54570.pdf," May 2012) Their differences lie in who receives the costs and benefits (including ownership), how the financing is structured to take advantage of tax benefits, and what utility, securities and business regulations must be taken into account. Of these three, the high-participant community oriented SPE model pioneered by the Clean Energy Collective is probably the most applicable for the City of Richmond, since it results in ownership being ultimately retained at the local level. Table 4 below provides an outline of program implementation. Figure 1 on the following page provides an outline of the financing structure.

Table 4: Program Overview- Community shared solar with virtual NEM
• Community members, with expertise from a new division of GRID, will form a SPE, the business enterprise (usually a Limited Liability Corporation or LLC) that will own and run the solar installation. • A Host site is found and leased, suitable for either ground or rooftop solar installation. The lease can be paid for partly in NEM electricity. • The SPE is financed by individual members, grants and incentives. Using SASH-provided funds, each qualifying homeowner would buy a specified number of kilowatts worth of solar panels, and become a member of the SPE. • GRID will manage the solar installation, partnering with local solar installers, and creating local solar jobs and training opportunities. • To take advantage of the large tax benefits that would otherwise be left unused (the federal Investment Tax Credit (ITC) and any accelerated depreciation expense), an investment partner would be found, with a large tax appetite for what the internal revenue calls passive losses. A short-term sale/leaseback would then be arranged, after which ownership would "flip" back to the SPE members. Being able to monetize the large savings from tax benefits would make this legally complex arrangement worth the trouble, and result in a substantially higher upfront return for the individual SASH SPE members. • The SPE would sell the Renewable Energy Credits (RECs) generated by the installation to the utility grid (MCE would be a likely purchaser). • The SPE would sell solar electricity generated to the host for its NEM. • Under an imagined expansion to VNM regulation (recommended by the Presidio Graduate School team), the participating SASH homeowner-members would then be able to also net-out their electric meters. VNM has been offered to all multifamily households in California since 2011 ("Virtual Net Metering," 2011), and expanding it to SASH homeowners would increase participation rates and enable SASH to better fulfill its mission of solar access for all. • The SPE would then sell any remaining electricity to the utility grid (most likely the local energy supplier MCE) under a power purchase agreement (PPA), and distribute all net revenue to its SASH members. • The SPE and its members could continue to own the installation as long as the host agrees to renew its long-term lease.

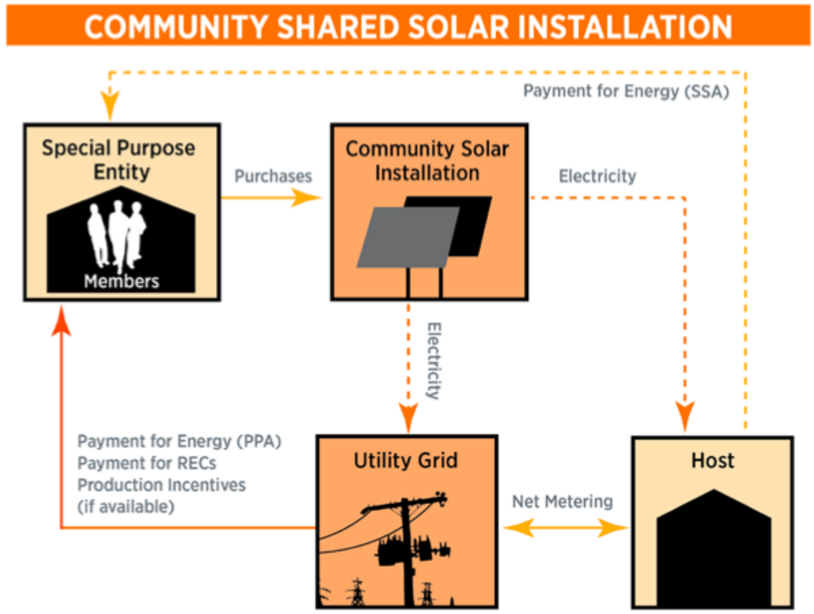

Figure 1. Model of Community Shared Solar with SPE ("A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development, DOE- 54570.pdf," May 2012)

There are several challenges impacting implementation of this mode. The first is the amount of legal and accounting expertise required, though the complexity should become routine, and associated costs drop as Community Shared Solar becomes more common. Next is the challenge of finding suitable host installation, though there may be opportunities on local brownfields and other property owned by Chevron or the city. A suitable tax benefits partner must also be found, such as a large bank or profitable corporation. Finally, the imagined expansion of California's VNEM would require regulatory changes by the CPUC. The CPUC could look for guidance to Massachusetts's new VNM law, particularly how it compensates the utility for use of local transmission lines. In the event that this imagined policy change to VNEM is blocked, SASH participants would still receive revenue, though at much lower wholesale PPA rates.

EVALUTION

Quantitative Analysis

A financial, sustainability, and social return on investment (SROI) analysis were conducted as a foundation for the decision criteria. The financial analysis evaluates the lifecycle cost of energy for each of the four scenarios. The sustainability analysis provides an estimate of the total renewable energy generated and greenhouse gas emissions (GHGs). The SROI looks at the net present value (NPV) of the cash flows from jobs created, utility bill savings, and avoided healthcare costs.

A number of assumptions were made in this analysis. The *SASH Funding %* required became a key factor in the model, since it drives the number of installs and the resulting amount of renewable energy generation and avoided greenhouse gas (GHG) emissions. Another assumption is the size of the install. 2.9 kW is the average size of installs with SASH 1.0 ("[DOCUMENT TITLE] - CSISASH_MASHImpact_and_Cost_Benefit_Report.pdf," 2011). (It is assumed that a lease model with inclusive NEM would enable an additional 1 kW per install (four extra panels). The community solar scenario assumes installs of approximately 50 kW. Table 5 below provides a summary of the quantitative analysis.

Table 5: Quantitative Analysis of Scenarios

	Ownership Model (SASH 1.0)	Lease Model (SASH 2.0)	Lease Model w/Virtual NEM	Community Solar w/ VNEM
Cost per Watt (unsubsidized)	$7	$7	$6.5	$3.5
SASH Funding %	**90%**[6]	**54%**	**54%**	**83%**
SASH Funding required per Watt	$6.3	$3.78	$3.51	$2.91
Estimated kW Installed	91	152	164	198
Estimated Capacity Per Install (kW)	2.9	2.9	3.9	50
Estimated # of Installs	31	52	42	4
Total Capacity by 2020 (kW)	**90**	**151**	**164**	**200**
# of Households w/Access to Solar	31	52	42	69
LCOE ($/kWh)	$.292	$.292	$.261	$.10
Renewable Energy Generated by 2020 (MW)	128	213	230	259
Avoided GHG Emissions (MtCO2e)	118	197	212	259
SROI NPV in 2020 ($)	$638k	$455k	$491k	$1,315k

Please refer to supplemental Excel worksheet for supporting details of these numbers.

[6] According to GRID, SASH 1.0 installs resulted in funding gaps that were filled by nonprofits, MCE and local government

Decision Criteria
The following decision criteria provide a mechanism for ranking the four scenarios and recommending an ideal approach.

Social Equity (25%) The primary goal of SASH is to provide low-income homeowners with access to solar. The number of installations and cumulative generation capacity provide a way to assess this.

Technical feasibility (20%) How easy is it to implement the proposed solution with the existing energy infrastructure? Will implementation require the development of new technologies or energy infrastructure?

Local Economic Development (15%) To what extend does the solution strengthen local economies? This includes job creation, homeowner savings on utility bills, and avoided healthcare costs. The SROI per kW provides a way to assess this criteria.

Cost-effectiveness (15%) To what extent does the solution use funding sources effectively? The levelized cost of energy (LCOE) provides a quantitative basis for this criteria.

Political feasibility (15%) Does the political landscape support the proposed solution? How challenging would it be to gain political support for the proposed scenario?

Sustainability (10%) How much renewable energy is generated? Does the solution reduce the amount of greenhouse gas emissions generated?

Weighting
The weighting reflects how a given criteria impacts the problem statement. Social equity and technical feasibility are given the highest weight. This is because the proposed solution should increase access to solar for low-income homeowners and be technically feasible with the current energy infrastructure. Other factors, such as local economic development, cost effectiveness, political feasibility, and sustainability are important secondary goals of the program.

Evaluation
Each of the scenarios is ranked on a scale of 0-5 (0= no benefit, 5 = excellent). The total weighted score is displayed in the final row.

Table 6: Ranking based on Decision Criteria				
Decision Criteria	**Ownership Model SASH 1.0**	**Lease Model (SASH 2.0)**	**Lease Model w/Inclusive NEM**	**Community Solar**
Social Equity	3	4	4	**5**
Technical Feasibility	4	4	3	**3**
Local Economic Development	4	4	4	**5**
Cost Effectiveness	4	4	4	**5**
Political Feasibility	4	4	3	**3**
Sustainability	4	4	4	**5**
Total	**3.75**	**4.0**	**3.65**	**4.3**

RECOMMENDATION & CONCLUSION

The evaluation in the prior section identifies community solar as the solution that achieves the greatest level of social equity, while also meeting financial, political, and sustainability objectives. One of the key advantages of community solar is that it removes the residential rooftop and electrical upgrade issues from the equation. The one drawback of this solution is related to its strength. Community Solar requires space, specifically land -an estimated 5.5 acres per 1kW install based on current technology. In an urban environment finding empty lots for large community installs could be challenging. It would also create a competitive dynamic between new housing developments and solar, which may not be ideal. Given this dynamic, community solar may need to look for post-industrial-use land that is unsuitable to housing, such as near or on the Chevron refinery site.

The future round of SASH funding will probably include a lease model as outlined in scenario #2. A lease model will increase the installed capacity by leveraging government tax incentives, however, it still doesn't resolve one of the fundamental issues, which is the viability of roofs in the City of Richmond. To truly provide equitable access to solar it will be important to move beyond residential installations. Community solar provides the mechanism to do so. Therefore it is recommended that GRID propose a Community Solar pilot program as part of the next round of SASH funding for a combined approach.

In the long run GRID should consider a lease model utilizing the virtual NEM approach outlined in scenario #3. Currently this option isn't technically feasible because it would require the installation of a different type of meter technology. Once that barrier has been resolved a lease model with expanded NEM will increase the installed capacity.

This combined approach will resolve the market failures, thereby providing access to solar for the greatest number of households, approximately 69 in the case of Community Solar (Table 5). Compared to continuing with the current ownership model, this will more than double access to solar in the City of Richmond. Additionally the Community Solar scenario will lead to more jobs and avoided healthcare costs, resulting in the maximum SROI benefit of $1,315k (Table 5). This approach can be used throughout the state to leverage the SASH program as effectively as possible.

REFERENCES

A Guide to Community Shared Solar: Utility, Private, and Nonprofit Project Development (Book), Powered by SunShot, U.S. Department of Energy (DOE) - 54570.pdf. (n.d.). Retrieved from http://www.nrel.gov/docs/fy12osti/54570.pdf

California Alternate Rates for Energy. (2014, July 30). Retrieved December 11, 2014, from http://www.cpuc.ca.gov/PUC/energy/Low+Income/care.htm

CSISASH_MASHImpact_and_Cost_Benefit_Report.pdf. (2011). Retrieved from http://www.cpuc.ca.gov/NR/rdonlyres/13AAEDF8-BB7D-4FBD-AC05-3FC2B9CBF746/0/CSISASH_MASHImpact_and_Cost_Benefit_Report.pdf

Go Solar California. (n.d.). Retrieved December 11, 2014, from http://www.gosolarcalifornia.ca.gov/consumers/taxcredits.php

Richmond (city) QuickFacts from the US Census Bureau. (n.d.). Retrieved December 11, 2014, from http://quickfacts.census.gov/qfd/states/06/0660620.html

SASH Program. (2014, November 12). Retrieved December 11, 2014, from http://www.cpuc.ca.gov/PUC/energy/Solar/sash.htm

Virtual Net Metering. (2011, December). Retrieved December 11, 2014, from http://www.cpuc.ca.gov/PUC/energy/DistGen/vnm.htm