CALIFORNIA
ENERGY
COMMISSION

NEW SOLAR HOMES PARTNERSHIP
THIRD EDITION

GO solar CALIFORNIA

GUIDEBOOK

JANUARY 2010
CEC-300-2010-001-CMF

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Cover Photos (top to bottom):

- Top two photos are production housing by Ponderosa Homes in Danville, Calif. (photos courtesy of PetersenDean Roofing and Solar Systems)
- Single-family affordable housing in Oakland, Calif. (photo courtesy of Habitat for Humanity, East Bay)

These guidelines were formally adopted by the California Energy Commission on December 13, 2006, pursuant to Public Resources Code Section 25744 and 25747 Public Resources Code Section 25780 et seq., as enacted by Senate Bill 1 (Chapter 132, Statute of 2006), and subsequently revised pursuant to this authority on July 11, 2007, August 21, 2008 and January 27, 2010.

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What's New in This Guidebook?

Below are the major changes in this edition of the New Solar Homes Partnership Guidebook as compared with the August 2008 edition of the NSHP guidebook:

Market Rate Housing

- Provides explicit language and requirements to clarify the eligibility of leased systems and systems furnishing electricity under power purchase agreements to participate in the NSHP program. Requirements include annual report and confirmation from lessor or system owner (for the first five years of the lease or PPA,) on the operational status of the solar PV system; payback of NSHP incentives within the first 5 years if a lease agreement is terminated and the system is removed from the building.

- Modifies the Solar As An Option program by increasing from 10 to 50 percent the maximum percentage level of a project's residential dwelling units that can be reserved, and extending the solar-as-option reservation period from 18 to 36 months.

- Allows builders/developers to submit applications for phases of six or more residential dwelling units to qualify for the solar-as-standard reservation.

Affordable Housing

- Affordable housing with occupancy permits less than two years old may apply for incentives.

- The restriction that affordable housing is required to remain as affordable housing is reduced from 45 years to 10 years.

- Explicitly recognizes virtual net metering for affordable housing as acceptable to apply for NSHP incentives.

- Projects requesting funding from the California Tax Credit Allocation Committee (TCAC) are given up to 60 days after the approval from TCAC to provide finalized energy efficiency documentation.

General Program Changes

- Allows system sizes that are increased after initial NSHP reservation approval time to receive the same original incentive level that the NSHP reservation was initially approved.

- Removes the system size justification requirement.

- Limits incentives to the first 7.5 kW AC of a solar energy system installed for individual residential dwelling units. Incentives for common area systems or virtual net metered systems are not similarly capped.

- Updates the California Flexible Installation criteria tilt range to include flat installations.

- Updates the energy efficiency Tier levels under the new 2008 Building Energy Efficiency Standards.

- Eliminates the NSHP-1.6 application process.

- Eliminates the need for annual retailer registration and completion of the NSHP-4 retailer form. This process is now being replaced by the online self-registration process at: http://www.gosolarcalifornia.ca.gov

- Revises and simplifies NSHP application forms.

- Removes requirement to provide build-out schedule.

Chapter I. Introduction

The New Solar Homes Partnership (NSHP) provides financial incentives and other support for installing eligible solar energy systems on new residential buildings[1] that receive electricity from specified investor-owned utilities.[2] The Energy Commission implements the New Solar Homes Partnership (NSHP) in coordination with the California Public Utilities Commission (CPUC) as part of the overall California Solar Initiative. This Guidebook describes the requirements to receive incentives for constructing energy efficient, solar homes under the NSHP.

A. Purpose

The goal of the NSHP is to create a self-sustaining market for solar homes where builders incorporate high levels of energy efficiency and high performing solar energy systems. The NSHP provides financial incentives and non-financial assistance in the form of builder and market support to accomplish this goal.

B. Program Overview

The NSHP is part of a comprehensive statewide solar program known as the California Solar Initiative (CSI). Senate Bill 1 (SB 1)[3] establishes three goals of the CSI: 1) to install 3,000 megawatts (MW) of distributed solar electric capacity in California by the end of 2016; 2) to establish a self-sufficient solar industry in which solar energy systems are a viable mainstream option in 10 years, and 3) to place solar energy systems on 50 percent of new homes in 13 years. The NSHP seeks to achieve 400 MW of installed solar electric capacity in California by the end of 2016.

The Energy Commission and the CPUC each administer separate, but coordinated elements of the CSI.

The NSHP is administered by Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE), and San Diego Gas & Electric Company (SDG&E), for their respective service areas. These entities administer the NSHP on the Energy Commission's behalf in accordance with their respective agreements with the Energy Commission. The Energy Commission provides oversight of the program and program administration for eligible customers of Bear Valley Electric Service (BVES).

The NSHP program provides two incentive structures, one for conventional or market-rate housing and another for qualified affordable housing projects. For market-rate

[1] See Chapter II, Program Eligibility Requirements, for the definition of new residential buildings.
[2] Eligible electric utilities are Pacific Gas and Electric Company, Southern California Edison Company, San Diego Gas & Electric Company, and Golden State Water Company (doing business as Bear Valley Electric Service).
[3] SB 1 (Murray), Chapter 132, Statutes of 2006, § 4, as codified in Public Resources Code sections 25780 – 25784.

housing, the incentive is determined by the level of an applicant's commitment to solar. For affordable housing projects, the incentive depends on the type of structure the solar energy system is servicing. The NSHP offers a higher incentive to affordable housing projects, because the affordable housing industry often faces more difficulties in the financing and incorporation of solar energy systems in its developments than do conventional housing developments.[4]

To qualify for an incentive, both the residential building and the installed solar energy system must meet specific program requirements included in this Guidebook.
The residential buildings must achieve energy efficiency levels substantially greater than the requirements of the current Building Energy Efficiency Standards, Title 24, Part 6, also known as "Title 24." Energy efficiency requirements may be satisfied through either Tier I or Tier II level energy efficiency measures.

The Energy Commission places great importance on ensuring that residential buildings, which qualify for an incentive under the NSHP, are as energy efficient as possible. The Tier I level is a minimum condition of participation in the NSHP, and consistent with the energy efficiency savings needed to qualify for incentives from current residential new construction programs operated by the IOUs. The Tier II level is expected to achieve an immediate positive cash flow for homeowners and encourages builders to move toward constructing zero energy residential buildings,[5] reflecting what is regularly being accomplished in California by builders that are participating in the national *Building America* program. For both tiers, incentives to builders for delivering the required energy efficiency levels are expected to be made available through coordinated utility energy efficiency programs overseen by the CPUC, such as the residential new construction programs.

Applicants are strongly encouraged to participate in their utility's residential and multifamily new construction energy efficiency programs to obtain the financial incentives that they can earn for meeting either Tier I or Tier II requirements, and to streamline the process for demonstrating that the energy efficiency requirements for NSHP are met. Energy efficiency documentation submitted and approved by utility new construction programs will not need to be submitted for NSHP, but will be verified before payment claims are approved by program administrators.

The expected performance of the solar energy system (anticipated annual electrical generation), which depends on specific key factors regarding equipment efficiency and the design and installation of the system, will determine the incentive amount. The incentive is paid once the system is installed, operational, and has met all program requirements.

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[4] These higher incentives are provided consistent with Public Resources Code section 25401.6.
[5] The U.S. Department of Energy (DOE) Building Technologies Program defines a net zero energy building as "a residential or commercial building with greatly reduced needs for energy through efficiency gains, with the balance of energy needs supplied by renewable technologies." Source: NREL – NAHB Research Center, February 2006.

Along with the financial incentive, the NSHP will provide non-financial support services, offering marketing and technical assistance to builders, as well as training to building officials and salespeople. The Energy Commission may provide greater assistance for builders choosing to build to Tier II energy efficiency levels. The Energy Commission's goal is to assist the industry to the maximum extent feasible to construct and sell new energy efficient, solar residential buildings.

By participating in the NSHP program, applicants authorize the Energy Commission and/or the Program Administrators[6] during the term of the NSHP to obtain information from the utility serving the project to verify compliance with program requirements, including requirements for system interconnection to the utility grid. In addition, the applicant must provide to the Energy Commission new homeowner contact information when requested by the Energy Commission and/or the Program Administrators.

The NSHP may be periodically evaluated and modified to ensure progress towards program goals. The evaluation may include: comparing the expected energy generation of systems to the actual output over time; determining the cost-benefit profile of systems; and/or, assessing overall program progress towards meeting installed capacity targets. In addition, an evaluation could include investigating risks to long-term achievement of expected performance levels, such as the effects of unforeseen shading or poor system maintenance, and identifying potential actions that would reduce those risks. Lastly, the NSHP may be modified in the future to address the eligibility of solar thermal electric systems, which are potentially eligible for funding under the CSI (SB 1) pursuant to Senate Bill 107[7] and Senate Bill 1250.[8]

Funding for the NSHP is provided through the Energy Commission's Renewables Resources Trust Fund pursuant to Senate Bill 107, which authorizes the allocation and use of funding available for emerging renewable technologies pursuant to Public Resources Code sections 25744 and 25751 to fund photovoltaic and solar thermal electric systems in accordance with the eligibility requirements established under SB 1. Because of this, the NSHP is considered an element within the Energy Commission's Renewable Energy Program umbrella and is subject to the general administrative requirements in the Energy Commission's *Overall Program Guidebook* for the Renewable Energy Program *(Overall Program Guidebook)*.
The *Overall Program Guidebook* describes how the Renewable Energy Program is administered. It includes information and requirements that apply overall to the Renewable Energy Program and the program elements, including information dealing with appeals, record retention, audits, and enforcement actions. To qualify for funding under the NSHP, applicants must satisfy the requirements specified in this NSHP Guidebook and the *Overall Program Guidebook.* **Applicants are strongly encouraged to read and understand their responsibilities under both guidebooks.**

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[6] The term "Program Administrators" refers to PG&E, SCE, and SGD&E, for their respective service territories.
[7] SB 107 (Simitian), Chapter 464, Statutes of 2006, § 7, as codified in Public Resources Code section 25744.5.
[8] SB 1250 (Perata), Chapter 512, Statutes of 2006, § 11, as codified in Public Resources Code section 25744, subd. (d).

C. Summary of New Solar Homes Partnership Guidebook Requirements

The following table is a brief summary of program eligibility requirements. The applicant should refer to Chapter II for more detailed descriptions of the requirements.

Program Element	NSHP
Eligible technologies	Solar electric generation only
Eligible electric service territories	PG&E, SCE, SDG&E, and BVES
Eligible housing types	New residential construction, including total building renovations, common areas of housing developments, and qualifying mixed occupancy projects.
Eligible equipment	New and not previously placed in service, and listed on the Energy Commission's eligible equipment list.
Reservation period	36 months for qualifying Solar as Standard and Solar as an Option developments and affordable housing projects. 18 months for all other projects.
Initial Incentive level	Expected Performance-Based Incentive (EPBI) based on the reference system receiving $3.50/watt for affordable housing dwelling units, $3.30/watt for affordable housing common areas, $2.60/watt for production homes with Solar as Standard, or $2.50/watt for all other projects. Additional funding is available from the utilities for meeting Tier I and Tier II energy efficiency requirements.
Incentive level adjustment	Volumetric trigger. Declines 10 percent based on original incentive level, as pre-specified target installed MW volumes are reached.
Incentive adjustments	Depends on geographic location, orientation, tilt, shading, and equipment efficiency.
Energy efficiency requirements	At least Tier I defined as 15% greater efficiency than the base level of the Building Energy Efficiency Standards (Title 24) in effect on the date the building permit was applied for. Tier II, higher levels of energy efficiency are strongly encouraged. *Energy Star* for builder installed appliances.
Field Verification	Solar energy system installation, equipment and performance shall be verified by the installing contractor and a qualified HERS Rater. All energy efficiency measures used to meet the above Title 24 requirements for program participation shall be verified by a qualified HERS Rater. Verification of some energy efficiency measures may be required to be completed as early in the construction process as foundation or rough-in.
Checkpoints	Solar as an Option projects only.
Interconnection	Grid connected with eligible utility required.

D. Flow Charts of the NSHP Application and Payment Process

The following flow charts provide a summary of the application and payment processing of the NSHP program. Figure 1 shows the process for all projects except Solar as an Option and Figure 2 shows the process for Solar as an Option projects.

Figure 1
Application Process Flow Chart for All Projects, Except Solar as an Option

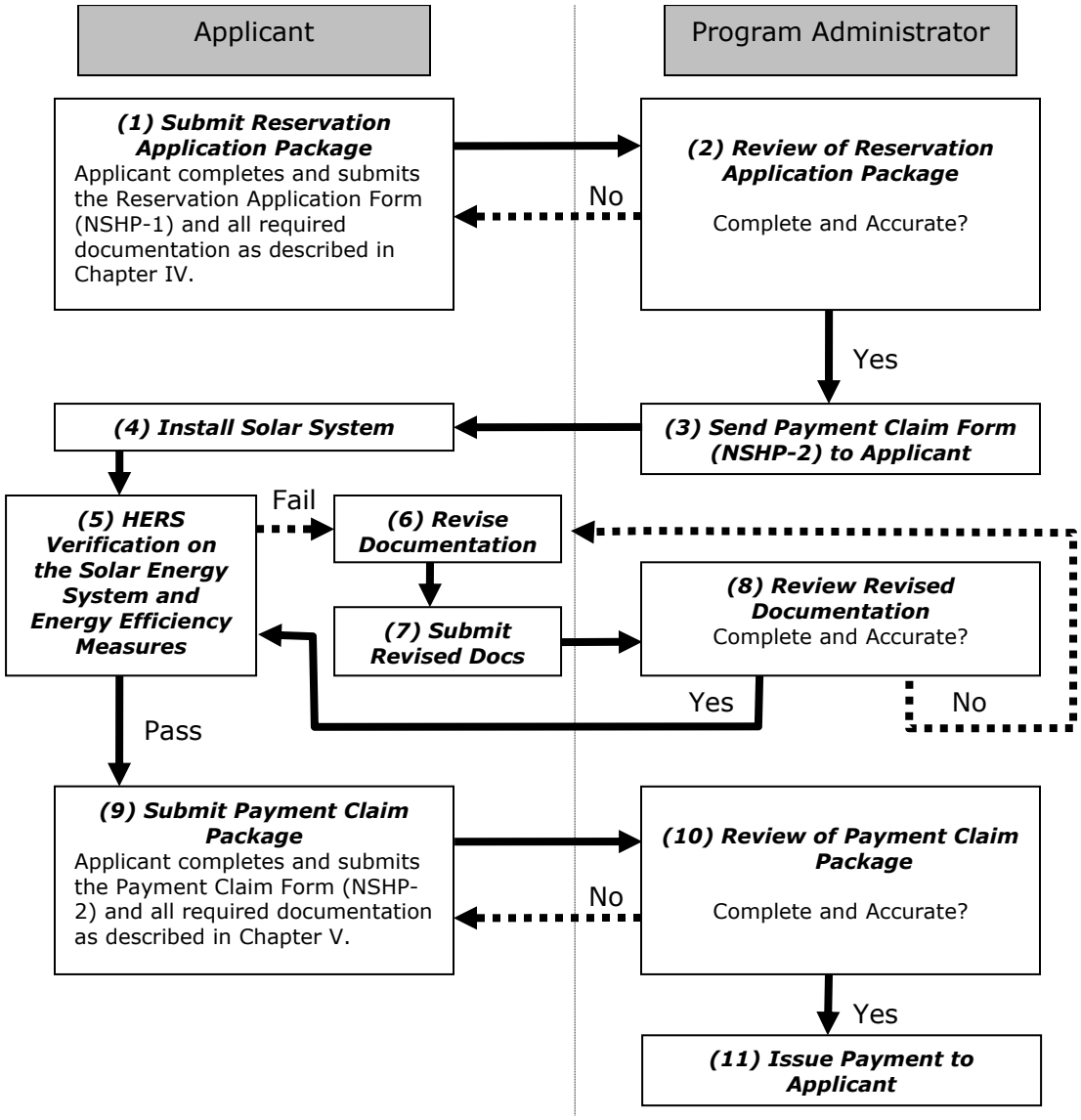
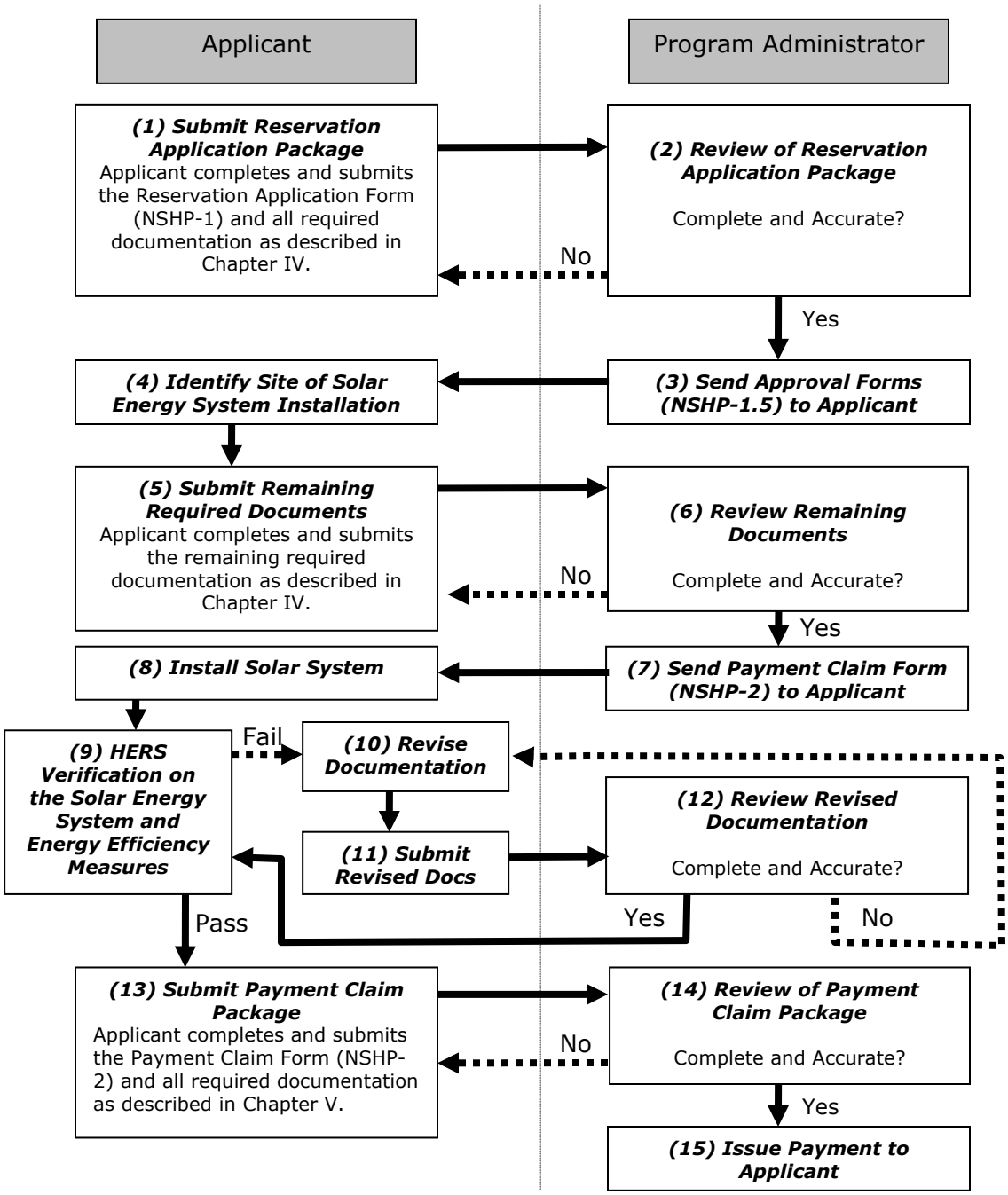


Figure 2
Application Process Flow Chart for Solar as an Option Projects



E. Renewable Energy Credits/Certificates

When electricity is generated using an eligible renewable energy resource, two commodities are created. The first commodity is the electricity, and the second is the renewable energy credits (also referred to as renewable energy certificates, or RECs)

representing the non-energy, environmental attributes associated with the electricity. For purposes of the state's Renewables Portfolio Standard, a renewable energy credit is defined to include "…all renewable and environmental attributes associated with the production of electricity from the eligible renewable energy resource..."[9]

The Energy Commission recognizes that owners of solar energy systems, including those participating in the NSHP, may assert claims concerning renewable energy credits attributed to their solar energy systems. However, the Energy Commission has established no rules or policies governing the creation, ownership or disposition of any such renewable energy credits. The Energy Commission does not require participants of the NSHP to relinquish their claims of renewable energy credits, or to transfer ownership of any such credits to the Energy Commission or any other entity, as a condition of receiving NSHP funding.

F. Applicability of Guidebook Changes to Existing Applications

1. The rules below explain the applicability of this third edition of the NSHP Guidebook to existing applications. For purposes of this section, "adoption date" means the date the Energy Commission adopts this edition of the Guidebook, and an "approved application" means one that the Commission approved prior to the adoption date. An approved application that has not received an approved payment claim will continue to be governed by the previous Guidebook versions except as follows:
    a) Applicants are permitted to enter into leasing/PPA agreements as long as they comply with the requirements in Chapter II, Section L.
    b) Applicants may increase the size of their systems but payment will be capped based on 7.5 kW AC per system.
    c) Applicants do not have to submit the final building permit signoff or final invoice, and may follow the third edition in regards to utility interconnection, EPBI and Energy Efficiency Documentation.

2. Approved applications that have been paid or that have approved payment claims are not eligible for additional compensation or to reapply for additional compensation.

3. An applicant who submitted an application prior to the adoption date and did not receive approval of the application by the adoption date may opt to follow either the previous Guidebook version or this third edition. The applicant must provide written or email notice to be subject to this third edition. If no notice is received by the

[9] Refer to definition in the *Overall Program Guidebook, January 2008 edition*, page 22.

Program Administrators or the Commission, the application will be governed by the previous edition.

4. All applications submitted after the adoption date will be governed by this third edition of the Guidebook.

Chapter II. Program Eligibility Requirements

This chapter covers the eligibility requirements necessary to receive incentives. Applicants can be either building owners or builders/developers. Eligible solar energy systems are limited to solar electric generators installed on new residential buildings that have achieved an Energy Commission-specified level of energy efficiency beyond that required by the current *Title 24 Standards*.

To be eligible for NSHP incentives, a solar energy system must be installed in conjunction with the construction of a new residential building that is permanently fixed to its foundation. In addition, the building permit for the solar energy system should be approved by the building code enforcement agency prior to the original occupancy of the newly constructed building, but no later than 60 days after the issuance of the occupancy permit, with original occupancy occurring on or after January 1, 2007.

Multifamily affordable housing projects with occupancy permits less than two years old are eligible to apply to the NSHP. This exception is designed to bridge the eligibility gap between the NSHP and the CPUC's MASH (Multi-Family Affordable Solar Housing) program. If future CPUC proceedings resolve this eligibility gap, this exception should no longer be necessary and shall be eliminated.

Solar energy systems installed on additions or alterations to existing buildings do not qualify for NSHP incentives nor do transient residences (e.g., motels, hotels). Solar energy systems installed on total rehabilitations where the entire structure is to be rebuilt to comply with current building requirements, are also eligible, as long as the entire structure meets the energy efficiency requirements.[10] No incentive from the NSHP will be provided to any solar energy system servicing nonresidential portions of a development, except in cases of mixed occupancy[11] buildings or the common areas of developments as described below.[12]

Qualifying solar energy systems must service newly-constructed residential buildings that are single family homes, duplexes, triplexes, condominiums, other multifamily buildings, including both "market rate" and affordable housing projects. Mixed occupancy buildings with both residential and nonresidential occupancies may also qualify for funding. The residential portion of mixed occupancy buildings is eligible for

[10] A residential building is considered "new" if the entire building structure is subject to current Title 24 building efficiency standards and does not yet have a Permit of Occupancy from the relevant Building Department.

[11] When a building is designed and constructed for more than one type of occupancy (residential and non-residential), the space for each occupancy shall meet the provisions of Title 24, Part 6, applicable to that occupancy. Exception: If one occupancy constitutes at least 80 percent of the conditioned floor area of the building, the entire building envelope, HVAC, and water heating may comply with the provisions of Title 24, Part 6 applicable to that occupancy, provided that the applicable lighting requirements in Sections 146 through 148 or 150(k) are met for each occupancy and space and mandatory measures in Sections 110 through 139, and 150 are met for each occupancy and space.

[12] Common areas are defined as those non-dwelling portions of a building that are intended for the primary benefit of the residential occupants of the building. Examples include, but are not limited to: hallways, laundry rooms, recreation rooms, manager unit, and tenant parking.

funding. If the nonresidential portion is equal to or less than 10 percent of the total building space, the entire solar energy system will be eligible for funding under the NSHP.

Solar energy systems serving the common areas of new residential and mixed occupancy developments are also eligible for incentives.

A. Technology and System Ownership

A solar energy system that achieves the direct conversion of sunlight to electricity is the only technology eligible to receive financial incentives. Eligible solar energy systems must be 1.00 kW AC (alternating current) or larger. It is the intent of the program that eligible systems remain interconnected to the utility distribution grid and be operated at the original location for at least the 10-year warranty period. The solar energy system must be located on the same site where the end-use customer's own electricity demand is located.

Solar energy systems that are leased by the end-use customer or that supply electricity to the end-use customer through a power purchase agreement (PPA) may qualify for NSHP funding, provided the applicant and system satisfy the additional requirements in Section L.

B. Residential Building Energy Efficiency

Eligible solar energy systems must be installed on new buildings (typically residential) that have achieved an Energy Commission specified level of energy efficiency beyond Title 24 Standards. Participating residential buildings are required to meet one of the tiers of energy efficiency shown below.

- Tier I – 15 percent reduction in the residential building's combined space heating, space cooling, and water heating energy compared to the Title 24 Standards in effect on the date the building permit was applied for.

For buildings which applied for building permits under the *2005* Building Energy Efficiency Standards (Title 24):

- Tier II – 35 percent reduction in the residential building's combined space heating, space cooling and water heating energy and 40 percent reduction in the residential building's space cooling (air conditioning) energy compared to the 2005 Title 24 Standards.

For buildings which applied for building permits under the *2008* Building Energy Efficiency Standards (Title 24):

- Tier II – 30 percent reduction in the residential building's combined space heating, space cooling and water heating energy and 30 percent reduction in the residential building's space cooling (air conditioning) energy compared to the 2008 Title 24 Standards.

Solar energy systems on common areas of high rise[13] and low rise[14] multifamily developments that are intended for the primary benefit of the residential occupants of the development are eligible to receive NSHP incentives. Both conditioned[15] and unconditioned common areas being served by the solar energy system must also be highly energy efficient. Examples of common area spaces may include, but are not limited to lobbies, hallways, corridors, pool rooms, game rooms, common area kitchens, manager offices and tenant parking. Documentation showing energy savings of at least 15 percent of the combined space heating, space cooling, water heating and lighting energy, compared to the Title 24 Standards (residential or nonresidential) in effect on the date the building permit was applied for, is required for Tier I. In case of unconditioned common areas, the documentation needs to show 15 percent less energy use in lighting under the applicable Title 24 standards for the space, as evidence of reducing electric use. This can be demonstrated through the use of relevant lighting forms associated with the space.

Field verification of ***all*** energy efficiency measures used to meet the above Title 24 requirements will be required and reported on the CF-4R-NSHP form and be consistent with current Title 24 Standards field verification procedures and protocols. In addition, each appliance provided by the builder must be Energy Star labeled if *Energy Star* is applicable to that appliance. Solar water heating may be used to assist in meeting the energy efficiency requirements of either Tier I or Tier II.

C. Grid Interconnection

Eligible solar energy systems must be permanently interconnected to the electrical distribution grid of the utility serving the customer's electrical load. The site where the system is installed must receive electrical distribution service from an existing in-state electrical corporation collecting funds to support the program as stated in Chapter I.

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[13] A building, other than a hotel/motel, of Occupancy Group R, Division 1 with four or more habitable stories. High-rise residential buildings are subject to the Building Energy Efficiency Standards for non-residential buildings. Refer to the California Code of Regulations, Title 24, Part 6.

[14] A building, other than a hotel/motel that is of Occupancy Group R, Division 1, and is multi-family with three stories or less, or a single family residence of Occupancy Group R, Division 3, or an Occupancy Group U building located on a residential site.

[15] Directly conditioned space is an enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/hr-ft^2), or is provided with mechanical cooling that has a capacity exceeding 5 Btu/hr-ft^2, unless the space-conditioning system is designed for a process space. Indirectly conditioned space is enclosed space, including, but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.

These in-state electrical corporations are PG&E, SCE, SDG&E, and BVES. The system interconnection to the utility distribution grid must also comply with applicable electrical codes, utility interconnection requirements, and metering requirements. The solar energy system shall not be interconnected to the utility distribution grid until the applicant has received a formal approval letter from the interconnection department of applicant's electric utility.

D. System Components

Major solar energy system components are defined as solar electric generators (typically photovoltaic modules), inverters and meters.

All major system components must be new and must not have been previously placed in service in any other location or for any other application. **Equipment purchased or installed more than 24 months before applying for a reservation is not eligible.** System components must satisfy the eligibility requirements specified in the most recent approved edition of Guidelines for California's Solar Electric Incentive Programs (Senate Bill 1) [http://www.energy.ca.gov/sb1/meetings/index.html]. Approved major components will be posted on the Energy Commission's lists of eligible equipment available at: [http://gosolarcalifornia.ca.gov/equipment/index.html].

The applicant must confirm that the components purchased for a system are eligible when applying for NSHP funding. The Energy Commission or its agents will confirm that the equipment identified in a reservation package meets eligibility requirements prior to a reservation being granted.

Because equipment is added and removed from the eligible equipment list on a regular basis, the Energy Commission recommends the applicant wait for an approved reservation before installation commences. If the applicant begins or completes the installation before the Energy Commission has approved the reservation, changes to the equipment lists may create a situation where significant and costly system modifications are required to comply with program guidelines.

E. System Performance Meter

All solar energy systems must be installed with a standalone performance meter or an inverter with a built-in performance meter so that the customer can determine the amount of energy produced by the system.

F. System Sized to Offset On-site Electricity Load

Eligible solar energy systems must be sized so that the amount of electricity that is produced offsets part or all of the end-use customer's electrical needs at the site of installation. Systems 7.5 kW AC or less are considered to be sized to serve the on-site

electric load of the end-use customer. The maximum incentive paid for a system on single family residential unit is limited to the first 7.5 kW AC of the system. For systems greater than 7.5 kW, See Appendix 2 for further details on how to determine the maximum system size eligible for incentives. The minimum size of an eligible system is 1.00 kW AC, measured after the inverter.

G. System Performance

The incentive amount will be based on the estimated performance of the solar energy system, calculated using the California Energy Commission's PV Calculator (CECPV Calculator).[16] The estimated performance of the system will be the basis for qualifying for a reservation, and for the final incentive amount. System installation should be consistent with the characteristics used to determine estimated performance to receive the reserved amount. The final incentive amount is subject to available funds. The characteristics that are addressed by the CECPV Calculator include shading by any obstruction of the modules.

The CECPV Calculator will include "California Flexible Installation" criteria (as detailed in Chapter III Section B) to allow estimated performance to be based on an estimate of performance for a range of module orientations and tilts. The California Flexible Installation is intended for use only by new residential developments and is not allowable for applications consisting of only one single family dwelling or only the common area of a multifamily development. Systems installed within the range of these orientations and tilts and meeting the "minimal shading criteria" can use the California Flexible Installation criteria as the basis for the reservation application and incentive request without having to know more specific orientations and tilts. Third-party field verification will be conducted to assess whether systems have been installed consistent with the characteristics used to determine estimated performance.

H. System Installation

Solar energy systems must be installed in conformance with the manufacturer's specifications and with all applicable electrical and building codes and standards.

If installed under contract, systems must be installed by an appropriately licensed contractor, in accordance with rules and regulations adopted by the California Contractors State License Board. Installation contractors must have an active A, B, C-10, or a C-46 license. Contractors with roofing specific licenses may place photovoltaic modules in accordance with limitations of their specific licenses; however, electrical

[16] Currently the CECPV Calculator can only be used to determine incentives for solar energy systems using photovoltaic modules. Applicants using any other solar electric generating technology should contact the California Energy Commission.

connections must be made by an above-mentioned contractor. Owner-builders are allowed under the NSHP to install their own systems.[17]

The Energy Commission encourages installation contractors to become certified by the North American Board of Certified Energy Practitioners (NABCEP). See [http://www.nabcep.org] for additional information.

I. Field Verification

Installed solar energy systems must be third-party field-verified as described in Appendix 2 to ensure that installations are consistent with the information used to determine the estimated performance, reservations, and ultimately the final incentive amount. Field verification is completed consistent with the procedures found in the current Building Energy Efficiency Standards [http://www.energy.ca.gov/title24]. Field verification for new housing developments may employ the sampling approach as allowed in the current Building Energy Efficiency Standards.[18]

Field verification will check the consistency either for residential buildings that have relied upon the "California Flexible Installation" criteria and the minimal shading criteria, or for residential buildings that have uniquely specified orientation, tilt and shading characteristics. Field verification will also be required for any eligible mixed occupancy buildings, nonresidential buildings or common areas. When field verification indicates that the installation will not achieve the estimated performance used for reservations, the deficiencies must be corrected or the estimated performance must be recalculated based on the actual installation and the application must be resubmitted for approval at the incentive level in effect at the time of the original reservation. When field verification indicates that the installation will achieve an estimated performance greater than that used for the reservation, the estimated performance may be re-calculated at the builder's option to reflect the higher performance, and the application may be resubmitted for the incremental performance at the incentive level in effect at the time of the original reservation.

J. Warranty Requirements

All solar energy systems must have a minimum ten-year warranty provided in combination by the manufacturer and installer to protect against defective workmanship, system or component breakdown or degradation in electrical output of more than 15 percent from the originally rated electrical output during the ten-year period. The warranty must cover the solar generating system only, including the solar electric generators (typically photovoltaic modules), inverters, and meters, and provide for no-

[17] For information on restrictions placed on owner-builders, contact the Contractors State License Board at (800) 321-CSLB to obtain a current edition of the Contractor's License Law and Handbook.
[18] For the 2005 Building Energy Efficiency Standards see Chapter 7 of the Residential Alternative Calculation Method (ACM) Approval Manual. For the 2008 Building Efficiency Standards see Appendix RA2 of the 2008 Reference Appendices.

cost repair or replacement of the system or system components, including any associated labor during the warranty period.

K. Equipment Sellers/Installers

To participate in the NSHP, companies that sell and/or install solar energy system equipment must be self-registered on the Energy Commission's Contractors, Installers, and Sellers Database (Database). Equipment sellers/installers should have the following information available prior to self-registration:

1. Business name, address, phone, fax, and e-mail address
2. Owner or principal contact
3. Business license number
4. Contractor license number (if applicable)
5. Proof of good standing on record with the California Secretary of State, as required for corporate and limited liability entities
6. Reseller's license number

This information must be submitted to the Energy Commission through the self-registration process before a company can become eligible to participate in the NSHP.

Self-registration can be done on-line at:
http://www.gosolarcalifornia.ca.gov/database/addcompany.php.

Sellers, contractors, or installers that are listed in the online Database should maintain their information on a regular basis. This can be done using the log-on account name and password provided when the company has registered. Updates can be done online at:

http://www.gosolarcalifornia.ca.gov/database/update.php

The Energy Commission will send out emails periodically to remind companies to update their online information, contacts, and other data.

It is the responsibility of each company to maintain its online information. If the Energy Commission's e-mails are returned as undeliverable, and the Energy Commission cannot reach that company by phone or by regular U.S. mail, the Energy Commission reserves the right to remove the company from the online Database after a three-month period.

L. Leases and Power Purchase Agreements

Solar energy systems that are leased by an end-use customer or provide electricity to an end-use customer under a power purchase agreement (PPA) are eligible for NSHP

funding if the lease agreement or PPA is executed and has a start date on or after July 1, 2009. Lease agreements and PPAs that are executed or have a start date prior to July 1, 2009, are not eligible for funding even though the system may have been installed after this date. Lease agreements and PPAs must have an initial term of no less than 10 years and must provide the lessee or customer the option to renew the agreement, purchase the system, or remove the system at the end of the initial term of the agreement. In addition, lease agreements and PPAs must demonstrate that the NSHP funding benefits the end-use customer by directly and exclusively reducing the lease payments for the system or the cost of electricity produced by the system.

For the first five years of the lease or PPA, the lessor or owner of the solar energy system, in the case of a PPA, shall provide an annual status report to the Program Administrator on the operation of the NSHP-funded solar energy system. The annual status report shall address agreements executed through December 31 of each year, be submitted to the Program Administrator no later than January 31 of each year, and shall include the following information for each system:

1) Date that the agreement was fully executed and the start date of the agreement;
2) Operational status of the system; and
3) Status of the agreement, and if status has changed, date of change and reason for the change. (Status changes would primarily include, change in lessee or customer, system purchase, termination of agreement, and system removal.)

The annual status report shall be submitted to the Energy Commission if the NSHP is not administered by a Program Administrator.

If any lease agreement or PPA for a system that received funding from the NSHP is terminated and the system is removed from the building on which it was originally installed, the NSHP funding received by the applicant shall be repaid by the Lessor or system owner to the Energy Commission in the amounts specified below:

- If the agreement is terminated within one year of the system's installation or the start date of the agreement, whichever is later, 100 percent of the funding received shall be repaid;
- If the agreement is terminated within two years of the system's installation or the start date of the agreement, whichever is later, 80 percent of the funding received shall be repaid;
- If the agreement is terminated within three years of the system's installation or the start date of the agreement, whichever is later, 60 percent of the funding received shall be repaid;
- If the agreement is terminated within four years of the system's installation or the start date of the agreement, whichever is later, 40 percent of the funding received shall be repaid;
- If the agreement is terminated within five years of the system's installation or the start date of the agreement, whichever is later, 20 percent of the funding received shall be repaid;

- Repayment shall not be required if the agreement is terminated more than five years after the system's installation or the start date of the agreement, whichever is later.

Repayment will not be required if a system is destroyed by natural disaster or fire at no fault of the lessor/owner or lessee/customer.

Nothing in this section precludes an applicant from using an otherwise valid reservation to request a rebate for a system that is leased or provides electricity through a power purchase agreement.

Chapter III. Incentive Levels and Structure

This chapter describes the incentives offered by the NSHP program. The NSHP provides an Expected Performance-Based Incentive (EPBI) using a specific dollars-per-watt amount applied to the Energy Commission-specified reference solar energy system. The incentive amount for each applicant solar energy system is determined by analysis using the CECPV Calculator, and is paid when the solar energy system has been installed, approved by the local building authority, and all program requirements have been met. Detailed information on how the incentive amount is determined can be found in Section B.

Incentives will decline over the life of the program, with the program's application process closing no later than the end of 2016. Incentive levels and reserved volume are subject to funding availability.

A. Incentive Levels and Decline Schedule

1. Incentive Levels for Market-Rate Housing

There are two available incentive levels:

- **Base incentive:** Beginning in January 2007, the EPBI amount is based on the reference solar energy system receiving $2.50/watt at the initial MW volume. The base incentive applies to custom homes, small developments, reservations where solar is identified as an option, production housing where solar will not be installed as a Solar as Standard feature, as defined below, and common areas of residential developments. Projects qualifying for the base incentive will receive an 18-month reservation period.

  EXCEPTION: Projects qualifying for Solar as an Option will receive a 36-month reservation period.

- **Solar as Standard incentive:** Beginning in January 2007, the EPBI amount is based on the reference solar energy system receiving $2.60/watt at the initial MW volume. To qualify, the builder must commit at the reservation stage that a minimum of 50 percent of the homes/dwelling units in the subdivision or multifamily housing phase with 6 or more homes/dwelling units will have solar energy systems that meet or exceed the California Flexible Installation criteria. Projects qualifying for this incentive will receive a 36-month reservation period.

The actual incentive amount for a particular solar energy system and installation depends on the EPBI calculation of the system's expected performance compared to the reference solar energy system. Incentive levels will decline when a specific cumulative MW volume of reservations, in terms of total-program capacity, has been reached, as reflected by the table below.

Funds reserved for solar energy systems not installed within the allowed reservation period will be reallocated to the incentive level in effect at the time those approved reservations expire or are cancelled, and the volume targets from that point forward will be adjusted to reflect the funds from the expired or cancelled reservations.

EPBI Incentive Levels and Related Reservation Volumes

Base Incentive (per watt, reference system)	**Qualifying Residential Units With Solar as a Standard Feature Incentive *** (per watt, reference system)	**Reserved Volume**** (MW-AC)
$2.50	$2.60	15
$2.25	$2.35	18
$2.00	$2.10	22
$1.75	$1.85	25
$1.50	$1.60	30
$1.25	$1.35	35
$1.00	$1.10	40
$0.75	$0.85	50
$0.50	$0.60	75
$0.25	$0.35	90
Total		400

*Residential developments of 6 or more dwelling units in which 50% of homes/dwelling units have solar energy systems that meet or exceed the California Flexible Installation Criteria.
**Reserved volume includes reserved affordable housing volumes, discussed later in this Guidebook.

2. Incentive Levels for Affordable Housing Projects

The following incentive levels apply to eligible affordable housing projects. Eligibility requirements for affordable housing can be found in Chapter IV, Section A. Projects qualifying for this incentive will receive a 36-month reservation period. The design of the incentive levels and decline structure for affordable housing is the same as the design for market-rate housing as discussed earlier.

Residential Dwelling Unit Incentive (per watt, reference system)	**Common Area Incentive** (per watt, reference system)	**Reserved Volume*** (MW-AC)
$3.50	$3.30	1.5
$3.15	$2.97	1.8
$2.80	$2.64	2.2
$2.45	$2.31	2.5
$2.10	$1.98	3.0
$1.75	$1.65	3.0
$1.40	$1.32	4.0
$1.05	$0.99	5.0
$0.70	$0.66	6.0
$0.35	$0.33	7.0
Total		36.0

*The 36 MW represents part of the total 400 MW goal for the entire NSHP program.

Beginning July 1, 2009, multifamily affordable housing projects using virtual net metering[19] are eligible for the residential dwelling unit incentive for the portion of the solar energy system that is allocated to the tenants. If the residential dwelling unit incentive is requested, the residential dwelling units must meet the residential building energy efficiency requirements in Chapter II, Section B.

Change in Incentive Level

The Energy Commission will issue a public notice to inform program participants of a drop in the incentive levels as shown in the above tables. The new incentive levels will be effective 30 days after the public notice is issued. Applicants can qualify for the then current incentive level as long as a complete NSHP reservation application with consistent and accurate information is submitted within the 30 day noticing period. After the incentive level has been lowered, the corresponding reserved volume target for the new incentive level may also be adjusted in order to maintain the overall program megawatt goals.

[19] Virtual net metering allows the electricity produced by a single solar energy system installation to be credited to the benefit of multiple tenants in an affordable housing multifamily building without requiring the solar energy system to be physically connected to each tenant's meter. Virtual net metering was adopted in the California Public Utilities Commission Decision 08-10-036. [http://docs.cpuc.ca.gov/cyberdocs/webquickstart.asp?DOC_ID=356818&docType=LEGAL_PROCEED]

For current incentive levels, please refer to [https://www.newsolarhomes.org/RebateLevels.aspx].

B. Expected Performance-Based Incentive Calculation

The NSHP provides an incentive based on the expected performance (i.e., expected annual electrical generation), of a solar energy system installed in a specific location. The EPBI is determined by analysis using the CECPV Calculator. The analysis accounts for the tested and certified performance of the specific module and inverter, the mounting type and cell temperature, the orientation and tilt of the modules, and the extent to which the system is shaded. The CECPV Calculator accounts for these parameters that are under the control of the builder/installer, as well as the solar and climatic conditions for the locale of the building to determine the hourly estimated performance over a year. This is then weighted to account for the time-of-use value of the electric generation to the utility system (referred to as time dependent valuation (TDV)).

The weighted TDV annual kilowatt-hour (kWh) production of an applicant system is compared to the weighted TDV annual kWh production of a reference system. The CECPV Calculator converts the available $/watt AC incentive level into the equivalent incentive amount for the TDV-weighted kWh of annual production for the reference system. This equivalent incentive per TDV-weighted kWh rate is applied to the expected annual TDV performance determined by the CECPV Calculator for the applicant system to determine the incentive for the specific equipment and installation characteristics of that system.

The Energy Commission uses the reference system shown in the following table:

Reference Solar Energy System and Installation

Parameters	**Reference System and Installation**
Location	San Jose (latitude, longitude, Climate Zone 4, weather file, TDV values)
Azimuth	180 degrees (south orientation)
Tilt	22.6 degrees (5:12 pitch)
Mounting	Direct mounted Building Integrated Photovoltaics (BIPV)
Photovoltaic Modules	Matches Systems Installed at Premier Gardens, Sacramento[20]
Number of Modules	
Strings (series and parallel)	
Inverter	
Shading	None
Default Losses	0.88 for dirt, dust and mismatched wiring

[20] The modules and inverter performance characteristics for the reference system are those that are specific to the installation in the Premier Gardens subdivision in Sacramento and include 42 BIPV modules connected in a single series string to a 2.5 kW inverter.

A minimum of 30 days public notice will be given when changes are made or will be made to the CECPV Calculator. The previous version of the CECPV Calculator will remain certified for use during this period.

California Flexible Installation
In lieu of site-specific EPBI analysis as described above, the NSHP program permits applicants to use the California Flexible Installation criteria as an alternative approach to estimate the EPBI. The California Flexible Installation is intended for use only by new residential developments and is not allowable for applications consisting of only one single family dwelling or only the common area of a residential development. The California Flexible Installation criteria offer a simplified approach to estimating the incentives for those solar energy systems in a development that are designed and installed to meet the criteria. One EPBI calculation can be made for all solar energy systems in a subdivision that meet all of the following: 1) have an azimuth ranging from 150 to 270 degrees, 2) have a tilt corresponding to a roof pitch between 0:12 and 7:12, 3) meet the “minimal shading criteria”, 4) use the same make, model, and quantity of major system components, and 5) fixed, non-tracking mounting. The minimal shading criteria implies no existing, planned or potential shading obstructions that are closer than a distance of twice the height that the obstruction extends above the nearest point on the array.

California Flexible Installation incentives will be calculated using the following default parameters: azimuth of 170 degrees, tilt of 5:12, two story mounting height, fixed non-tracking mounting, and minimal shading. User input will be used for photovoltaic module and inverter make, model and quantity, array standoff height from roof, location, and incentive type.

C. Other Incentives May Affect the NSHP Incentive Amount

Incentives received from sources other than the NSHP that lower the cost of the solar energy system may affect the incentive amount applicants receive from the Energy Commission. If incentives are from other utility incentive programs, a State of California sponsored incentive program, or a federal government sponsored incentive program (other than tax credits), a minimum of five percent of the total incentives received or expected from other sources will be subtracted from the NSHP incentive amount. The percent reduction will be increased as necessary to ensure the sum of all incentives received or expected from all sources, including the NSHP, does not exceed the total cost of the system.

The NSHP will not issue a reservation or make a payment for any system or portion of a system that has received payment from, or is eligible for and participating in, the California Public Utilities Commission-approved California Solar Initiative program, or any other incentive program for solar energy systems using electric utility ratepayer funds.

Chapter IV. Reservation Process

This chapter describes the types of reservations and the documentation required to reserve funding from the NSHP.

Please read the following descriptions carefully to determine which reservation your project may qualify for and the documentation you will need to provide. Once the required information has been submitted and confirmed to meet the requirements of the NSHP program, the reservation application will be approved, and funding will be reserved for your project.

A. Types of Reservations

1. Solar as Standard

Build-out phases of 6 or more residential dwelling units where the builder/developer has committed to installing solar energy systems on 50 percent or more of the dwelling units and that meet at minimum, the California Flexible Installation criteria are eligible for a Solar as Standard reservation.[21] This includes single family and multifamily projects. Applicants meeting these criteria will receive a 36-month reservation period. Applicants not meeting the above criteria may qualify for the Base Incentive and should refer to Section 2 described below.

2. Base Incentive

The following projects are eligible for the base incentive and an 18-month reservation period:

- Custom homes
- Small developments/phases (under 6 residential dwelling units)
- Projects where solar will be installed on less than 50 percent of the residential dwelling units
- Common areas of residential developments

Projects offering solar as an option to homebuyers are also eligible for the base incentive but will receive a 36-month reservation. See section C for more details on the reservation process for solar as an option projects.

[21] A build-out phase is part or all of a development which an applicant plans to build within the reservation period.

3. Affordable Housing

The NSHP offers higher incentives for qualifying systems installed on affordable housing projects. Affordable housing projects of all sizes are eligible for a 36-month reservation period.

Eligible projects include multifamily and single-family developments where at least 20 percent of the project units are reserved for extremely low, very low, lower, or moderate income households for a period of at least 10 years. Qualifying systems must be connected to and serving the energy needs of 1) residential units subject to affordability requirements, 2) the office and residential unit of the project manager, provided all other residential units in the project are subject to affordability requirements, or 3) the common areas of the project, where all of the project's units are reserved for extremely low, very low, lower or moderate income households, except for the manager's unit. Examples of common areas include, but are not limited to: hallways, recreation rooms, manager's unit, and tenant parking.

Below are additional requirements for affordable housing projects:

a) Regulatory Agreement

The affordable housing project must be undertaken pursuant to section 50052.5, 50053, or 50199.4 of the Health and Safety Code, or other affordable housing laws or regulations adopted by the California Department of Housing and Community Development. Applicants must demonstrate this by providing documentation that identifies the statutory basis under which the project was undertaken. In addition, the applicant must provide a copy of the regulatory agreement or approval for the project's development that identifies 1) the project, 2) the number of residential units in the project subject to the affordability requirements, and 3) the applicable affordability requirements for these residential units. The regulatory agreement or approval must expressly limit residency in the affordable residential units to persons with extremely low, very low, lower or moderate income persons as defined by the Health and Safety Code sections 50079.5, 50105, 50106, and 50093 et seq. or regulations adopted by the California Department of Housing and Community Development. The regulatory agreement shall reserve at least 20 percent of the project units for extremely low, very low, lower, or moderate income households for a period of at least 10 years.

b) Individual Meter Requirement

Each residential dwelling unit for which a solar energy system is being installed must have an individual electricity consumption meter capable of monitoring and reporting the utility electricity consumption of that unit. The solar energy system for each residential dwelling unit shall be separately net-metered through that individual electricity consumption meter. If the meter is an electric utility meter, applicants must provide documentation from the electric utility confirming service and meter number at payment claim time. If the meter is supplied by an entity other than the utility, documentation must be provided explaining how the meter monitors and reports individual unit

consumption. Meters supplied by an entity other than a utility must be utility-grade and have the same reporting accuracy levels of utility-supplied meters.

EXCEPTION: Affordable housing projects that qualify for virtual net metering (VNM) as adopted by the California Public Utilities Commission (CPUC) in Decision 08-10-036 are not required to separately net-meter each residential dwelling unit that will be allocated electricity from the solar system.

c) Maintenance and Monitoring Plan

Affordable housing applicants shall develop a maintenance and monitoring plan for NSHP-funded systems and shall retain a copy of such plan for inspection by the Energy Commission or the Program Administrator. This plan shall be provided to the system owner and the building or property manager and shall identify specific maintenance, monitoring, and inspections the building or property manager will need to undertake, or have contracted for, to ensure that the system produces maximum output over the system's expected life. The plan should include activities such as: a) cleaning schedule for the removal of any dirt and dust build up on the solar energy system; b) periodic checking of all electrical connections for corrosion and looseness; c) checking the inverter for instantaneous power and long term energy output and diagnose and taking corrective action needed if production is significantly lower than expected; and d) checking for any tree/plant growth or other obstructions that are causing shading on the array and take action to eliminate that shading. The Energy Commission or its Program Administrators reserve the right to request applicants to provide a copy of the maintenance and monitoring plan at anytime during the course of the NSHP program.

B. Forms and Documentation

1. Reservation Application Form (all reservations)

The Reservation Application Form (NSHP-1) provides general information about the proposed project, the electric utility service area in which the project will be located, and must be signed by the homeowner or builder/developer. The form also identifies what information must be submitted with the application and requests applicants to share the contact information of the Home Energy Rating System (HERS) Rater, if available. The NSHP-1 provides the homeowner or builder/developer an opportunity to assign his/her administrative rights.

2. Proof of Residential New Construction

a) For Solar as Standard Projects

A copy of the final subdivision map, or "tract map" must be submitted. Each site included in the reservation must be indicated as pre-plotted locations on the map for the reservation. If the sites are not pre-plotted, the application does not qualify for the solar

as standard incentive reservation and must use the criteria outlined under Base Incentive.

b) For Base Incentive and Affordable Housing Projects

Applicants must submit either building permits for new construction or a copy of the final subdivision map. Grading permits and expired permits are not acceptable and may not be submitted to support an application. Total rehabilitations of residential dwelling units must provide adequate proof that the entire unit(s) are to be renovated and will meet or exceed the energy efficiency requirements for the entire structure.

3. Expected Performance Based Incentive (EPBI) Documentation (all reservations)

The Expected Performance Based Incentive (EPBI) documentation specifies the expected performance of the solar energy system(s) to be installed and the eligible funding amount to the applicant. To complete this documentation, the applicant must use the CECPV Calculator for each unique solar energy system.[22] The CECPV Calculator will produce the CF-1R-PV output report. A development may use the California Flexible Installation criteria to calculate the incentives for all systems that meet the criteria.[23] In cases where there is more than one solar energy system design that results in different levels of expected performance, a CF-1R-PV for each system design that results in a unique expected performance calculation must be submitted.

Applicants must submit each CF-1R-PV and the associated .emf digital input file and .her digital output file for review by the Program Administrator. The Program Administrator will upload the .her digital output file into the data registry of one of the Energy Commission approved HERS Providers. Applicants are advised to identify the HERS Rater and Provider early in the application process so that the payment claim process will not be unnecessarily delayed due to the unavailability of this information.

4. Energy Efficiency Documentation (all reservations)

To participate in the NSHP, the residential buildings must also be highly energy efficient. Documentation showing energy savings for each single family home or multifamily building of at least 15 percent of the combined space heating, space cooling and water heating energy compared to the current Building Energy Efficiency Standards is required.. Either of the two Tier levels described in Chapter II Section B can be used to meet this requirement. Documentation must also show that appliances provided by the builder are *Energy Star* labeled if *Energy Star* is applicable to that appliance. Solar

[22] For solar energy systems consisting of photovoltaic modules, NSHP defines a system as one or more strings of modules connected to one inverter.

[23] The California Flexible Installation criteria offer a simplified approach to estimating the incentives for those solar energy systems in a development that are designed and installed to meet the criteria, as outlined in Chapter III Section B.

water heating may be used to assist in meeting the requirements of either Tier I or Tier II.

Residential energy efficiency documentation (CF-1R) must be completed by a Certified Energy Plans Examiner (CEPE) approved for residential compliance by the California Association of Building Energy Consultants (CABEC).Nonresidential energy efficiency documentation (PERF-1) must be completed by a CEPE approved for nonresidential compliance by CABEC. For a list of CEPEs, visit the CABEC website at: [http://www.cabec.org/ceperosterall.php].

Applicants must submit the CF-1R (or PERF-1 when applicable) and other required energy efficiency documentation forms and the associated digital input files (e.g. *.bld or *.mp7, *.mp8), generated directly by one of the Energy Commission-approved Title 24 compliance software programs, showing all of the measures used to meet the energy savings requirements. The CF-1R (or PERF-1 when applicable) and other energy efficiency documentation forms must be consistent with the construction plan-set.

The associated digital input files (e.g. *.bld or *.mp7, *.mp8) will be used for uploading into the data registry of one of the Energy Commission approved HERS Providers. This step normally will be completed in conjunction with the utility new construction processes or by the Program Administrator. Applicants are advised to identify the specific HERS Rater and Provider as early in the design process as possible. Many energy efficiency measures, that can be used to meet the required tier levels of energy efficiency, must be included early in the building design and subsequently verified by a HERS Rater during construction.

A copy of the construction plan-set that is used for building permit purposes must be submitted by the applicant. The construction plan-set is used to verify the energy efficiency measures to be installed on the project. The construction plan-set must include: a) architectural floor plans, elevations and sections (including information on windows and other measures used for the Title 24 energy calculations); b) site plan for custom homes indicating the north direction; c) electrical plans (as appropriate for Title 24 plan check); and d) mechanical plans (should include information relevant for Title 24 plan check). Additional information may be required upon request to review and complete the plan check. Applicants are encouraged to provide the construction plan-set in electronic format, preferably portable document format (PDF).

Applicants are strongly encouraged to participate in their utility's residential and multifamily new construction energy efficiency programs to obtain the financial incentives that they can earn for meeting either Tier I or Tier II requirements, and to streamline the process for demonstrating that the energy efficiency requirements for NSHP are met. Energy efficiency documentation submitted and approved by utility new construction programs will not need to be submitted for NSHP, but will be verified before payment claims are approved by program administrators.

a) For Affordable Housing Projects

Projects requesting funding from the California Tax Credit Allocation Committee (TCAC) are given up to 60 days after the approval from TCAC to provide finalized energy efficiency documentation as described above.

5. Equipment Purchase Agreement and Installation Contract

a) For Solar as Standard Projects

The equipment purchase agreement and installation contract indicate the applicant's commitment to the purchase and installation of solar energy systems. The applicant must submit one master equipment purchase and installation agreement for all the residential dwelling units in the reservation or one agreement for the system equipment and a second agreement for the installation. In cases where the installation is performed by the builder's employees, installation labor cost must be separately listed.

The master purchase agreement(s) for the equipment and installation labor must contain language indicating the builder's commitment to purchase eligible solar energy systems for all of the residential dwelling units in the reservation and include the following information:

- List of the physical addresses for the system installations.
- Quantity, make and model of the solar electric generators (typically photovoltaic modules), inverters, and meters to be installed at each address.
- Total system cost of the eligible equipment and/or labor.

The master purchase agreement(s) must be signed by the applicant or the applicant's representative, the seller of the systems, and the installer (an installer's signature on the equipment purchase agreement is not required if the applicant is hiring a separate company for the installation of the equipment). The seller of the systems must be an Energy Commission registered retailer.

In situations where the applicant is purchasing the system from one company and hiring a separate company for installation, the applicant must provide proof of his or her commitment to purchase and install the system in separate documents.

An installation contract must state the price charged for the installation of equipment for all of the residential dwelling units in the reservation. Installation contracts must comply with the California Contractors State License Board (CSLB) requirements. In general, proper contracts will contain the following information:

- Name, address and contractor's license number of the company performing the system installation.
- Site address for the system installation; description of the work to be performed;
- Total agreed price to install the system; payment terms (payment dates and dollar amounts).
- Printed names and signatures of the builder and the installation company's authorized representative.

For more information on CSLB guidelines, please refer to their website at: [http://www.cslb.ca.gov/]

For systems that are leased or provide electricity under a power purchase agreement, instead of providing both an equipment purchase agreement and installation contract, applicants must provide an installation contract that lists the proposed equipment to be installed.

b) For Base Incentive and Affordable Housing Projects

Equipment purchase agreements and installation contracts should mirror those described above.

In cases where there is no signed purchase agreement, the applicant may provide invoices or receipts showing that at least 10 percent of the system equipment purchase price [solar electric generators (typically photovoltaic modules), inverters, and performance meter(s)] has been paid to the seller(s).

C. Projects Where Solar is Offered as an Option to Homebuyers

For projects where the builder/developer offers solar energy systems as an option to residential home buyers, the NSHP will reserve funding for up to 50 percent of the residential dwelling units in the project. Funding will be reserved assuming a 2 kW AC system size at the base incentive available at the time of reservation. The NSHP requires the following documents for reservation approval:

- Reservation Application Form (NSHP-1)
- Final Subdivision Map showing eligible lots
- Equipment Purchase Agreement and Installation Contract
- Build-out schedule for the project, including a projected timeline for completing the construction of dwelling units that will have solar energy systems.

The Program Administrator will issue Solar as an Option Approval Forms (NSHP 1.5 forms), which represents initial approval for up to 50 percent of the residential dwelling units identified in the application. As each specific residential dwelling unit is identified to have a solar energy system installed, the applicant shall provide the Program Administrator with a completed NSHP-1.5 form, the EPBI and energy efficiency documentation pertaining to the residential dwelling unit for plan review. The Program Administrator will conduct the plan review process to verify that the information is complete and meets eligibility requirements, and will notify the applicant by sending him a site specific NSHP-2 form. The applicant will then fill out, sign, and submit the NSHP-2 and supporting documentation for payment claim.

The applicant shall provide the Program Administrator an update on the project's construction and system installation progress 18 months after the reservation has been approved. The update shall include an evaluation of the probability of how many of the

remaining residential dwelling units will have solar energy systems installed, stating the projected timeline. Program Administrator will evaluate the progress on the project to determine if the reserved funding is deemed greater than the projected pay-out in the remaining months of the reservation. This evaluation will consider the build-out schedule the applicant included with its Reservation Application. If the Program Administrator, in consultation with Energy Commission staff, concludes that the project is not progressing as expected, the project's funding reservation may be reduced or completely disencumbered.

D. Additional Information for All Reservation Applications

Funding is available on a first-come, first-served basis for applicants who submit complete and accurate applications. Only one reservation and one incentive payment will be allowed for each residential dwelling unit during the reservation period.[24] Applicants will not be allowed to submit multiple reservation applications for the same residential dwelling unit.

Only applicants or designated payees who submit complete and accurate reservation applications and provide all supporting documentation will receive reservation approval. In applications with only minor omissions or discrepancies that do not affect eligibility or the amount reserved, the Energy Commission or its agents *may* request clarification of information. If the additional information is not supplied within the stated timeframe, the applicant may be notified to reapply.

No funding will be reserved if an application is incomplete or illegible, has conflicting information or does not otherwise comply with the program requirements. Incomplete applications will not be approved and may require reapplication. If an applicant re-applies, the complete reservation application and all supporting documentation must be submitted as one package and will be subject to the program requirements and funding availability in effect at the time of the new submission.

While information sent in after the initial application may be matched to the application, it is not guaranteed.

Information provided in the application and supporting documentation must be consistent throughout. Applicants should ensure all names, addresses, and equipment are the same throughout all documentation or provide an explanation if they are different. Failure to do so may result in delays or application rejection.

An application will be approved for a reservation based on the date it is deemed complete, not the date it was first submitted. The incentive level and other program

[24] An applicant may only cancel their reservation and re-apply for a new reservation within the original reservation period if the incentive has dropped at least one level from the incentive level in the original reservation. A letter explaining the request must be submitted with a new Reservation Application Form signed by the applicant. This is designed to discourage applicants from applying too early in the construction process for a system to be installed within the reservation period.

criteria applicable on the date the application is deemed complete will apply. **Applicants are strongly encouraged to keep copies of all applications and supporting documentation submitted to the Energy Commission or its agents.**

Because the available funding changes during the term of the program, the Energy Commission recommends that applicants not start construction on participating residential buildings and system installations until they receive a confirmation indicating the amount of funding that has been approved for their reservation.

E. Where to Send Reservations

The complete reservation application must be delivered to the appropriate Program Administrator. For mailing address, fax and contact information, please visit [http://www.gosolarcalifornia.ca.gov/contactus.html].

Alternatively, applicants are strongly encouraged to electronically send applications through the NSHP application web tool [https://www.newsolarhomes.org]. Please visit the Go Solar California website for tutorials on how to use and navigate through the web tool before submitting applications electronically.

Chapter V. Payment Process

This chapter identifies the information and steps necessary to receive the incentive payment. To be eligible all applications must first have followed the instructions outlined in Chapter IV, Reservation Process, in securing a reservation. In addition, the solar energy system must be completely installed, grid-connected, operating satisfactorily, and the building must be in compliance with the energy efficiency specifications proposed in the applicant's reservation. The applicant must then complete the Payment Claim Form (NSHP-2), which the applicant should have received when the reservation was approved, and provide all supporting documentation below before the reservation expires.

If the reservation expires on or before the payment claim and supporting documentation have been submitted to the NSHP Program Administrator, the applicant will be required to reapply under the program eligibility requirements and incentive levels in effect at the time of the reapplication.

A. Forms and Documentation

1. Payment Claim Form (NSHP-2)

The applicant will receive a Payment Claim Form (NSHP-2) for each residential dwelling unit upon reservation approval. (An exception is for applications where solar is an option. See Chapter IV, Section C for discussion of this reservation process.) When the system has been installed, the applicant may submit the completed NSHP-2 Payment Claim Form to request payment. The completed Payment Claim Form must identify any changes (e.g., changed equipment, installer or equipment seller) that have been made to the information submitted since the reservation was approved. Additional pages may be attached if needed. Please see Appendix 1 for information on how reservation changes may affect application eligibility or the incentive amount.

The NSHP-2 requests applicants to submit information on solar energy equipment and installation costs. If the HERS rating cost can be broken down by unit, the HERS rating cost shall also be reported.

Assignment and re-assignment of incentive payment. The designated payee may use the NSHP-2 to assign his or her right to receive the incentive payment to another party. If a designated payee assigns his or her rights to receive the incentive payment to one party and then cancels that assignment, the designated payee may subsequently re-assign his or her right to receive payment to another party. Designated payee that assign their incentive payment to another party will still be reported as the recipients of the incentive payments for tax purposes.

The NSHP-2 with original signatures (copies are not accepted) must be submitted to the Program Administrator by mail. The Energy Commission encourages applicants to sign

with blue or other ink that is clearly distinguishable as original. Stamped signatures will not be accepted.

2. Expected Performance Based Incentive (EPBI) Documentation

Applicants must submit signed copies of a Certificate of Field Verification and Diagnostic Testing (CF-4R-PV) for each solar energy system consistent with the procedures found in Appendix 2.[25] When the Program Administrator has online access to a HERS Provider Registry for verification purposes, electronic copies of a CF-4R-PV that are registered in a HERS Provider data registry are acceptable in lieu of a signed CF-4R-PV. HERS Raters must be certified and work under the oversight of one of the Energy Commission approved NSHP HERS Providers – California Home Energy Efficiency Rating Services (CHEERS) or California Certified Energy Rating & Testing Services (CalCERTs). Web links to these Providers can be found on the Energy Commission Website: [http://www.energy.ca.gov/HERS]. The CF-4R-PV form must be generated through the data registry system of an Energy Commission-approved NSHP HERS Provider. The CF-4R-PV shall not be generated unless it has been confirmed by the HERS Provider that the energy efficiency verification(s) have been completed. The applicant must provide the HERS Rater with the solar energy system information specified in Section C2 of Appendix 2 for each solar energy system being tested. In cases where the CF-4R-PV shows that the installed solar energy system is not consistent with CF-1R-PV that has been previously submitted to the Energy Commission or its agents, a revised CF-1R-PV that reflects the actual installation shall be prepared and submitted. When such an inconsistency is found when the sampling approach is used, a revised CF-1R-PV shall be prepared for all systems in the group that was sampled, consistent with the Energy Commission's re-sampling and corrective action procedures. Applicants may be required to submit Installation Certificates (CF-6R-PVs) to the Energy Commission or its agents upon request.

3. Energy Efficiency Documentation

The requirements for energy efficiency documentation in conjunction with the payment claim are conceptually the same as for EPBI documentation. The energy efficiency documentation is specified below.

Applicants are strongly encouraged to participate in their utility's residential and multifamily new construction energy efficiency programs to obtain the financial incentives that they can earn for meeting either Tier I or Tier II requirements, and to streamline the process for demonstrating that the energy efficiency requirements for NSHP are met. Energy efficiency documentation submitted and approved by utility new construction programs will not need to be submitted for

[25] The field verification procedures found in Appendix 2 are currently applicable only for solar energy systems using photovoltaic modules. Applicants using any other solar electric generating technology should contact the California Energy Commission.

NSHP, but will be verified before payment claims are approved by program administrators.

Applicants must submit a signed copy of the Certificate of Field Verification and Diagnostic Testing (CF-4R) for any HERS verification measures installed to meet either Tier I or Tier II. When the Program Administrator has online access to a HERS Provider Registry for verification purposes, electronic copies of a CF-4R that are registered in a HERS Provider data registry are acceptable in lieu of a signed CF-4R. A CF-4R is required when indicated by the statement "HERS Verification Required" on the CF-1R (or PERF-1).

Applicants must submit a signed copy of the Above Code Energy Efficiency Measures Verification Checklist (CF-4R-NSHP) for all energy efficiency measures used to meet the above Title 24 requirements. When the Program Administrator has online access to a HERS Provider Registry for verification purposes, electronic copies of a CF-4R-NSHP that are registered in a HERS Provider data registry are acceptable in lieu of a signed CF-4R-NSHP The CF-4R-NSHP is generated from the CF-1R (or PERF-1) and will be unique to the energy efficiency measures proposed for a specific design. The CF-4R-NSHP is always required regardless of the use of any HERS verification measures.

It is the responsibility of the NSHP applicant to properly arrange, with the HERS Rater, the inspections required for completing the CF-4R-NSHP. Please be aware that some of these inspections may need to take place as early in the construction process as foundation or rough-in.

HERS Raters must be certified and work under the oversight of one of the Energy Commission approved NSHP HERS Providers – CHEERS or CalCERTs. Web links to these Providers can be found on the Energy Commission Website: [http://www.energy.ca.gov/HERS]. The CF-4R and CF-4R-NSHP must be generated through the data registry system of an Energy Commission-approved HERS Provider.

4. Ten-Year Warranty (NSHP-3)

A Ten-Year Warranty Form (NSHP-3) must be completed and signed by the appropriate party(ies).

For owner-builder installed systems, please submit copies of the manufacturers' 10-year warranties for the inverter(s) and solar electric generating equipment.

5. System Interconnection with Utility Grid

Program Administrators will verify that the system has been interconnected prior to issuing payment. Upon request of the Program Administrator, the applicant must provide proof from the electric utility that the solar energy system is interconnected to the utility distribution grid and that the utility has approved the system's interconnection.

Approval by the utility to interconnect reflects that the appropriate building inspectors have approved the installation of the solar system.

6. Payee Data Record (STD-204) / IRS W-9 Form

The Payee Data Record must be completed by the party identified as the designated payee in the NSHP-1 Reservation Application Form. If the designated payee has already submitted a complete STD-204 form with a prior application and has already received an incentive payment within the past year from the Program Administrator or the Energy Commission, a new STD-204 is not needed. In these cases the Program Administrators and Energy Commission will use data from the previously submitted STD-204 form. If the data provided in a previously submitted STD-204 has changed, the designated payee must submit a new STD-204.

In addition, payees for projects located in the territories of PG&E and SDG&E must provide a copy of the Request for Taxpayer Identification Number and Certification (IRS W-9 form) if requested by the Program Administrators.

When the payee is a corporation or limited liability entity, the payee must also submit proof of good standing with the California Secretary of State.

7. Lease Agreement or Power Purchase Agreement

For systems utilizing third-party ownership structures, the lease agreement or power purchase agreement shall be submitted to the Program Administrator. See Chapter II, Section A for requirements.

B. Additional Information on Payment Claims

Applicants must ensure that all program requirements as stated in Chapter 2 have been met prior to the submission of a payment claim package.

Applicants must submit the complete payment claim package to the appropriate Program Administrator on or before the expiration date specified on the Payment Claim Form. A payment claim package is for one residential dwelling unit. Multiple payment claim packages for multiple residential dwelling units may be submitted at the same time. Applicants who reserve more than one residential dwelling unit in the program are not required to have completely installed all systems in their reservations before submitting a payment claim package. **Applicants are strongly encouraged to keep copies of all documents submitted in the payment claim package to the Program Administrator.**

If the payment claim package is incomplete, the Program Administrator will request the applicant to provide all missing or unclear information. The applicant will be responsible

for obtaining missing or revised information from the equipment seller, installer, or HERS Rater to process the request. The Program Administrator will allow the applicant up to 60 days to respond with corrections to all the missing or unclear information to approve payment.

If the claim is made after the expiration date of the reservation or is otherwise ineligible, the applicant may reapply for an incentive reservation but will be subject to the program eligibility requirements, incentive levels, and funding available at the time of the re-application.

The complete payment claim package must be delivered to the appropriate Program Administrator. For mailing address, fax and contact information, please visit [http://www.gosolarcalifornia.ca.gov/contactus.html]. Alternatively, if the applicant had previously submitted the application via the NSHP application web tool, the applicant may choose to submit all of the documents in the payment claim package, except the NSHP-2, through the web tool as well. Applicants are strongly encouraged to use the web tool for submitting payment claim documents.

The Energy Commission and the Program Administrators intend to make payments within 6 to 8 weeks of receipt of a complete payment claim package. Payment will be made to the payee and mailed to the address on the NSHP-2 and/or Payee Data Record (STD-204).

C. Claiming an Incentive Payment Without a Prior Reservation

If a solar energy system has been installed and the applicant subsequently wishes to receive an incentive from the program, the reservation process in Chapter IV must still be followed. However, applicants should be aware that program eligibility requirements and incentive levels at the time of application/payment claim submission may have changed since the system installation, resulting in necessary system modifications, lower incentives, or ineligibility for incentives.

Appendix 1 – Frequently Asked Questions

A. Can My Installed System Be Different Than My Reservation?

The Energy Commission expects a solar energy system to be installed as described in the Expected Performance Based Incentive Documentation (CF-1R-PV), but recognizes that changes may occur during installation. Any change in the solar energy system specifications or the expected performance of the system as determined through field verification, must be documented by re-running the CECPV Calculator.

If the applicant uses the "California Flexible Installation" criteria and the minimal shading criteria, the applicant may complete the payment claim package using the expected performance used for the reservation as long as the orientation, tilt and minimal shading criteria are determined to be met by the field verification. The applicant also has the option of recalculating the incentive based on the actual orientation and tilt of the system as determined by the field verification. If the field verification determines that the "California Flexible Installation" criteria and the minimal shading criteria are not met, the expected performance will be re-calculated based on the actual orientation, tilt and shading.

The incentive level used to reserve funding when the application was approved will be used to calculate the incentive payment for the installed system. These changes must be submitted to the Program Administrator prior to the submission of the payment claim package. Changes must also be documented in the Payment Claim Form (NSHP-2).

B. Can Applicants Add to Their Existing Systems?

Once incentives are paid, changes to expand or otherwise improve the expected performance of a system(s) are not eligible for NSHP funding. Homeowners otherwise ineligible for the NSHP funding may apply to the California Solar Initiative Program administered by the California Public Utilities Commission. See [http://www.gosolarcalifornia.ca.gov/csi/index.html] for additional information and requirements.

C. Time Extensions

Projects with valid, unexpired reservations as of January 1, 2010, are automatically granted a one-time time extension as follows: Solar as Standard and affordable housing projects have an additional 12 months from the expiration date of their reservations as stated on the NSHP-2 to submit a payment claim package. Base incentive projects have an additional six months from the expiration date of their reservation as stated on the NSHP-2 to submit payment claim packages.

No other time extensions will be granted to any other projects under any circumstances.

Appendix 2 – Field Verification and Diagnostic Testing of Systems[26]

A. Background

The New Solar Homes Partnership (NSHP) provides incentives for installing high performance solar energy systems on energy efficient homes. The incentive amount is determined by the expected performance of the solar energy system. The expected performance calculation accounts for the tested and certified performance of the specific photovoltaic (PV) modules and inverter, mounting type, cell temperature, orientation, tilt of the modules, and the extent to which the system is shaded. The CECPV Calculator developed by the Energy Commission accounts for these parameters as well as the solar and climatic conditions for the location of the system to determine hourly estimated performance, which is weighted to account for the time dependent valuation (TDV) of the electricity that is produced. Third-party field verification must be conducted to ensure that the components of the PV system and its installation are consistent with the characteristics used to determine the estimated performance. Field verification is a value-added service paid for by the applicant that provides quality control and can protect the applicant, builder, installer, supplier, and homeowner. Field verification is completed consistent with the procedures found in the current Building Energy Efficiency Standards [http://www.energy.ca.gov/title24]. Field verification for new housing developments may employ the sampling approach as allowed in the current Building Energy Efficiency Standards.[27]

The field verification and diagnostic testing procedures described in this Appendix are intended to ensure that the:

- PV modules and inverters used in the expected performance calculations are actually installed at the applicable site;
- PV modules are minimally shaded, or if shaded, that the actual shading does not exceed the shading characteristics that were included in the expected performance calculations; and
- Measured AC power output from the PV system is equal to or exceeds that calculated by the CECPV Calculator within the specified margin at the prevailing conditions at the time of field verification and diagnostic testing.

[26] The field verification procedures found in Appendix 2 are currently applicable only for solar energy systems using photovoltaic modules. Applicants using any other solar electric generating technology should contact the California Energy Commission.

[27] For the 2005 Building Energy Efficiency Standards see Chapter 7 of the Residential Alternative Calculation Method (ACM) Approval Manual. For the 2008 Building Efficiency Standards see Appendix RA2 of the 2008 Reference Appendices.

B. Responsibilities

Field verification and diagnostic testing is the responsibility of both the PV system installer and the Home Energy Rating System (HERS) Rater who completes the third-party field verification. The PV installer must perform the field verification and diagnostic testing procedures in this document for every system that they install. The HERS Rater working under the oversight of an Energy Commission approved HERS Provider then performs independent third-party field verification and diagnostic testing of the systems.

The field verification and diagnostic testing protocol is the same for both the PV installer and the HERS Rater. The protocol anticipates that the PV installer will have access to the roof to make measurements, but that the HERS Rater will not. The measurements required by this protocol are not required to be completed on the roof, but more accurate measurement techniques are possible with roof access. The measurements required by the protocol may be performed in multiple ways as described in the subsections below.

C. Field Verification and Diagnostic Testing Process

The NSHP field verification and diagnostic testing of PV systems follows the process described below. Note, for NSHP purposes, a PV system is one or more strings of PV modules connected to one inverter. Documentation of the process uses three forms that are counterparts to the compliance forms used for the *Building Energy Efficiency Standards*.

1. The applicant enters the necessary input data into the CECPV Calculator, which produces an output report (Certificate of Compliance Form (CF-1R-PV)) that documents the specific modules, inverter(s) and meter(s) that are used in each PV system, the anticipated shading of each system (either the intent for the system to meet the minimal shading requirements or the actual shading that is anticipated), and a table of predicted electrical generation for each system for a range of solar irradiance and ambient air temperature. The CF-1R-PV is provided to the Program Administrator with the NSHP reservation application and to the HERS Provider.

2. Once each PV system is installed, the PV installer completes the field verification and diagnostic testing protocol for each PV system and documents the results on the Installation Certificate (CF-6R-PV), verifying that the installation is consistent with the CF-1R-PV. The PV installer documents and certifies that the PV system meets the requirements of this appendix and provides copies of the CF-6R-PV to the builder/homeowner, applicant, and HERS Rater. The CF-6R-PV shall indicate the actual azimuth and tilt for all PV systems where the California Flexible Installation was used on the CF-1R-PV. The CF-6R-PV shall be completed by the PV system installer in all cases.

EXCEPTION: If 100 percent of the PV systems in a NSHP application are being tested by a HERS Rater (sampling is not being used), the HERS Rater can complete the testing required for the CF-6R-PV; however, the PV installer is still required to sign the CF-6R-PV.

The applicant shall provide the CF-6R-PV to the HERS Rater. In conjunction with the CF-6R-PV, the applicant shall provide to the HERS Rater a site plan for each lot:

a) Identifying the height category (small, medium, or large) of all pre-existing, planted and planned trees and the location and height of any structures which will be built on the lot and neighboring lots of the building with the PV system; and

b) Showing the bearing of the property lines and the azimuth and tilt or roof pitch of each PV system.

The applicant shall also provide the HERS Rater a product specification (cut-sheet) for the PV modules, inverter and meter for the specific system, attached to the CF-6R-PV along with an invoice or purchase document which lists the make and model of the PV modules installed.

3. The HERS Rater completes independent third-party field verification and diagnostic testing of each PV system and documents the results on the Certificate of Field Verification and Diagnostic Testing (CF-4R-PV), independently verifying that the installation is consistent with the CF-1R-PV and the CF-6R-PV. The HERS Rater provides a copy of the CF-4R-PV to the applicant and the HERS Provider. The CF-4R-PV shall indicate the actual azimuth and tilt for all PV systems where the California Flexible Installation was used on the CF-1R-PV. In cases where the CF-6R-PV or the CF-4R-PV show that the installed PV system is not consistent with the previously submitted CF-1R-PV, a revised CF-1R-PV must be prepared and submitted with the associated electronic files to the Program Administrator , that is consistent with the as-installed conditions. When such an inconsistency is found when the sampling approach is used, revised CF-1R-PVs must be prepared and submitted to the Program Administrator for all systems in the sampling group.

4. As part of the payment process, the applicant submits a copy of the Certificate of Field Verification and Diagnostic Testing (CF-4R-PV), to the Program Administrator, for each PV system in the NSHP application.

D. Relationship to Other Codes, Standards and Verification

The local jurisdiction must issue a building permit for the qualifying PV system, either as a separate permit or as part of the new residential building permit. The PV system must meet all applicable electrical code, structural code, building code, and local electric utility interconnection requirements.

The field verification and diagnostic testing procedures described in this document do not substitute for normal electrical, structural or building plan check or field inspection. Nor do they substitute for field verification by the local utility regarding interconnection to the electric grid.

E. Field Verification Visual Inspection

The purpose of the visual inspection described in this protocol is to verify the installation of the proper equipment and the installation conditions specified on the CF-1R-PV. The HERS Rater shall use binoculars or another means to view the installation without being required to have access to the roof. The HERS Rater may rely on photographic evidence provided by the installer on the make, model and quantity of PV modules, standoff distance and shading, but in the absence of such evidence, must rely on a conservative determination based solely on their own observation.

1. PV Modules

The PV installer and the HERS Rater shall verify that the make, model, and quantity of PV modules specified on the CF-1R-PV are installed in the field. The PV installer and HERS Rater shall verify the module mounting type (flush mounted BIPV or rack mounted) and in the case of rack mounted modules, the standoff distance of the modules above the mounting surface. The PV installer and the HERS Rater shall verify the mounting height of the modules above the ground (either one story, two story or applicant specified height).

2. Inverters

The PV installer and the HERS Rater shall verify that the make, model, and quantity of inverters specified on the CF-1R-PV are installed in the field.

3. System Performance Meters

The PV installer and the HERS Rater shall verify that either a standalone system performance meter or an inverter with a built-in system performance meter is installed that is the same make and model specified on the CF-1R-PV and that the meter meets all Guidebook requirements for system performance meters.

4. Tilt and Azimuth

The PV installer and the HERS Rater shall verify that the tilt and azimuth of the PV modules installed in the field match the values specified on the CF-1R-PV, within ± 5

degrees. In some systems, PV modules may be installed in multiple orientations with different tilts and azimuths. In these cases the tilt and azimuth of each array must be verified. Note that for systems using the California Flexible Installation criteria, the tilt and azimuth of each system must be shown to fall within the range of tilt and azimuth that is allowable under that criteria (see section E. 4. c) below).

a. Determining Tilt

The tilt angle of the PV modules is measured in degrees from the horizontal (horizontal PV modules will have a tilt of zero and vertically mounted PV modules will have a tilt of 90 degrees). The tilt of the PV modules may be determined in the following ways:

i. Using the building plans

The as-built or construction drawings for the residential building will state the slope of the roof, usually as the ratio of rise to run. If the PV modules are mounted in the plane of the roof then the slope of the PV modules is the same as the slope of the roof. Table 1 may be used to convert rise to run ratios to degrees of tilt.

Table 1 – Conversion of Roof Pitch to Tilt

Roof Pitch (Rise:Run)	Tilt (degrees)
2:12	9.5
3:12	14.0
4:12	18.4
5:12	22.6
6:12	26.6
7:12	30.3
8:12	33.7
9:12	36.9
10:12	39.8
11:12	42.5
12:12	45.0

ii. Using a digital protractor

A digital protractor may be used to measure either horizontal or vertical angles (see Figure 1). These devices when sighted up the slope of the PV modules from the ground will display the slope, relative to the horizontal.

Figure 1 – Digital Protractor

b. Determining Azimuth

The PV installer and the HERS Rater must determine the azimuth of the PV modules and verify that the azimuth is the same as that used to determine the expected performance of each PV system. The convention that is used for measuring azimuth is to determine the degrees of angle clockwise from north: north azimuth is zero degrees, east is 90 degrees, south is 180 degrees and west is 270 degrees (see Figure 2).

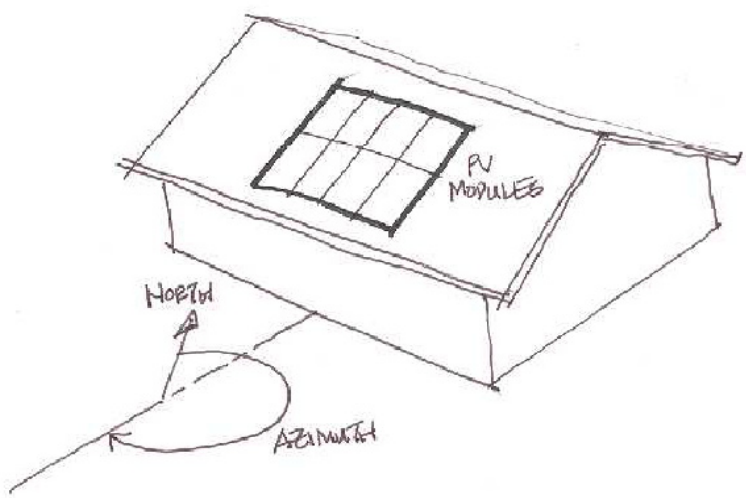


Figure 2 – Azimuth of the PV Array

The following methods may be used to determine the azimuth.

i. Using the site plans

In new subdivisions, the house plans will often not show the property lines since the plans are used on multiple lots. However, the subdivision plot plan will show the property lines of the lots. The plot plan will show the bearing of the property lines, and

from this information the azimuth of the roof surfaces where the PV modules are mounted may be determined from the position of the house on the lot relative to the bearings of the property lines.

Figure 3 shows an example plot plan with a house located on it. In this case, the house does not align with any of the property lines, but is rotated 15 degrees from the westerly property line as shown. Property lines on plot plans are typically labeled in terms of their bearing, which is the direction of the line. The westerly property line is labeled “North 12° East”. If the house was aligned with this property line, the southerly exposure of the house would have an azimuth of 192° (180° plus the 12° bearing of the property line). Since the house is rotated an additional 15°, the azimuth of the southerly face of the house and the azimuth of the PV array is 207° (192° plus 15°). Usually, the house will be aligned with one of the property lines and the calculation described above will be simplified.

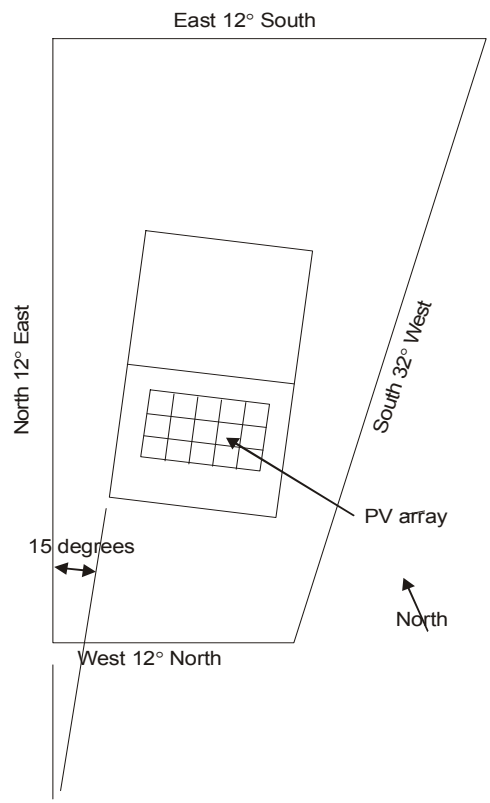


Figure 3 – Example Plot Plan

ii. Using a compass with a sighting feature and an adjustment for magnetic declination.

Make sure that the compass has a sighting feature. The compass may have an adjustment built in for magnetic declination so that the reading on the compass is true north or the installer and the HERS Rater shall determine the magnetic declination using the tool available at [http://www.ngdc.noaa.gov/geomagmodels/Declination.jsp]

and adjust the compass reading to account for the magnetic declination. Position the compass and determine the angle between compass north and the direction that the PV modules face. It's usually convenient and most accurate to align the compass along the edge of the array using the sighting feature (see Figure 4).

Figure 4 – Compass with a sighting feature

c. Verifying Tilt and Azimuth for Systems Meeting the California Flexible Installation Criteria

For new residential developments, NSHP allows determination of expected performance using the California Flexible Installation criteria. The California Flexible Installation criteria allow all PV systems that are installed with an azimuth ranging from 150 to 270 degrees and with a tilt ranging from 0:12 and 7:12 to use a single expected performance calculation. The CECPV Calculator allows the user to choose the California Flexible Installation criteria for easy input and easy compliance when there are multiple systems at various azimuths and tilts. For each system on each building that has the expected performance based on the California Flexible Installation criteria, the HERS Rater must verify that the array is installed with both an azimuth and with a tilt within the acceptable range. The California Flexible Installation criteria require each PV system to meet the "minimal shading" criterion discussed below.

F. Shading Verification

Shading of photovoltaic systems, even partial shading of arrays, can be the most important cause of failure to achieve high system performance. Significant shading should be avoided whenever possible. Shading can be avoided by careful location of the array at the point of installation or in some cases, particularly during the process of constructing buildings, by moving obstructions to locations where they do not cast shading on the array. Partial shading from obstructions that are relatively close to the array, particularly obstructions that are on the roof even if they are relatively small, can

be particularly problematic because they cause partial shading of the array for longer time periods of the year. Shading caused in the future due to the maturing of trees that are immature at the time of installation of the PV system can also be a major cause of failure to achieve high performance over the life of the PV system.

The PV installer and the HERS Rater must verify that the shading conditions on the PV system in the field are consistent with those used in the expected performance calculations. The estimated performance calculations will be done either assuming that the "minimal shading" criterion is met or based on the specific shading characteristics of each system.

1. Minimal Shading Criterion

The "minimal shading" criterion is that no obstruction is closer than a distance ("D") of twice the height ("H") it extends above the PV array (see Figure 5 for an artistic depiction of "H" and "D"). As the figure illustrates the distance "D" must be at least two times greater than the distance "H." All obstructions that project above the point on the array that is closest to the obstruction must meet this criterion for the array to be considered minimally shaded. Obstructions that are subject to this criterion include:

i. Any vent, chimney, architectural feature, mechanical equipment or other obstruction that is on the roof or any other part of the building.
ii. Any part of the neighboring terrain.
iii. Any tree that is mature at the time of installation of the PV system.
iv. Any tree that is planted on the building lot or neighboring lots or planned to be planted as part of the landscaping for the building (the expected shading must be based on the mature height of the tree).
v. Any existing neighboring building or structure.
vi. Any planned neighboring building or structure that is known to the applicant or building owner.
vii. Any telephone or other utility pole that is closer than thirty feet from the nearest point of the array

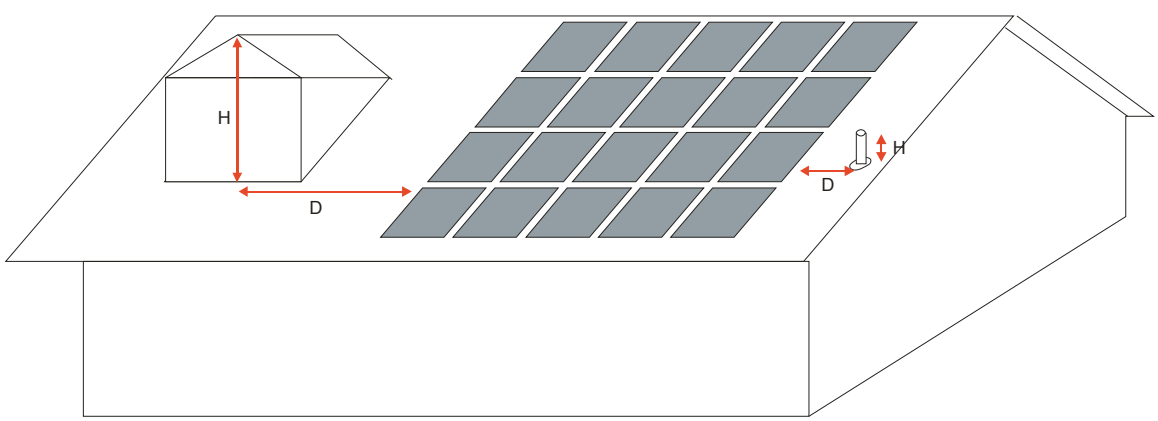


Figure 5 – The Minimal Shading Criterion - Artistic Depiction of "H" and "D"

To determine whether or not the minimal shading criterion is met, the PV installer or HERS Rater shall determine for each shading obstruction the smallest ratio of the horizontal distance from the obstruction to the array divided by the vertical height of the obstruction above that point on the array (this is the “closest point on the array”). Often the point on the obstruction that results in the smallest ratio is the topmost point of the obstruction, but in cases where the shape of the obstruction is complex, points on the obstruction that are not the topmost but are closer to the array may actually produce the lowest ratio. “H” is the vertical height of the shading obstruction point above the horizontal projection to the closest point on the array. “D” is the horizontal distance from the closest point on the array to the vertical projection from the point on the obstruction that results in the lowest ratio of “D” divided by “H.” Any obstruction located north of all points on the array need not be considered as shading obstructions. When an obstruction is north of some parts of an array but east, south or west of other parts of the array, the minimal shading criterion shall be determined to the closest point on the array that is west, north or east of the obstruction.

The PV installer and the HERS Rater may verify through visual inspection that all obstructions meet the 2:1 criterion (note that an altitude angle of 26.6 degrees is equivalent to the 2:1 criterion). For obstructions that visual inspection indicates potentially do not meet the criterion, the PV installer and HERS Rater must measure the height and distance of the obstruction(s) relative to the PV array as described above to verify that the 2:1 shading criterion (or a lower than 26.6 altitude angle through the same points on the obstruction and array) is met. A tolerance of ± 5 percent will be permissible when determining the ratio (or the altitude angle).

2. Accounting for Actual Shading

When a PV installation does not meet the minimal shading criterion, it can still qualify for an incentive and participate in the NSHP program, but the shading conditions for each PV system at the site must be accounted for in the expected performance calculation as described in this section. The basic method is used when the shading condition is measured using a tape measure or using a digital protractor. A different method is used when measurements are made with a solar assessment tool.

For shading obstructions that are accounted for in the expected performance calculation the CECPV Calculator will produce on the CF-1R-PV a table similar to Table 2 that shows the distance to height ratio and altitude angle for the closest point on the array for each obstruction including mature trees that shade the PV array. This table divides the compass into 11 (approximately 22.5 degree) sectors, progressing clockwise around the compass from north. The table provides the distance to height ratio and altitude angle for each sector of the compass. When there is more than one obstruction in a sector, the information is reported for the obstruction with the lowest distance to height ratio (highest altitude angle). The distance to height ratio will be a number less than or equal to two, because if it is greater than two, the minimal shading criterion is satisfied in that direction and shading is not considered in the expected performance calculation for that sector. The table also shows the minimum distance to small, medium and large

trees to meet the minimal shading criterion for trees that are not at their mature heights. The data in Table 2 is specific to a particular PV system installation. In this example the minimal shading condition is not met for five sectors of the compass, ESE, SSE, S, SW, and WNW.

The PV installer and the HERS Rater must verify that the shading conditions that exist (or are expected to exist in the case of the mature heights of trees that are planted on the building lot or neighboring lots or planned to be planted as part of the landscaping or planned buildings or structures on the building lot or neighboring lots that are known to the applicant or building owner) at the site will not cause greater shading of the PV array than the shading characteristics that were used in the expected performance calculations.

Table 2 – Example CF-1R-PV Format for PV Shading

Orientation	Obstruction Type	Altitude Angle to Shading Obstruction	Distance to Height Ratio	Minimum Distance to Small Tree	Minimum Distance to Medium Tree	Minimum Distance to Large Tree
ENE (55 – 79)	NA	Minimal Shading	2.00	16	46	76
E (79 -101)	NA	Minimal Shading	2.00	16	46	76
ESE (101 – 124)	Neighboring structure	45 degrees	1.00			
SE (124 – 146)		Minimal Shading	2.00	16	46	76
SSE (146 – 169)	On roof obstruction	50 degrees	0.84			
S (169 – 191)	Tree (existing-mature)	70 degrees	0.36			
SSW (191 – 214)		Minimal Shading	2.00	16	46	76
SW (214 – 236)	Tree (existing-not mature)	30 degrees	1.5			
WSW (236 – 259)		Minimal Shading	2.00	16	46	76
W (259 – 281)		Minimal Shading	2.00	16	46	76
WNW (281 – 305)	Tree (planned)	65 degrees	0.49			

3. Measuring Heights and Distances or Altitude Angles

One of the following procedures may be used to measure heights and distances or altitude angles to obstructions.

a) Using a Tape Measure

A tape measure or other measuring device may be used to measure the distance (“D”) from the point on the PV array corresponding to the lowest ratio of distance to height (“H”) for each shading obstruction for each 22.5 degree compass sector. The distance to a tree is measured to the nearest edge of the trunk of the tree. Once the height difference (“H”) and distance (“D”) are determined in each compass sector, the ratio is calculated and must be greater than the value used in the expected performance calculation as reported on the CF-1R-PV (see the fourth column in Table 2 labeled

Distance to Height Ratio). This method can be employed from the ground without access to the roof, when factoring in the rooftop dimensions.

The height measurement for trees that are immature shall be based on the mature tree height discussed below. Determining the distances and heights of obstructions for buildings and structures that are planned but have not yet been constructed shall be based on plans for those structures.

b) Using a Digital Protractor

A digital protractor (see Figure 1) may be used to measure the highest altitude angle from the obstruction to the closest point on the array (using the same points on the array and on the obstruction that produce the lowest ration of “D” to “H” if those dimensions were measured instead of the altitude angle). The measured altitude angle for each obstruction in each compass sector must be smaller than or equal to that used in the expected performance calculation as reported on the CF-1R-PV (see the third column in Table 2). To use the digital protractor measurement directly, the measurement must be made from the roof. Alternatively, the digital protractor measurement may be made from the ground. Trigonometric adjustments will be required to correct for the height difference between the ground where the measurements are made and the nearest point, on the PV array, to the shading obstruction.

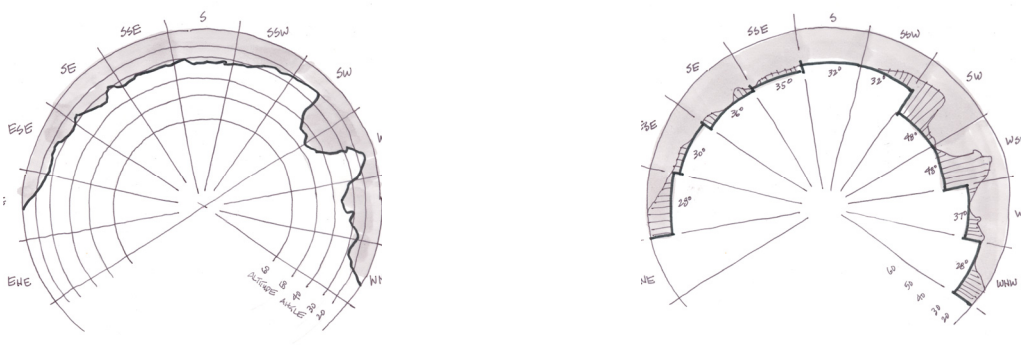
This method does not address expected shading resulting from the mature heights of planted immature trees or planned trees. To determine distances for planted immature trees a tape measure should be used. The height measurement for trees that are immature shall be based on the mature tree height discussed below. Determining the distances and heights of obstructions for buildings and structures that are planned but have not yet been constructed shall be based on plans for those structures..

c) Using a Solar Assessment Tool

For shading from existing obstructions, shading conditions may be verified using a solar assessment tool. This procedure will typically be used by the PV installer, but the HERS Rater may not have direct access to the array and if not, would rely on the adequacy of documentation by the installer to confirm the shading conditions.

At each point of measurement, the tool is placed on the PV array, leveled and oriented consistent with the manufacturer’s instructions. Once the tool is properly positioned, it will determine the obstructions that cast shade and the month and time of day when shading will occur. The tool will enable these determinations either through the use of a digital photograph or a manual tracing on an angle estimator grid overlay. These results for a single point of reference on the array are converted into a format that can be used by the CECPV Calculator, either through software provided by the tool manufacturer or manually, as shown in Figure 6(b), to determine the altitude angle of an obstruction in

each compass sector. The installer should keep documentation of the shading shown on the tool, the location of the tool on the array, and the shading obstructions that are indicated on the tool for the HERS Rater to verify the results.



(a) This diagram shows the 22.5 degree compass sectors used by the CECPV Calculator and the altitude angles determined by a Solar Assessment Tool for a single point of reference on the array.

(b) Within each compass sector, the highest altitude is selected and used for that entire sector. This data is shown for a single point of reference on the array.

Figure 6 – Conversion of Results to CECPV Calculator Input

Measurements shall be made at all the major corners of the array with no adjacent measurement being more than 40 feet apart (see example in Figure 8). The points of measurement shall be distributed evenly between two major corners if they are more than 40 feet apart such that the linear distance between any sequential points is no more than 40 feet. However, if any linear edge of the array has no obstructions that are closer than two times the height they project above the closest point on the array, then the intermediate measurements along that edge do not need to be made.

The altitude angles measured at each major corner shall be overlapped onto a single diagram or processed with the tool manufacturer's software. The maximum altitude angles measured at any of the major corners of the array within a given sector shall be applied to the entire sector. This creates a set of 11 values which are used in the CECPV Calculator.

This method does not address expected shading resulting from the mature heights of planted immature trees or planned trees or expected construction of buildings or other structures on neighboring lots. To determine distances for planted immature trees a tape measure should be used. To determine distances for planned trees a landscape plan provided by the applicant should be used. The height measurement for trees that are immature must be based on the mature tree height discussed below. Determining the distances and heights of obstructions for buildings and structures that are planned but have not yet been constructed shall be based on plans for those structures. Such shading shall be addressed separately.

The results determined by the tool in combination with the expected future shading described above are compared to the data that was used in the expected performance

calculations to ensure that there is not greater shading at the site than was used in the expected performance calculations.

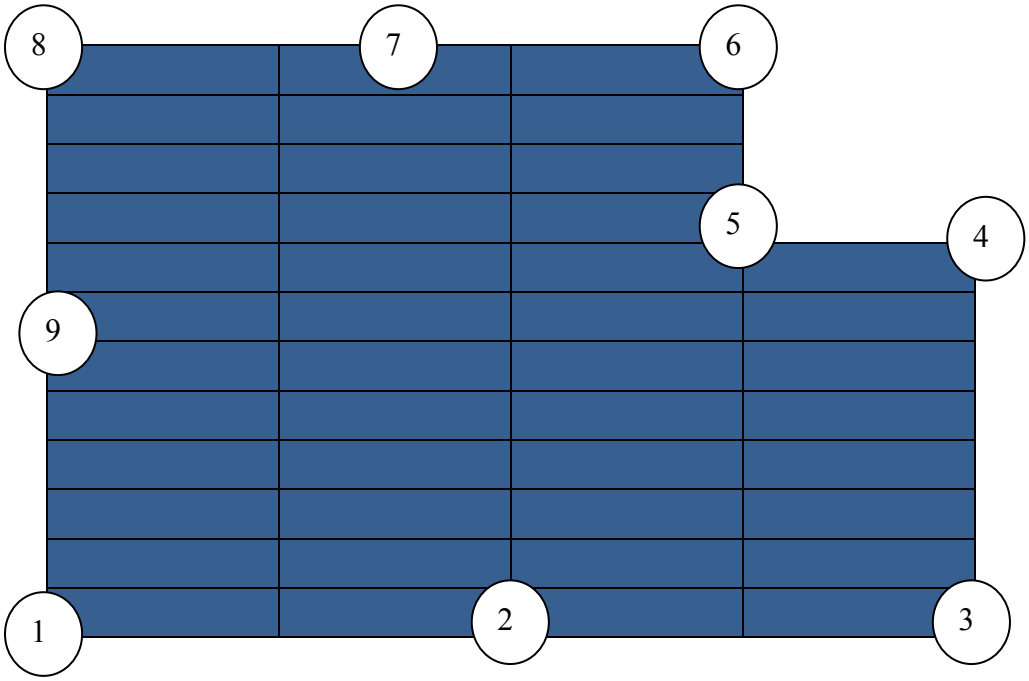


Figure 8 – Example of Points where Measurement shall be made using a Solar Assessment Tool (overall array dimensions 76 feet by 50 feet)

4. Mature Tree Height

The expected performance calculations require the mature height to be used when accounting for the shading impact of planted immature trees.. This section provides guidelines for determining the mature height of such trees. Applicants must identify the height category (small, medium, or large) of all planted and planned trees at the site. That information must be documented in conjunction with the CF-6R-PV and provided to the HERS Rater for verification. Any existing tree with a height greater than 50 feet at the time observations are made shall be recorded with its actual height or altitude angle instead of the height category.

All trees are classified as small, medium or large by species. Trees with a mature height of 20 feet or smaller are small trees. Trees with a mature height greater than 20 feet but less than 50 feet are medium trees. Trees with a mature height equal to or greater than 50 feet are large trees. If the type of tree is unknown, it must be assumed to be large. The mature heights of small, medium and large trees that must be used in the expected performance calculations are 20 feet, 35 feet, and 50 feet, respectively.

The Center for Urban Forestry Research of the U.S. Department of Agriculture's Forest Service has published tree guides for tree zones that are applicable to California. Table 3 shows the appropriate tree guide to use for each of California's climate zones for the expected performance calculations.

The guides provide tree selection lists for each tree zone. The lists provide either the mature height or the size category in that tree zone for each species. These tree guides are posted at: [http://www.fs.fed.us/psw/programs/cufr/tree_guides.php].

For trees not listed in the tree selection tables of the tree guides, the Sunset Western Garden book should be consulted. This document provides the mature height range or maximum height for each species. If a range is given, the average of the maximum height range should be used to determine if the tree is large, medium or small.

Table 3 – Appropriate Tree Guide to Use for each California Climate Zone

CEC Climate Zones	Tree Regions	Tree Guide to Use	
1, 2, 3, 4, 5	Northern California Coast	Under Development (Use Sunset Western Garden Book)	
6, 7, 8	Southern California Coast	McPherson, E.G., et al. 2000. Tree guidelines for coastal Southern California communities. Sacramento, CA: Local Government Commission	Chapter 5, pages 57-65
9, 10	Inland Empire	McPherson, E.G., et al. 2001. Tree guidelines for Inland Empire communities. Sacramento, CA: Local Government Commission	Chapter 6, pages 65-82
11, 12, 13	Inland Valleys	McPherson, E.G., et al. 1999. Tree guidelines for San Joaquin Valley communities. Sacramento, CA: Local Government Commission	Chapter 5, pages 50-55
14, 15	Southwest Desert	McPherson, E.G., et al. 2004. Desert southwest community tree guide: benefits, costs and strategic planting. Phoenix, AZ: Arizona Community Tree Council, Inc.	Chapter 7, pages 51-53
16	Northern Mountain and Prairie	McPherson, E.G, et al. 2003. Northern mountain and prairie community tree guide: benefits, costs and strategic planting. Center for Urban Forest Research, USDA Forest Service, Pacific Southwest Research Station.	Chapter 5, pages 47-55

Table 4 shows the horizontal distance that trees of each mature height category would need to be located from nearest point of the PV array in order to meet the condition of minimal shading.

Table 4 – Horizontal Distance Trees Would Need to be located from the Closest Point of a PV Array to Qualify for Minimal Shading

Mounting Location	Small Tree (20 ft)	Medium Tree (35 ft)	Large Tree (50 ft)
1 Story (Lowest Point of Array at 12 ft)	16	46	76
2 Story (Lowest Point of Array at 22 ft)	Any Distance	26	56
3 Story (Lowest Point of Array at 32 ft)	Any Distance	6	36

G. Verification of System Performance

The PV installer and HERS Rater must verify that the AC power output from the PV system is consistent with that predicted by the expected performance calculations. The CECPV Calculator will determine an estimate of system AC power output for a range of solar irradiance and ambient air temperature conditions and print a table on the CF-1R-PV form. The values in the table will be 90 percent of the output estimated by the CECPV Calculator for each set of conditions in the table (the calculations also include the default adjustment of 0.88 for losses such as dirt, dust and mismatched wiring). The values in the table are for an unshaded array. An example of the data that will be produced is shown in Table 5. The data in the table is specific to each PV system.

Verification of system performance must be performed after the PV system is installed and connected to the electricity grid. Measurements must be made with a minimum irradiance of 300 W/m² in a plane parallel to the array. The PV installer and/or the HERS Rater must 1) measure the solar irradiance in a plane parallel to the array 2) measure the ambient air temperature and 3) determine the expected AC power output for the measured field conditions from the table on the CF-1R-PV form. The PV installer or the HERS Rater must then observe the AC power output displayed on the system performance meter (typically an inverter with a built-in performance meter) and verify that the AC power output is equal to or greater the amount shown in the table for the field measured conditions. To qualify for incentives under NSHP, PV systems must have a standalone performance meter or an inverter with a built-in performance meter that measures AC power output.

The PV installer and HERS Rater must observe the AC power output on the system performance meter after waiting for a period of stable conditions during which the measured solar irradiance has stayed constant within ± 5 percent.

Table 5 – Example Table of Expected AC Power Output from CECPV Calculator (Watts)

(W/m²)	T=15	T=20	T=25	T=30	T=35	T=40	T=45	T=50	T=55	T=60	T=65	T=70	T=75	T=80	T=85	T=90	T=95	T=100	T=105	T=110	T=115	T=120
300	614	606	599	591	584	576	568	560	553	544	536	528	520	512	504	496	487	479	471	463	454	446
325	665	657	648	640	632	623	615	607	598	590	581	572	564	555	546	537	528	519	510	501	492	483
350	716	707	698	689	680	671	662	653	643	634	625	616	606	597	588	578	569	559	550	540	530	520
375	766	757	747	738	728	718	708	699	689	679	669	659	649	639	629	619	609	598	588	578	568	557
400	817	807	797	786	776	765	755	745	734	723	713	702	691	681	670	659	648	637	626	615	604	593
425	868	857	846	835	824	813	802	790	779	768	757	745	734	722	711	699	688	676	664	653	641	629
450	918	907	895	883	872	860	848	836	824	812	800	788	776	764	752	739	727	715	702	690	677	665
475	967	955	943	931	919	907	894	882	869	856	843	831	818	805	792	779	766	753	740	727	714	700
500	1016	1004	991	978	966	953	940	927	913	900	887	873	860	846	832	819	805	791	777	763	750	736
525	1065	1052	1038	1025	1012	998	984	971	957	943	929	915	901	887	872	858	843	829	814	800	785	770
550	1113	1099	1085	1071	1057	1043	1029	1014	1000	986	971	956	942	927	912	897	882	866	851	836	820	805
575	1161	1147	1132	1117	1102	1088	1073	1058	1043	1027	1012	997	982	966	951	935	919	903	887	871	855	839
600	1209	1194	1178	1163	1147	1132	1116	1100	1085	1069	1053	1037	1021	1005	989	972	956	940	923	906	890	873
625	1256	1240	1224	1208	1192	1176	1159	1143	1126	1110	1093	1077	1060	1043	1026	1009	992	975	958	941	924	906
650	1302	1286	1269	1252	1236	1219	1202	1185	1168	1150	1133	1116	1098	1081	1063	1046	1028	1010	992	974	957	939
675	1348	1331	1314	1296	1279	1261	1244	1226	1208	1190	1172	1154	1136	1118	1100	1081	1063	1045	1026	1007	989	970
700	1394	1376	1358	1340	1322	1304	1285	1267	1248	1230	1211	1192	1174	1155	1136	1117	1098	1078	1059	1040	1021	1001
725	1439	1420	1401	1383	1364	1345	1326	1307	1288	1269	1249	1230	1210	1191	1171	1151	1132	1112	1092	1072	1052	1032
750	1483	1464	1444	1425	1405	1386	1366	1346	1327	1307	1287	1267	1246	1226	1206	1185	1165	1144	1124	1103	1082	1061
775	1526	1506	1487	1466	1446	1426	1406	1385	1365	1344	1323	1303	1282	1261	1240	1219	1198	1176	1155	1134	1112	1090
800	1569	1549	1528	1507	1486	1466	1445	1423	1402	1381	1360	1338	1317	1295	1273	1252	1230	1208	1186	1164	1141	1119
825	1611	1590	1569	1547	1526	1504	1483	1461	1439	1417	1395	1373	1351	1328	1306	1284	1261	1238	1216	1193	1170	1147
850	1653	1631	1609	1587	1565	1542	1520	1498	1475	1452	1430	1407	1384	1361	1338	1315	1292	1268	1245	1221	1198	1174
875	1693	1671	1648	1626	1603	1580	1557	1534	1510	1487	1464	1440	1417	1393	1369	1345	1322	1298	1273	1249	1225	1200
900	1733	1710	1687	1663	1640	1616	1593	1569	1545	1521	1497	1473	1449	1424	1400	1375	1351	1326	1301	1276	1251	1226
925	1772	1748	1725	1701	1676	1652	1628	1603	1579	1554	1529	1505	1480	1455	1430	1404	1379	1354	1328	1302	1277	1251
950	1811	1786	1762	1737	1712	1687	1662	1637	1612	1586	1561	1536	1510	1484	1459	1433	1407	1381	1354	1328	1302	1275
975	1980	1823	1798	1772	1747	1721	1696	1670	1644	1618	1592	1566	1540	1513	1487	1460	1434	1407	1380	1353	1326	1299
1000	1980	1980	1980	1807	1781	1755	1729	1702	1676	1649	1622	1595	1569	1542	1514	1487	1460	1432	1405	1377	1349	1322
1025	1980	1980	1980	1980	1815	1788	1761	1734	1706	1679	1652	1624	1597	1569	1541	1513	1486	1457	1429	1401	1372	1344
1050	1980	1980	1980	1980	1980	1820	1792	1765	1737	1709	1681	1653	1624	1596	1568	1539	1511	1482	1453	1424	1395	1365
1075	1980	1980	1980	1980	1980	1980	1823	1795	1767	1738	1709	1680	1652	1623	1593	1564	1535	1506	1476	1446	1417	1387
1100	1980	1980	1980	1980	1980	1980	1980	1825	1796	1766	1737	1708	1678	1648	1619	1589	1559	1529	1499	1468	1438	1407
1125	1980	1980	1980	1980	1980	1980	1980	1980	1824	1794	1764	1734	1704	1674	1643	1613	1582	1551	1520	1490	1458	1427
1150	1980	1980	1980	1980	1980	1980	1980	1980	1980	1822	1791	1760	1729	1698	1667	1636	1605	1573	1542	1510	1479	1447
1175	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1817	1786	1754	1722	1691	1659	1627	1595	1563	1530	1498	1466
1200	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1810	1778	1746	1714	1681	1649	1616	1583	1550	1517	1484

1. Measuring Solar Irradiance

Solar irradiance must be measured using an irradiance meter. When making this measurement, the PV installer or HERS Rater must place the irradiance meter in a plane that is parallel to the PV array. The PV installer should position the irradiance meter on top of the PV array or on the roof next to the PV array. If the HERS Rater does not have direct access to the roof, he or she must position the irradiance meter such that it is in full sun and is in a plane that is parallel to the PV array. Digital protractors or other instruments may be used to properly position the irradiance meter.

2. Measuring Ambient Air Temperature

Ambient air temperature must be measured with a digital thermometer in the shade. The instrument must have an accuracy of ± 2 degrees Celsius.

3. Observing AC Power Output at the System Performance Meter

The PV installer and the HERS Rater must observe and record the AC power output reading from the system performance meter as soon as possible after making the measurements of solar irradiance and ambient temperature. The inverter may cycle between multiple readings (total kWh, AC power output, etc.), so the PV installer or HERS Rater will need to wait until the power is displayed and record this reading; several readings should be made to make sure that they are consistent and stable.

4. Multiple Orientation Arrays

Multiple orientation arrays are those with parallel strings, each with an equal number of modules, in different orientations (azimuth and tilt) and connected to the same inverter.[28] When parallel strings in different orientations are connected to the same inverter, separate CF-1R-PV forms must be prepared for each orientation and solar irradiance must be measured separately in a plane parallel to each orientation. Field verification will require separate CF-6R-PV and CF-4R-PV forms for each orientation. The expected AC power output is determined separately for each orientation and the sum is used for verification purposes.

For example a qualifying 3 kW PV system has 20 PV modules grouped evenly into two parallel strings of 10 modules each, one facing south with an azimuth of 170 degrees and one facing west with an azimuth of 260 degrees. The installer or HERS Rater evaluates system performance at 11:30 AM in March with an ambient temperature of 62 degrees Fahrenheit. The installer or HERS Rater measures 950 W/m² of solar

[28] Substantial reductions in performance will result if there are different numbers of modules in each string or if the strings with different orientations are connected in series.

irradiance in the plane parallel to the south string and 500 W/m² in a plane parallel to the west facing string.[29]

The total expected AC power output table on the CF-1R-PV indicates that the system should be producing 1,200 W at 950 W/m² and 700 W at 500 W/m² of solar irradiance. The expected AC power output is calculated as 1,900 W by summation of each orientation's expected AC power output (1,200 W + 700 W = 1,900 W). This calculated value must be compared to the value displayed on the system performance meter.

[29] When testing systems with multiple orientation arrays, the solar irradiance levels on all arrays must remain constant within ± 5 percent as discussed in Verification of System Performance above.

Appendix 3 – NSHP Forms

NSHP-1 **Reservation Application Form**

NSHP-1.5 **Solar as an Option Approval Form**

NSHP-2 **Payment Claim Form**

NSHP-3 **Ten-Year Warranty Form**

STD-204 **Payee Data Record**

The following forms are not in the Guidebook, and are either produced by the CECPV Calculator or provided by the solar energy system installer or HERS Rater:

CF-1R-PV **Energy Commission CECPV Calculator Output Form**

CF-4R-NSHP **Above Code Energy Efficiency Checklist**

CF-4R-PV **Field Verification and Diagnostic Testing Form**

CF-6R-PV **Installation Certificate Form**

NSHP-1

RESERVATION APPLICATION FORM
NEW SOLAR HOMES PARTNERSHIP

1. Applicant Name and Contact Information

Homeowner or Builder/Developer Name	Phone Number	Email Address

Please check one of the following:

I am the: ☐ Homeowner ☐ Builder/Developer

Mailing Address	City:	State:	Zip Code:

Contact Name (if different from above) & Company	Address	Phone, Fax and Email Address

2. Project Description

Please give a general project description including the site address of development.

Name of project: _____

Address to where the system will be installed (if this is a housing development, only the city or location to nearest city needs to be specified): _____

Please check all that apply to your project:

Occupancy type: ☐ Single Family ☐ Multifamily/Mixed Occupancy

Reservation type: ☐ Solar as Standard (More than 50 percent of the residential dwelling units in a large project (minimum of 6 residential dwelling units) will have solar energy systems installed)

☐ Base Incentive
- Custom home
- Small housing developments with less than 6 residential units
- Projects where solar will be installed on less than 50 percent of the residential dwelling units
- Common area systems in residential developments
- Solar as an Option (Please note, if solar is offered as an option, your reservation can only be for up to 50 percent of the residential dwelling units in the project)

Total number of residential dwelling units in the project: _____
Total number of residential dwelling units with solar energy systems installed: _____

☐ Affordable Housing
- ☐ Total number of common areas systems installed: _____
- ☐ Total number of residential dwelling units with solar energy systems installed: _____

Please note that only Solar as Standard, affordable housing, and solar as an option projects will receive a 36-month reservation. All others will receive an 18-month reservation.

For custom home applicants to complete
Anticipated new construction permit issue date(s): _____

Anticipated solar permit issue date(s):_____ Anticipated occupancy permit issue date(s):_____

Please note that the building permit for the solar energy system should be approved by the building code enforcement agency prior to the original occupancy of the newly constructed building, but no later than 60 days after the issuance of the occupancy permit.

3. Electric Utility, Participation in Utility's Energy Efficiency Program

Please select the utility providing electricity to the project: ☐ PG&E ☐ SCE ☐ SDG&E ☐ BVE

Is your project participating in the electric utility's residential new construction program? ☐ Yes ☐ No

Please note that projects participating in the electric utility's residential new construction program can waive the submission of the energy efficiency documentation.

4. Home Energy Rating System (HERS) Information[30] (if available)

	HERS Rater Company	HERS Rater	Phone number	HERS Provider
Energy efficiency measures verification				
Solar energy system field verification				

5. Required Supporting Documentation

Solar as Standard Projects:

- ☐ Final Subdivision Map
- ☐ EPBI Documentation
  - ☐ CF-1R-PV form
  - ☐ Electronic input files (.emf, .her)
- ☐ Equipment Purchase Agreement**
- ☐ Labor Contract (if separate from the equipment purchase agreement)
- ☐ Energy Efficiency Documentation*
  - ☐ CF-1R form
  - ☐ Electronic input file (.bld/.mp7, .mp8)
  - ☐ Construction plan set

Base Incentive Projects, except Solar as an Option:

- ☐ Final Subdivision Map/Building Permit
- ☐ EPBI Documentation
  - ☐ CF-1R-PV form
  - ☐ Electronic input files (.emf, .her)
- ☐ Equipment Purchase Agreement**
- ☐ Labor Contract (if separate from the equipment purchase agreement)
- ☐ Energy Efficiency Documentation*
  - ☐ CF-1R form
  - ☐ Electronic input file (.bld/.mp7, .mp8)
  - ☐ Construction plan set

Solar as an Option Projects:

- ☐ Final Subdivision Map
- ☐ Equipment Purchase Agreement**
- ☐ Labor Contract (if separate from the equipment purchase agreement)
- ☐ Build-Out Schedule

To be submitted later when installation details are specified:

- ☐ EPBI Documentation
  - ☐ CF-1R-PV form
  - ☐ Electronic input files (.emf, .her)
- ☐ Energy Efficiency Documentation*
  - ☐ CF-1R form
  - ☐ Electronic input file (.bld/.mp7, .mp8)
  - ☐ Construction plan set

Affordable Housing Projects: in addition to a copy of the regulatory agreement, submit all required supporting documentation pertaining to the project's housing type. TCAC projects have up to 60 days after funding approval to submit the Energy Efficiency Documentation.

*****Waived if participating in a utility residential new construction program*

***In the case of lease or PPA projects, an installation contract with equipment listed shall replace the equipment purchase agreement.*

6. Declaration

The undersigned party declares under penalty of perjury that the information in this form and the supporting documentation submitted herewith is true and correct to the best of his or her knowledge and acknowledges the following program requirements to reserve funding:

- ☐ Incentives are based on the expected performance of the systems installed.
- ☐ Buildings must achieve at a minimum Tier I Energy Efficiency to be eligible for the program.
- ☐ Systems that are leased or provide electricity under a power purchase agreement are subject to special reporting requirements. Applicant may be required to repay some or all of the NSHP funding he or she receives if the system is leased or provides electricity through a power purchase agreement, and the lease agreement or power purchase agreement is terminated within five years of the system's installation or the start date of the agreement, whichever is later.

The undersigned party further acknowledges that he or she is aware of the requirements and conditions of receiving funding under the New Solar Homes Partnership (NSHP) and agrees to comply with all such requirements and conditions as provided in the Energy Commission's NSHP Guidebook, Third Edition, and Overall Program Guidebook as a condition to receiving funding under the NSHP. The undersigned party authorizes the Energy Commission, during the term of the NSHP, to exchange information on this form with applicable electric utility servicing the project to verify compliance with NSHP requirements.

Signature, Assignment of Administrative Rights and Incentive Recipient Information

Homeowner or Builder/Developer Name:	_____	Date:	_____
Signature:	_____	Title:	_____

(Optional)

☐ I, the applicant, am designating _____ as my authorized representative for the New Solar Homes Partnership program. This party is permitted to sign the NSHP-2(s) and any revised EPBI Documentation on this project on my behalf.

Designated Payee of NSHP Incentive: _____

Payee's Address: _____

[30] It will be the responsibility of the applicant to provide this information to the program administrators at the earliest opportunity, if not available at this time. This information is used to upload the project information to the HERS registry and has to occur in a timely manner at least 6 months prior to the field verification process.

NSHP-1.5

SOLAR AS AN OPTION APPROVAL FORM
NEW SOLAR HOMES PARTNERSHIP

1. Confirmation of Reservation Amount

This is to confirm that financial incentives have been reserved for _____ through the NSHP. The amount of funding reserved for your project is $_____.

The reserved funding is based on the following formula:

Total number of homes in a development or build-out phase x 50% x 2 kW per home x base incentive

Your reservation period begins _____ and will expire on _____. The payment will be made to _____ (designated payee).

The exact incentive amount for each site will not be confirmed until the applicant identifies a specific site to which a solar energy system will be installed. At that point, the applicant shall provide a copy of this form and the remaining required supporting documentation pertaining to the site to the Program Administrator. The Program Administrator will review and approve the information submitted. Once approved, the exact incentive amount will be confirmed, and the applicant will be provided a Payment Claim Form (NSHP-2) for the specified site.

2. Site Address

Address to where the system will be installed: _____

3. Home Energy Rating System (HERS) Information[31] (if previously not provided)

	HERS Rater Company	HERS Rater	Phone number	HERS Provider
Energy efficiency measures verification				
PV installation field verification				

4. Signatures

The undersigned parties declare under penalty of perjury that the information in this form and the supporting documentation submitted herewith is true and correct to the best of their knowledge.

Applicant/ Authorized Representative	*Required Supporting Documentation*
Name: _____ Title: _____ Signature: _____ Date: _____	☐ EPBI Documentation • CF-1R-PV form • Electronic input files (.emf, .her) ☐ Energy Efficiency Documentation* • CF-1R form • Electronic input file (.bld/.mp7, .mp8) • Construction plan set **Waived if participating in a utility residential new construction*

For the latest mailing address information, visit [http://www.gosolarcalifornia.ca.gov/contactus.html]. Alternatively, you may submit your application via the NSHP application tool at [https://www.newsolarhomes.org]. Please visit the Go Solar California website for tutorials on how to use the application tool.

[31] It will be the responsibility of the applicant to provide this information to the program administrators at the earliest opportunity, if not available at this time. This information is used to upload the project information to the HERS database and has to occur in a timely manner at least 6 months prior to the field verification process.

NSHP-2

PAYMENT CLAIM FORM
NEW SOLAR HOMES PARTNERSHIP

[CEC use only]

Incentive @ _____ = $_____

Payment Approval Date:_____

Reservation ID _____

Project Name _____

Address or _____

Site ID _____

1. Confirmation of Reservation Amount

_____ has been granted a reservation of $ _____ for a _____ kW solar energy system. This reservation is for a _____ project and will expire on _____. The system is being installed at _____. The payment will be made to _____ (designated payee).

The solar energy system must be completed and the claim submitted with the appropriate documentation by the deadline. Claims must be postmarked by the expiration date or the reservation will expire. This reservation is non-transferable. System must be installed at the installation address.

2. Major System Equipment of Record (Modules, Inverters, Meters)

Quantity	Manufacturer	Model	Cost

3. System Details

Total System Price: _____ Total HERS Cost: _____ Lot Number: _____

Equipment Cost (before rebate): _____ PV HERS Cost: _____ Final Address: _____

Installation Cost: _____ EE HERS Cost: _____ Interconnection Date: _____

Sales Arrangement: ☐ Purchased ☐ Leased ☐ PPA Annual kWh: New Construction Building Permit Issue Date:

Final Equipment Seller Name:	Final PV HERS Rater Name and Provider:
Final System Installer Name:	Final EE HERS Rater Name and Provider:

4. Modifications

Has any of the equipment or installation specifications changed since the reservation was approved? ☐ Yes ☐ No
If yes note the changes before claiming payment.

_____

_____

_____

_____

5. Payment Assignment

Is payment assigned to another party?

☐ **Yes (Please fill out all the sections below.)**

☐ **No (Please skip Section 5 and complete all others.)**

Assignment Request

I, _____, the applicant or authorized representative of the applicant as specified on the NSHP-1 form, hereby assign the right to receive payment for the above noted reservation under the NSHP to the following individual or entity and request that payment be forwarded to this individual or entity at the address below. An STD-204 should be submitted for the person/entity receiving the payment, if not already on record with the Energy Commission.

Name: _____

Address: _____

_____

Phone Number: _____

As the applicant or authorized representative of the applicant as specified on the NSHP-1 form, I understand that I remain responsible for complying with the requirements of the NSHP and will remain liable for any tax consequences associated with the reservation payment, despite the payment's assignment. I further understand that I may revoke this payment assignment at any time prior to the Energy Commission's processing of the payment by providing written notice to the Energy Commission's Renewable Energy Office.

Signature: _____ Date: _____

Name: _____ Title: _____

6. Signatures

The undersigned party declares under penalty of perjury that the information in this form and the supporting documentation submitted herewith is true and correct to the best of his or her knowledge. The party further declares under penalty of perjury that the following statements are true and correct to the best of his or her knowledge:

(1) The electrical generating system described above and in any attached documents meets the terms and conditions of the Energy Commission's NSHP and has been installed and is operating satisfactorily as of the date stated below.

(2) The electrical generating system described above and in any attached documents is properly interconnected to the utility distribution grid and has been issued utility approval to operate the system as interconnected to the distribution grid.

(3) The rated electrical output of the generating system, the physical location of the system, and the equipment identified were installed as stated above.

(4) Except as noted above, there were no changes in the information previously submitted for this system.

The undersigned party further acknowledges that he or she are aware of the requirements and conditions of receiving funding under the NSHP, including the special reporting and repayment requirements for leased systems and systems providing electricity under a power purchase agreement, and agree to comply with all such requirements and conditions as provided in the Energy Commission's NSHP Guidebook, Third Edition, and Overall Program Guidebook as a condition to receiving funding under the NSHP. As specified in the NSHP Guidebook, the undersigned applicant authorizes the Energy Commission during the term of the NSHP to exchange information on this form with the electric utility servicing the system in order to verify compliance with the NSHP requirements.

Applicant/ Authorized Representative	***Required Supporting Documentation***	***Documents to be Verified by Program Administrator***
Name: _____ Title: _____ Signature: _____ Date: _____	• Ten-Year Warranty Form (NSHP-3) • Payee Data Record (STD-204), and IRS W-9 if requested • Lease or Power Purchase Agreement, if applicable	• Final EPBI Documentation (CF-4R-PV) • Final Energy Efficiency Documentation (CF-4R and/or CF-4R-NSHP) • Utility Approval of Interconnection

For the latest mailing address information, visit [http://www.gosolarcalifornia.ca.gov/contactus.html].

NSHP-3	TEN-YEAR WARRANTY FORM *NEW SOLAR HOMES PARTNERSHIP*

System Information

This warranty applies to the following _____ kW solar electric generating system

Description: _____

Located at: _____

What is Covered

This ten-year warranty is subject to the terms below (check one of the boxes):

☐ **All components of the generating system AND the system's installation.** Said warrantor shall bear the full cost of diagnosis, repair, labor, and replacement of any system or system component, at no cost to the customer. Said warrantor also assumes coverage of the major system components in all situations where the manufacturer warranty does not cover the entire ten-year period; or

☐ **System's installation only.** Said warrantor shall bear the full cost of diagnosis, repair, labor, and replacement of any system or system component, exclusive of the manufacturer's coverage, at no cost to the customer. Copies of manufacturer ten-year warranty certificates for the major system components (i.e. photovoltaic modules and inverter MUST be provided with this form).

☐ **Owner-builder or self-installed installation.** Warranty is inclusive only of the manufacturer's coverage. Copies of manufacturer ten-year warranty certificates for the major system components (i.e. photovoltaic modules and inverter MUST be provided with this form). The owner-builder or self-installer assumes coverage of all other aspects of the ten-year warranty.

General Terms

This warranty extends to the original purchaser and to any subsequent purchasers or owners at the same location during the warranty period. For the purpose of this warranty, the terms "purchaser," "subsequent owner," and "purchase" include a lessee, assignee of a lease, and a lease transaction. This warranty is effective from _____ (date of completion of the system installation).

Exclusions

This warranty does not apply to:

- Damage, malfunction, or degradation of electrical output caused by failure to properly operate or maintain the system in accordance with the printed instructions provided with the system.
- Damage, malfunction, or degradation of electrical output caused by any repair or replacement using a part or service not provided or authorized in writing by the warrantor.
- Damage malfunction, or degradation of electrical output resulting from purchaser or third party abuse, accident, alteration, improper use, negligence or vandalism, or from earthquake, fire, flood, or other acts of God.

Obtaining Warranty Service

Contact the following warrantor for service or instructions:

Name: _____ Phone: ( )

Company: _____ Fax: ( )

Address: _____

Authorized Representative(s): _____ Date: _____