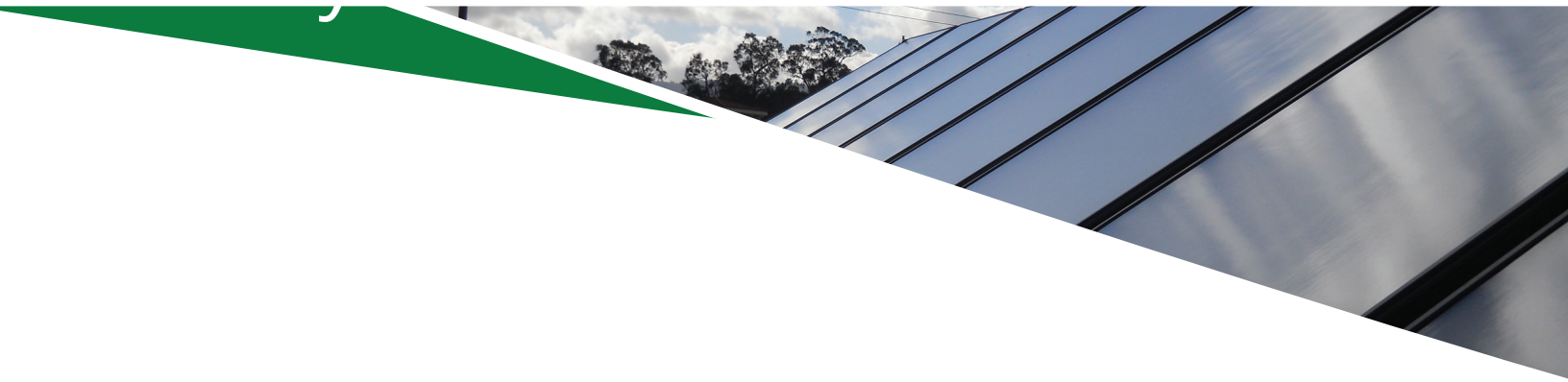
City of Palo Alto Utilities



Solar Water Heating Program
Handbook

OCTOBER 2017

CITY OF PALO ALTO UTILITIES
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Updates and Changes to the SWHP Handbook

If necessary, the CPAU SWHP Handbook will be updated on a monthly basis.

June 20, 2008	1. Section 2.2.2 – Anti-scald valves are required by the City of Palo Alto Building Department. 2. Section 4.2 – New construction installation reservations are valid for 12 months after the approval date. 3. Appendix C - Contractor Participation Application – Removed Business License # and added a "Mail to" address box.
September 10, 2009	Updated Program Manager contact information from Annie Henderson to Katrina Phruksukarn in Section 7: Program Contact
January 4, 2011	The CPAU SWHP has been modified to more closely mirror the program requirements and processes of the California Solar Initiative Thermal Program. This version of the Handbook reflects all of those modifications.

July 2012	1. Section 2.1.9 & 4.5.5 – Added information about the City of Palo Alto Smart Energy Rebate Program financed by EGIA 2. Section 2.5 - Updating shade factor language 3. Section 6.1.2 - Clarifying Language Regarding Ineligibility of Direct Forced Circulation Systems 4. Section 6.3.2 and Appendix E – Expanding sizing options for Multi-family and Commercial Systems 5. Appendix D – Addition of Military Barracks and refinement of GPD for Coin-op Laundries
October 2012	1. Section 3 - Updated incentive rates to reflect the change of incentive rates in the CSI-Thermal Program. 2. Section 6.1.3 - Inserted language to allow closed loop recirculation systems that re-circulate water in the collector loop 3. Sections 2.2.1, 2.2.2.2, 2.3, 6.2.4, 6.2.8 - Clarified language for eligible and ineligible equipment
March 2013	1. Section 1.4 – Updated Application Submittal Address 2. Section 2.1.4.3 – Clarified the requirements of the contractor training 3. Section 2.2.1 - Added eligibility specifications for OG-300 systems certified to a boiler auxiliary 4. Section 2.2.1 - Added eligibility specifications for multiple OG-300 ICS or Thermosiphon systems on one site 5. Section 2.6.1 - Updated eligible residential home energy efficiency audit 6. Section 2.8 - Added a process for changes in site location or system ownership 7. Section 4.6.4 - Clarified system operation standards and solar tank requirements 8. Section 4.6.4 - Added collector loop tubing to insulation requirements 9. Section 6.3.2.1 - Changed the actual metered consumption duration for building types not in Appendix D 10. Section 6.3.2.1 - Added an additional sizing option for small commercial systems not in Appendix D 11. Section 6.3.2.2 - Removed the PE stamp requirements and stagnation protection explanation for commercial/multi-family drainback systems that will use reduced storage
August 2013	1. Section 2.1.10 – Added section on low-income participants 2. Section 3.1 - Added section on low-income incentives 3. Tables 5 & 6 – Added tables defining low-income incentive structure 4. Section 3.2.3 - Added section on multi-family low-income incentives 5. 4.2.1- Explanation of the additional documentation for low-income incentives 6. 4.5- Added a description of low-income documents 7. Section 6.3.2.1- Updated GDP sizing validations 8. Appendix B – Added definition of Public Utilities Code 2861(e) in glossary 9. Appendix E – Removed 60-day metering requirement for sizing Instructions 10. Appendix H – Added affidavit for low-income property conditions
November 2013	1. Table 6 – Updated rates
November 2014	1. Update the California Center for Sustainable Energy's name to the Center for Sustainable Energy
October 2015	1. Updated the freeze tolerance level for Integral Collector Storage systems.
October 2017	1. Removed reference to a free energy audit service that is no longer offered in Section 2.6.1

1. Introduction to City of Palo Alto Utilities Solar Water Heating Program

1.1 Program Background

The Solar Water Heating Program (CPAU SWHP) provides incentives to residential and non-residential customers who install qualifying solar water heating (SWH) systems that offset energy used by an existing water heater or boiler. The Program also provides necessary education and training to SWH stakeholders. The Program is available to existing residential, commercial and industrial natural gas and electricity customers of the City of Palo Alto Utilities (CPAU) service territory.

The CPAU SWHP is innovative in basic design by virtue of type of technology – SWH is an energy efficiency measure with a renewable energy component. This program tangibly connects energy efficiency to renewable technology. Additionally, solar water heating is a measure that speaks to the concept of sustainability and specifically climate change. The CPAU SWHP is designed to encourage the adoption of SWH technologies by providing financial incentives to assist with installation costs, training for contractors and education to help potential customers make informed decisions.

CPAU proposed implementing a solar water heating incentive program in the City's Ten-Year Energy Efficiency Portfolio Plan, approved by the City Council in April 2007. Since that time, the State Legislature enacted California's Solar Water Heating and Efficiency Act of 2007 (AB 1470) in October 2007, which requires natural gas utilities, including the three publicly-owned gas utilities, Palo Alto, Long Beach, and Coalinga, to implement and fund solar water heating incentive programs. The CPAU SWHP is intended to ensure effective and successful design and implementation of a solar water heating program in order to meet the goals described in the City's Ten-Year Energy Efficiency Portfolio Plan and to fulfill the statutory requirements described in AB 1470.

A "solar water heating system" as defined in AB 1470 is a solar energy device with the primary purpose of reducing demand for natural gas through water heating, space heating, or other methods of capturing energy from the sun to reduce natural gas consumption in a home, business, or any building receiving natural gas that is a utility retail customer that meets or exceeds certain eligibility criteria.

1.2 Program Budget

CPAU offers incentives on a first-come, first-served basis within both incentive categories (Single-Family Residential or Multifamily/Commercial). Incentives will decrease over the program lifetime.

1.3 Program Goals

CPAU currently provides approximately 32 million therms of natural gas per year to its retail customers, which represents approximately 0.25% of statewide non-electric-generation natural gas sales. CPAU's estimated proportionate share of the State goal to install 200,000 solar water heating systems by 2017 is approximately 530. As part of the Palo Alto Climate Protection Plan, the City has set a goal of achieving 1,000 systems by 2020.

This program pursues the Governor's and State's goal of greenhouse gas emissions reduction by lowering the usage of natural gas and electricity for water heating.

1.4 Program Contact Information

For customer and installer inquiries:

Phone: (866) 611-CPAU / (866) 611-2728

Email: SWHP@cityofpaloalto.org

Website: www.cityofpaloalto.org/SWH

For Application Submittal:

Center for Sustainable Energy

Attn: City of Palo Alto Utilities SWH Program

9325 Sky Park Court, Suite 100

San Diego, CA 92123-1502

Email: SWHP@cityofpaloalto.org

Fax: (858) 244-1178

1.5 CPAU SWHP Handbook Structure

Following this introduction, the Handbook is divided into two primary sections: Program and Technical. The Program Section focuses on descriptions of eligibility and participation, incentive structure and application processes. As its name applies, the Technical Section includes technical program information, such as metering requirements, freeze protection,

stagnation/overheat protection, and system sizing. Appendices with acronyms, term definitions and additional program details follow these sections. This structure is intended to make the Handbook more useful and accessible.

2. Program Eligibility Criteria and Requirements

The criteria and requirements listed below must be met for an application to be deemed eligible. If, for any reason, a project does not meet these criteria and requirements please contact the CPAU SWHP to discuss the circumstances of the project. Both retrofits and new construction are eligible to receive the incentive.

In all cases, systems must be installed in conformance with the manufacturers' specifications and with all applicable electrical, plumbing and building codes and standards.

2.1 Participants in the CPAU SWHP

Any retail electric or natural gas customer of City of Palo Alto Utilities is eligible to install a solar water heating system and receive incentives from the CPAU SWHP. Any class of customer (industrial, commercial, or residential) is eligible for the incentive. The project site must be within the service territory of, and receive natural gas or electric utility service from, the City of Palo Alto Utilities.

Participants will be required to show proof of electric or natural gas distribution services provided by CPAU.

Additionally, participants must consent to being surveyed by CPAU and/or the Independent Program Evaluator, and must sign the Program Application Form and the Incentive Claim Form.

This program is designed for retrofit and new construction applications. All fuel sources are acceptable such as: natural gas, electricity and propane.

2.1.1 Host Customer

The Host Customer is the owner of the solar water heating system at the time the incentive is paid. For example, when a vendor sells a turnkey system to a property owner, the property owner is the Host Customer. The Host Customer should be designated on the Program Application Form and on the Incentive Claim Form. In the case of a third-party-owned system (or leased system, for example), the property owner is the Host Customer.

2.1.2 System Owner

The System Owner is the owner of the SWH system at the time the incentive is paid. For example, when a vendor sells a turnkey system to a property owner, the property owner is the System Owner. In the case of a third-party-owned system, the third party (or lessor) is the System Owner.

The System Owner should be designated on the CPAU SWHP application. If different from the Host Customer, the System Owner shall also be a party to the CPAU SWHP contract. CPAU may require documentation substantiating equipment ownership.

2.1.3 Applicant

The Applicant is the entity that completes and submits the CPAU SWHP application and serves as the main contact person throughout the application process. The eligible Solar Contractor or Self-Installer will be the Applicant for CPAU SWHP applications.

2.1.4 Solar Contractor

2.1.4.1 Contractor Participation

All contractors installing SWH systems through the CPAU SWHP must become listed as eligible to participate in the program. Contractors must meet the license, training, and warranty requirements as stated in Sections 2.1.4.2, 2.1.4.3, and 2.5 of this Handbook. Contractors must also complete the Contractor Participation Application prior to submitting an incentive application (see Appendix G Program Forms for the Contractor Participation Application). Each contractor who meets these requirements will be added to the program's list of eligible contractors. This list will be available publicly on the program website: www.cityofpaloalto.org/SWH.

2.1.4.2 Contractor License Requirements

Eligible contractors must be licensed by the State of California Contractors State License Board (CSLB) and have an active A (Engineer), B (General), C-4 (Boiler, Hot Water Heating and Steam Fitting), C-36 (Plumbing) or C-46 (Solar) contractors' license, and be in accordance with rules and regulations adopted by the CSLB. CPAU may request documentation from the contractor proving that they have the minimum insurance requirements mandated by the CSLB.

All solicitations, sales, negotiations, or executions of home improvement contracts outside of the contractor's normal place of business shall abide with all codes, laws, and other jurisdictional requirements by a Home Improvement Salesperson (HIS) including but not limited to those outlined by the CSLB under the California Contractors License Law.

2.1.4.3 Contractor Training Requirements

Contractors are required to participate in either a designated City of Palo Alto Utilities Contractor and Self-Installer Workshop or a CSI-Thermal Program training workshop. These contractor trainings are intended to familiarize contractors with program rules and requirements; it is not a course on the basics of solar thermal installation. Only contractors who participate in either of these workshops will be allowed to install and collect incentives from the CPAU SWH Program.

These workshops provide an overview of the CPAU SWH Program Handbook and CSI-Thermal Program Handbook, application process, program requirements, technical requirements, and additional related resources. Upon completion of this designated workshop and meeting other said requirements, a contractor will be eligible to install SWH systems and collect incentives.

The CPAU SWHP Training workshops will be held on an as needed basis. CSI-Thermal Training workshops are held monthly in each CSI-Thermal Program Administrator (PA) territory. Attendance at either a CPAU or CSI-Thermal workshop is required by an individual listed on the CSLB Contractor's Personnel List. Attendance is encouraged for other employees involved with the CPAU SWHP application process. Individuals listed as disassociated on a particular license are not eligible to attend on behalf of the company. Contractors should designate a Program Supervisor to attend at least one workshop and serve as an interface with the CPAU SWHP. It is strongly recommended that the lead installer and rebate manager attend, as well. Contractors are encouraged to attend multiple workshops and to send multiple employees. To see latest CPAU training workshops, visit the CPAU SWHP website at www.cityofpaloalto.org/SWH. To see the latest CSI-Thermal Contractor and Self-Installer Workshops, visit the CSI-Thermal website at www.gosolarcalifornia.org/solarwater or contact your local Program Administrator (Pacific Gas & Electric is the local CSI-Thermal Program Administrator in the Palo Alto territory).

The CPAU SWHP will maintain a list of eligible contractors. This list will be updated monthly. Each month, the CPAU SWHP will review whether a contractor has either (1) completed training in the previous 12 months and/or (2) completed three or more projects in the previous 12 months.

2.1.5 Suspended Solar Contractor

If a contractor's license expires or becomes suspended during the program, CPAU will deactivate their eligible standing as a CPAU SWHP contractor until their license becomes active again, and the following will occur:

- Reservations will not be confirmed and all applications associated with the contractor will be suspended;
- No CPAU SWHP incentive payment will be made unless the Applicant obtains the final signed- off permit prior to the suspension;
- All parties identified on the application will be notified of the suspension;
- If the system has not yet been installed, the Host Customer will be able to hire a new contractor without losing its current incentive reservation and apply for an extension, if necessary.
- Upon project completion, the CPAU SWHP incentive payment will be made only directly to the Host Customer and not any other third-party.

If it is determined that an Applicant, System Owner, Seller, and/or Host Customer is suspended from the program, CPAU will notify all parties involved in the application of the suspension. CPAU will determine whether the project can be paid incentives or whether the project is ineligible to be paid incentives. If the project is deemed to be payable, CPAU in most cases, will only pay the Host Customer for the project.

2.1.6 Self-Installer

Self-installations are permitted in the CPAU SWHP. Homeowners or building owners who choose to install a SWH system on their property must attend a designated City of Palo Alto Utilities Contractor and Self-Installer Workshop or a CSI-Thermal Program training workshop, as described in Section 2.1.4.3 Contractor Training Requirements.

Self-Installers must install their SWH system within 12 months of attending the required training otherwise they must once again attend the designated training workshop. CPAU may request proof of property ownership from Self-Installers.

Self-Installers are also required to comply with all applicable laws, codes, regulations, permits and installation requirements listed in this handbook. Self-Installers must submit receipts or invoices showing 100% of the system has been purchased in place of the installation agreement outlined in Section 4.5.5.

2.1.7 Equipment Sellers

Equipment Sellers may be the same as the Solar Contractor. If the Equipment Seller is not the Solar Contractor, indicate the contact information for the Seller on the Program Application.

2.1.8 Customer Performance Monitoring Provider

Customer Performance Monitoring (CPM) providers in the CPAU SWHP refer to the entity that provides SWH system performance monitoring and reporting services to the System Owner. The data provided allows the System Owner to maintain and evaluate system performance. CPM monitoring is required for SWH systems with capacity over 30 kWth, see Section 6.4.2 for details.

2.1.9 Financier

The Electric & Gas Industries Association (EGIA) has partnered with the City of Palo Alto Utilities to help contractors develop and sustain their business. The City of Palo Alto Smart Energy Rebate Program is reimbursing contractors for some or all of the buydown costs associated with offering a Same-As-Cash Financing Option with Zero Interest with No Payments for 6 months. Contractors enrolled in the program will have this finance advantage as well as access to EGIA member benefits. Learn more at the consumer portal at www.egia.org/paloalto or the contractor portal at www.egia.org/paloalto/contractor.

When a CPAU SWH project participates in the SMART Energy Rebate Program, the terms of financing and the recipient of the CPAU SWH rebate must be communicated in the "Executed Agreement of SWH System Purchase & Installation." For more information, see Handbook section 4.5.5.

2.1.10 Low-Income Participants

The low-income component of the CPAU SWHP offers increased incentives to qualifying multi-family low-income customers. To be eligible for low-income SWH incentives, the following requirements must be met:

- The project site must be within the service territory of, and receive natural gas or electric service from CPAU; and
- The SWH system must displace the use of natural gas, electricity, or propane and meet the equipment eligibility requirements of the CPAU SWHP, listed in section 2.2.

There are two ways to qualify for low-income SWH incentives for a multi-family residential property:

1. 50% of units must be participating in CPAU's Rate Assistance Program[1]; or

2. Low-income status is achieved through Public Utilities Code (PUC) (2861) e[2].

Refer to Section 4.5 for a description of required documents to prove low-income status.

2.2 Equipment Eligibility and Requirements

2.2.1 Eligible Equipment

Residential, commercial and industrial SWH systems that offset energy used by an existing water heater or boiler are eligible for a CPAU SWHP incentive. All displaced fuels, natural gas, electricity, propane and diesel are allowed, so long as the client is a CPAU electric or natural gas customer.

To receive a CPAU SWHP incentive, installed SWH equipment must meet the following criteria:

- Single-family residential SWH systems must have a Solar Rating and Certification Corporation (SRCC) or International Association of Plumbing and Mechanical Officials (IAPMO) OG-300 System Certification; Exceptions include:

    - Substitution of Solar Storage Tank: Applicants may substitute a solar storage tank of equal or greater performance than the solar storage tank identified in the OG-300 certification. The substituted solar storage tank must meet or exceed the tank volume (gallons) and insulation R-Value of the certified tank. The substitution applies only to OG-300 systems. It also applies to both 1 and 2 tank systems. A substitute tank must be in the same configuration as that of the originally certified system. That is, the type of heat exchanger may not be changed, the orientation of the tank may not be changed, a drain back tank may not be exchanged for a pressurized tank (and vice versa). There will be no changes in the incentive payment based on tank substitutions from the original OG-300 calculations. Applicants are required to report solar storage tank substitutions on the Incentive Claim Form.

[1] The Rate Assistance Program offers reduced energy rates to CPAU low-income customers. For more information, visit http://www.cityofpaloalto.org/gov/depts/utl/billpay/assist.asp

[2] Definition for PUC 2861(e) is referenced in Appendix B

- Substitution of Auxiliary Tank with Tankless: For two tank systems, Applicants may substitute an auxiliary tank-type water heater with an auxiliary tankless water heater, even when the OG-300 system is not certified with a tankless auxiliary water heater. The auxiliary tankless water heater must use the fuel source in which the system was certified by SRCC of IAPMO, e.g. if the fuel source is electric, then the tankless water heater must be for an electric system not natural gas. The auxiliary tankless is required to have a modulating heater. This substitution is only allowed for two tank systems. For OG-300 systems certified with a tankless auxiliary water heater, Applicants may not replace it with a non-tankless water heater. There will be no changes in the incentive payment based on tank substitutions from the original OG-300 calculations.
- Substitution of Auxiliary Tank with a Heat Pump Water Heater (applies to electric displacing OG-300 systems only): For 2-tank systems, the PAs will allow Applicants to substitute an auxiliary tank-type water heater with a separate heat pump water heater for electric displacing SWH systems, even when the OG-300 system is not certified with a heat pump water heater as the auxiliary tank. One tank electric SWH systems are also eligible for this substitution only if thermal stratification is maintained. Thermal stratification means that the solar collector loop and heat pump water must be connected at tank heights that will maintain the intended stratification. This substitution option is not permitted for natural gas displacing OG-300 SWH systems.
- OG-300 systems certified to a boiler may be installed to a natural gas tank or tankless auxiliary and maintain CPAU SWH Program eligibility.
- Expired OG-300 systems that were previously certified by SRCC or IAPMO: The system must be purchased prior to the expiration or removal date of the certification. In order to meet this exception, the date of the Executed Agreement of SWH System Purchase and Installation or Executed Alternative System Ownership Agreement (if System Owner is different from Host Customer) must be before the expiration date of the certification. The applicable document must list the expired OG-300 system in order to be eligible for incentives; otherwise the system is ineligible.

- Solar collectors used in multi-family/commercial water heating shall have SRCC OG-100 Collector Certification. Systems in compliance with OG-300 standards will also be eligible to receive multi-family/commercial incentives. Exceptions include the following:
  - Expired OG-100 collectors that were previously certified by SRCC or IAPMO: The initial reservation request date must be before the expiration date of the certification in order for the equipment to be eligible for incentives; otherwise, the collector is ineligible. This only applies to the collector listed on the Reservation Request.
  - Multiple OG-300 ICS or Thermosiphon systems on one site: Please contact the Program Administrator if you plan to install multiple OG-300 ICS or Thermosiphon systems on one multi-family/commercial building.

- All components must be new and unused. Exceptions include the following if proposed system is replacing an existing SWH system:

  - existing de-scaled copper piping, and/or
  - existing racking with a design that has been stamped and signed by a State of California licensed Professional Engineer (P.E.).
  - existing storage tanks in multi-family/commercial systems may be used under the following conditions:
    - The tank must meet the storage requirement of Section 6.3.2.
    - The tank must be in workable condition with no leaks.
    - The tank must have at least R12 insulation. The Program reserves the right to request documentation confirming that this requirement is met.
    - The tank can be plumbed to the solar system without impairing the functioning of the solar or auxiliary systems

- System installations must conform to manufacturer's specifications and all applicable codes and standards;
- All systems must have freeze and stagnation protection, see Section 6.1 and 6.2.

2.2.2 End Use Eligibility

2.2.2.1 Single-Family End Uses

In single-family applications, all Domestic Hot Water (DHW) end uses are eligible in the CPAU SWHP. DHW is defined as water used, in any type of building, for domestic purposes, principally drinking, food preparation, sanitation and personal hygiene (but not including space heating, space cooling, or swimming pool heating).

2.2.2.2 Multifamily/ Commercial End Uses

To be eligible, SWH applications must directly consume the solar heated potable water, as opposed to using the solar heated water as a medium to carry heat for some other end use. In multi- family/commercial applications, DHW and commercial end uses are eligible for CPAU SWHP incentives. Examples of eligible DHW end uses in include: apartment buildings with central DHW systems, convalescent homes, hotels and motels, military bachelor quarters, school dormitories with central DHW systems and prisons. Examples of eligible commercial end uses include: commercial laundries, laundromats, restaurants, food processors, agricultural processes and car washes. Combination systems that are oversized (see Section 6.3, regarding System

Sizing) will require a document describing the stagnation/overheat protection method that needs to be stamped and signed by a State of California licensed Professional Engineer (P.E.). The document must also describe the entire system being installed (see Section 4.5.13). The incentive payment will only be based on eligible load.

2.2.3 Ineligible Technology and System Application

The CPAU SWHP will pay incentives for SWH systems that displace natural gas, electricity, or propane usage. The following system applications are ineligible:

(a) Direct Forced Circulation systems, see Section 6.1.2.

(b) Open loop Thermosiphon systems with potable water in the collector loop, see Section 6.1.4.

(c) Systems that heat pools and spas. (Note: Pools and spas may be used as an alternative heat dump. See section 6.2.4)

(d) Combination system energy savings for anything other than DHW usage. Applicants must provide documentation proving DHW energy savings for combination systems. Incentives will only apply to the DHW portion of the load.

(e) End uses that do not directly consume the solar heated water, but rather use the water as a medium to carry heat for some other end use.

(f) Systems with a Surface Orientation Factor of less than 0.75, see Section 2.4

(g) Portable systems or systems that are not permanently installed.

(h) A SWH system that replaces a SWH system which previously received a CPAU SWHP incentive.

(i) A SWH system that received incentives from the CPAU Commercial Advantage Program.

2.2.4 Permit and Code Compliance Requirements

Necessary local permits are required for SWH system installations. A final signed-off permit issued by The City of Palo Alto is a key requirement in determining project completion. In most cases, a permit will be signed-off by The City of Palo Alto building department official. To be eligible for the CPAU SWHP incentive, a customer must apply for their incentive within 24 months of the date on the final signed-off permit. Contractors should be familiar with local code requirements as they relate to SWH

installations to include, but not limited to roof loading, anti-scald valves, heat exchangers, back flow protection, health and safety.

Public schools, County, State, and Federal projects are not required to get a local permit, however they require necessary documentation to prove health and safety code compliance with the approving authority. For Federal projects that do not come under the jurisdiction of any local permitting authority, a Certificate of Final Acceptance will be accepted in lieu of a final signed-off permit. The certificate must be on government letterhead from the contracting authority and must reference the contract number and satisfactory acceptance of the contract's construction scope of work, inclusive of the thermal solar domestic water heating system(s), and signed by the Contract Officer. Public schools require approval from the California Department of State Architecture for permitting purposes.

2.3 Shade Factor

Since shading from trees and structures reduces the effectiveness of SWH systems, contractors are required to conduct a shade analysis for each site. It is strongly recommended that contractors use a Solar Pathfinder, Solmetric SunEye, or similar device to conduct the shade analysis on the collector(s). If a shade analysis cannot be conducted from the center of the array, the measurements should be taken at the major corners.

Additionally, for each percentage of average annual availability below 100 percent on the solar collector(s) between 10:00 am and 3:00 pm, there will be an equal percentage reduction in the system incentive payment down to 85 percent. For example, if the shade analysis reveals a 95 percent average annual availability between 10:00 am and 3:00 pm, The CPAU SWHP will multiply the incentive amount by 95 percent (reduce the incentive by 5 percent). In this example, an incentive of $1,500 with a 95 percent Shade Factor will be reduced by 5 percent such that the incentive payment will be $1,425.

2.4 Surface Orientation Factor

The Surface Orientation Factor (SOF) is one of the variables in the OG-300 incentive calculation formula. It is calculated by measuring the collector's tilt from horizontal and compass orientation, or azimuth, adjusted for magnetic declination of the SWH collectors. The ideal SOF is a value of 1.0, which is achieved by mounting the SWH collector(s) facing due south (180°) and tilted at latitude (32°) of the project site. The minimum SOF should be 0.75. The incentive will be decreased accordingly for collectors positioned outside of the ideal range as defined in Appendix C.

In cases where there are multiple arrays with various tilts and azimuths, refer to Section 3.3 which discusses how to calculate weighted average SOF.

2.5 Warranty Requirements

System owners will acknowledge on the Incentive Claim Form (ICF) that they have received, at a minimum, the following warranties:

2.5.1 Contractor-Installed Systems

All contractor-installed systems must provide for the following warranties:

- All solar collectors must have a minimum of a 10-year manufacturer's performance warranty to protect against defects and 15 percent degradation.
- All systems must have a minimum 10-year performance warranty to protect the purchaser against more than a 15 percent degradation of system performance over the 10-year period that may occur as a result of faulty installation.
- All systems must have a minimum 1-year warranty on installation labor and workmanship not otherwise covered by the manufacturer's performance warranty.

2.5.2 Self-Installed Systems

All self-installed systems must provide for the following warranty:

- All solar collectors must have a minimum of a 10-year manufacturer's performance warranty to protect against defects and 15 percent degradation.

2.6 Energy Efficiency requirements

Making a home or business energy efficient before going solar is an essential first step. Although not a requirement of the CPAU SWHP, installing low flow shower heads and faucet aerators are simple and inexpensive energy efficiency measures that will reduce overall hot water demand. Sections 2.6.1 through 2.6.2, below, outline the minimum energy efficiency requirements for participation in the CPAU SWHP.

2.6.1 Energy Efficiency Audit

An energy efficiency audit is required for all existing residential and commercial buildings in order to receive a CPAU SWHP incentive. The audit must have been performed during the past three years. Acceptable audit protocols consist of an online audit, telephone audit, or onsite audit provided by the utilities, or a qualified independent vendor or consultant. Audit information can be found at your utility website. For single family residential projects, you may use the Lawrence Berkeley National Labs Home Energy Saver audit at http://homeenergysaver.lbl.gov/consumer/. For multi-family or commercial projects, you may contact your CPAU Account Representative (650-329-2241) to inquire about consultant assistance with energy audits.

A copy of the completed Energy Efficiency Audit must be submitted with the project application.

Applicants may submit proof of Title 24 energy efficiency compliance issued within the last three years in lieu of an energy efficiency audit. A Title 24 report would be required for new residential homes to satisfy energy efficiency requirements.

2.6.2 Pipe Insulation

To be eligible for a CPAU SWHP, SWH systems are required to have minimum R2.6 value insulation on all exposed and accessible hot water piping. Pipes are considered accessible if the contractor can access them safely without damaging or displacing building materials.

Systems with recirculation loops must have insulation on all accessible piping with a minimum of R2.6 value insulation. This includes the hot supply line from the back-up water heater to the farthest accessible point of use and the return line from the farthest accessible point of use back to the back-up water heater.

2.7 Metering Requirements

There are two purposes of metering in the CPAU SWHP. For technical metering specifications see Section 6.4. The two purposes of metering are as follows:

- Measurement and Evaluation (M&E): A sample of single-family residential systems will be selected by the CPAU SWHP to be metered for M&E purposes and will be funded by the CPAU SWHP. Any participant in the program must agree to allow their system to be metered for M&E.

- Customer Performance Monitoring (CPM): Systems greater than 30 kWth[3] (equivalent to 462 square feet of fluid collectors) are required to have CPM to ensure System Owners can effectively monitor their system's performance, see Sections 2.7.2 and 6.4.2.

2.7.1 Measurement and Evaluation

Metering for M&E will help CPAU SWHP evaluate program and technology performance over time. Data and information collected through the M&E process will not be used by the CPAU to inform customers directly on the performance of their systems. The CPAU SWHP will select a sample of projects that will be required to have M&E metering and will notify customers after payment of the incentive. Customers selected for M&E metering must agree to allow a third party M&E contractor to install metering on their system.

The cost for the M&E metering equipment on this sample will be borne by the CPAU SWHP.

2.7.2 Customer Performance Monitoring (capacity over 30 kWth)

Customers that have a system with capacity over 30 kWth are required to install metering and monitoring to ensure the system is performing properly. The cost for CPM equipment will be borne by the System Owner. See Section 6.4.2 for CPM metering, monitoring and communication requirements.

2.8 Performance and Permanency Requirements

Equipment installed under the CPAU SWHP is intended to be in place for the duration of its useful life. Only permanently installed systems are eligible for CPAU SWHP incentives. This means that the SWH system must demonstrate to the satisfaction of the CPAU SWHP adequate assurances of both physical and contractual permanence prior to receiving an incentive.

Physical permanence is to be demonstrated in accordance with industry practice for permanently installed equipment. Equipment must be secured to a permanent surface. Any indication of portability, including but not limited to temporary structures, quick disconnects, unsecured equipment, wheels, carrying handles, dolly, trailer, or platform, will deem the system ineligible.

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[3] 30 kW_{th} is equivalent to 462 square feet of fluid collectors based on a calculation developed by a consortium of international solar rating agencies in 2004, using 0.7 kW_{th} per M_2. Fluid collectors include unglazed, glazed, and evacuated tube collectors. 30 kW_{th} is also equivalent to or 855 square feet of air collectors.

Contractual permanence shall be for the duration of the warranty period, but no less than 10 years, which is to be demonstrated as follows:

- All agreements involving the solar water heating system receiving an incentive are to be provided to the PA for review as soon as they become available and at the incentive-claim stage at the latest. These agreements include, but are not limited to, system purchase and installation agreements, warranties, leases, energy or solar services agreements, energy savings guarantees, and system performance guarantees.

The System Owner agrees to notify the PA in writing a minimum of 60 days prior to any change in either the site location of the SWH system or change in ownership of the system if either change takes place within the applicable warranty period. The warranty period for the CPAU SWHP is 10 years. If the system is removed prior to the end of the 10 year warranty period the solar thermal system may be installed at another site within the CPAU service territory and must be done so within six months of PA approval. The relocated system installed at the alternate site will not be eligible for an additional CPAU SWHP incentive. A mandatory site inspection is required for all relocated equipment. See Section 4.6 for more information regarding the Onsite Field Inspection.

Failure to re-install the SWH system within six months of the PA approval will result in the return of a pro-rated portion of the CPAU SWHP incentive payment to CPAU.

2.9 Onsite Field Inspections

A portion of all systems installed through the CPAU SWHP are subject to onsite field inspections at the program's discretion. For each eligible contractor, the first three ICFs submitted with capacity of 30 kWth or less and the first three ICFs submitted with a capacity greater than 30 kWth will be inspected. A random sample of projects will be inspected thereafter. The inspection checklist is a quality assurance measure designed to guarantee that systems are installed and functioning properly prior to incentive payment.

3. CPAU SWHP Incentive Structure

The CPAU SWHP has a goal to lower the cost of SWH technology for the System Owner through incentives. Incentive rates will decline over the life of the program in four steps to facilitate market transformation. To determine the incentive amount, Applicants may use the online incentive calculation tool provided by the CSI-Thermal Program at www.csithermal.com, as described in Section 3.4.

Natural gas-displacing incentives will decline from step to step when the amount reserved in incentives is equal to the budget allocation for the given step in each service territory. As incentives decline under the natural gas-displacing program, a corresponding step reduction occurs to the electric-displacing incentive.

3.1 Single-Family Incentives

Single-family residential system incentives are calculated using the OG-300 rating (i.e., the estimated annual therm or kWh savings) in the appropriate California Energy Commission (CEC) climate zone, combined with the SOF, the Shade Factor and the current incentive rate. Single-family incentives are paid in one lump sum after the project is completed and approved. The actual incentive paid for any qualified system is derived as follows:

Incentive Amount (not to exceed the CPAU SWHP current step maximum) = system's OG-300 rating * incentive rate * SOF * Shade Factor

The system's OG-300 rating is generally displayed in annual kWh savings. To convert kWh to therms, multiply kWh by 0.034. For example, 3,000 kWh equals 102 therms. Customers are eligible for one OG-300 incentive per single-family residential dwelling unit. A single-family residential dwelling unit is defined as a group of rooms, such as a house, a flat, an apartment, or a mobile home which provides complete single-family living facilities in which the occupant normally cooks meals, eats, sleeps, and carries on the household operations incident to domestic life. The CSI-Thermal OG-300 system incentive calculator that applicants may use is described in Section 3.4.1.

The adjusted incentive structure, specified in Table 1 and Table 2 applies to applications submitted after July 3, 2012.

3.1.1 Single Family Natural Gas

Table 1 below displays the single-family natural gas-displacing system incentive steps and rate per therm.

Table 1: Single-Family Natural Gas-Displacing System Incentive Steps

Step	Incentive per therm displaced	Maximum Incentive Single-family Residential Projects
1	$18.59	$2,719

2	$13.11	$1,919
3	$7.69	$1,125
4	$3.23	$475

3.1.2 Single Family Electric/Propane

Table 2 below displays the single-family electric/propane-displacing system incentive steps and rate per kWh.

Table 2: Single-Family Electric/Propane-Displacing System Incentive Steps

Step	Incentive per kWh displaced	Maximum Incentive Single-family Residential Projects
1	$0.54	$1,834
2	$0.38	$1,311
3	$0.22	$752
4	$0.10	$329

3.2 Multi-Family/Commercial Incentives

Multi-family and commercial systems with SRCC OG-100 collectors will use the CSI-Thermal Program online incentive calculator tool (located at www.csithermal.com) to calculate the incentive amount, as described in Section 3.4.2. Multi-family/commercial projects with OG-300 systems may use the OG-300 incentive calculator as described in Section 3.4.1.

A maximum of one multi-family or commercial incentive will be allowed per SWH system, not to exceed $100,000 for either natural gas displacing systems or electric displacing systems. In addition, the total incentives for multiple systems on one site cannot exceed the incentive maximums stated above and described in Sections 3.2.1 and 3.2.2 below. A site is defined as follows:

- The Host Customer's premises, consisting of all the real property and apparatus employed in a single enterprise on an integral parcel of land undivided, except in the case of industrial, agricultural, oil field, resort enterprises, and public or quasipublic institutions divided by a dedicated street, highway or other public thoroughfare or railway.

- Automobile parking lots constituting a part of and adjacent to a single enterprise may be separated by an alley from the remainder of the premises served.
- Separate business enterprises or homes on a single parcel of land undivided by a highway, public road, and thoroughfare or railroad would be considered for purposes of CPAU SWHP as separate sites.

For example: A multi-family building owner owns two buildings on one site under one business. Each building has a natural gas-displacing solar water heating system that qualifies for a CPAU SWHP incentive. A separate incentive will be allowed for each building, as long as the combined total of the incentives do not exceed $100,000 for the site.

Multi-family/commercial systems will receive one-time lump-sum incentives. The payment is based on their estimated first year therm or kWh savings. The payment is paid after the project is completed, approved, and inspected (if applicable).

The adjusted incentive structure, specified in Table 3 and Table 4 applies to applications submitted after July 3, 2012.

3.2.1 Multi-Family/Commercial Natural Gas

Table 3 below displays the multi-family and commercial natural gas-displacing system incentive steps and rate per therm.

Table 3: Multi-Family/Commercial Natural Gas-Displacing System Incentive Steps

Step	Incentive per therm displaced	Maximum Incentive Multi-Family/Commercial Projects
1	$14.53	$100,000
2	$9.88	$100,000
3	$6.55	$100,000
4	$3.13	$100,000

3.2.2 Multi-Family/Commercial Electric/Propane

Table 4 below displays the multi-family and commercial electric/propane-displacing system incentive steps and rate per kWh.

Table 4: Multi-Family/Commercial Electric/Propane-Displacing System Incentive Steps

Step	Incentive per kWh displaced	Maximum Incentive Multi-Family/Commercial Projects
1	$0.42	$100,000
2	$0.29	$100,000
3	$0.19	$100,000
4	$0.09	$100,000

3.2.3 Multi-Family Low-Income Incentives

Multi-family low-income incentive levels are set at an increased level from the applicable levels of the gas and electric/propane-displacing CPAU SWHP incentives, and use the same incentive caps as Shown in Tables 5 and 6. Incentives are calculated in the same manner as Section 3.4.2 using the SRCC or IAPMO OG-100 Incentive Calculator.

Multi-family low-income systems with a capacity of 250 kWth or less will receive one-time lump-sum incentives. The payment is based on their estimated first year therm displacement and paid after the project is completed, approved, and has passed the inspection (if applicable).

Table 5 below displays the multi-family and commercial natural gas-displacing system incentive steps and rate per therm.

Table 5: Low-Income Multi-Family Natural Gas-Displacing System Incentive Steps

Step	Incentive per therm displaced	Maximum Incentive Low-Income Multi-Family Projects
1	$19.23	$100,000
2	$15.39	$100,000
3	$11.53	$100,000
4	$7.05	$100,000

Table 6 below displays the multi-family and commercial electric/propane-displacing system incentive steps and rate per kWh.

Table 6: Low-Income Multi-Family Electric/Propane-Displacing System Incentive Steps

Step	Incentive per kWh displaced	Maximum Incentive Multi-Family/Commercial Projects
1	$0.56	$100,000
2	$0.45	$100,000
3	$0.33	$100,000
4	$0.21	$100,000

3.3 Multiple Orientation Arrays

3.3.1 Determine Weighted Average SOF

In situations where there are multiple arrays with different tilts and azimuths, the Applicant needs to determine an aggregate SOF. This is done as follows:

1. Determine the SOF of each array.

2. Weight the SOFs based on the relative number of square footage. For example: A system has two arrays, one with 400 square feet with a SOF of 0.9, and the other with 800 square feet and a SOF of 0.8. The weighted average SOF for this system would be 0.83 = (400 * 0.9) + (800 * 0.8) / 1200.

3.3.2 Determine Weighted Average Shade Factor

In situations where there are multiple arrays with different tilts and azimuths, the Applicant needs to determine an aggregate Shade Factor. This is done as follows:

1. Determine the Shade Factor of each array.

2. Weight the Shade Factors based on the relative number of square footage. For example:

A system has two arrays, one with 400 square feet and a Shade Factor of 98 percent, and the other with 800 square feet and a Shade Factor of 86 percent. The weighted average Shade Factor for this system would be 90% = (400 * 98%) + (800 * 86%) / 1200.

3.4 CPAU SWHP Program Incentive Calculator

The CPAU SWHP Applicants will use the CSI-Thermal Program incentive calculators for both single family and multifamily/commercial projects, which estimate natural gas or electricity displacement for SWH systems based on system location and design. The calculators are located at www.csithermal.com/calculator/.

3.4.1 OG-300 Incentive Calculator

The installation of an OG-300 system will use the following calculation method. System incentives are calculated using the SRCC or IAPMO OG-300 rating (i.e., the estimated annual energy savings) in the appropriate CEC climate zone, combined with the SOF, the Shade Factor and the current incentive rate. The actual incentive paid to any qualified system is derived as follows:

Incentive Amount (not to exceed the CPAU SWHP current step maximum) = system's OG-300 rating * incentive rate * SOF * Shade Factor

Single-family customers are required to use this method and multi-family/commercial customers may use it if their system is OG-300 certified.

3.4.2 OG-100 Multi-Family/Commercial Incentive Calculator

3.4.2.1 Calculator Inputs

All multi-family and commercial SWH systems that use OG-100 collectors, but do not have an OG-300 system certification, must use this calculator to determine the project incentive. This incentive calculator is not for single-family SWH systems. The incentive calculator for multifamily/ commercial projects requires various inputs as necessitated by SWH system type including but not limited to the following:

- OG-100 Collector
- Number of collectors (square feet will be calculated)
- Number of collectors in series per flow path
- Heat exchanger type (immersed or external), if applicable
- Freeze protection type

- Number of tanks (1 tank, 2 or more tanks, or 1 tank with a tankless back-up)
- Solar storage capacity (gallons)
- Back-up heater storage capacity (gallons)
- Back-up fuel source (natural gas or electricity)
- ZIP code
- Hot water demand (gallons per day)
- Building load profile, e.g., hotel, Laundromat, 5-day business, university dorms
- Recirculation loop (yes/no)
- Set point temperature for back-up heater (degrees Fahrenheit)
- Set point temperature for delivered water to end-use (degrees Fahrenheit)
- Array tilt
- Array true azimuth
- Shade Factor

3.4.2.2 Calculator Outputs

The multi-family/commercial calculator will produce the following outputs:

1. Estimated annual energy savings in units of therms or kWh, based on back up fuel source. Note: estimated annual energy savings cannot exceed actual gas or electric usage based on the last twelve months of utility bills.
2. Estimated incentive amount, based on energy savings produced from the calculator and the current incentive step level.
3. Total collector area in units of square feet.

3.4.2.3 Calculator Modifications

The incentive calculator used to determine the CPAU SWHP was developed by the CSI-Thermal Program Administrators (PA) in conjunction with the California Public Utilities Commission (CPUC). The CPUC reserves the right to modify the calculator at any time without advance notice to Applicants. CPAU does not have any rights to modify or prohibit modification of this calculator.

If changes to the calculator do not affect the incentive amount on a given project, the CPAU SWHP is not required to notify the Applicant for that project.

If changes to the calculator do affect the Applicant's confirmed reservation, the CPAU SWHP will notify the Applicant in writing. Upon receiving the notification, Applicant can do one of the following:

1. Nothing, in which case Applicant will keep their confirmed reservation.
2. Resubmit the application using the updated calculator within 30 calendar days. If the Applicant chooses to resubmit, they will not lose their place in the queue.

If the Applicant has not yet received a confirmed reservation before a calculator change, the CPAU SWHP will use the updated calculator when issuing Applicant's confirmed reservation. The confirmed reservation notice will inform Applicant that the reservation is different than what the Applicant originally submitted. Upon receiving the notice, the Applicant can do one of the following:

1. Nothing, in which case the confirmed reservation stands.
2. Notify the CPAU SWHP within 30 calendar days that they wish to withdraw their application.

3.5 Incentive Limitations

If the project is installed as described on the ICF and all program and contract terms and conditions are complied with, including timely submission of all documents described in the Handbook, the CPAU SWHP will pay an incentive to the entity designated as the incentive recipient. The CPAU SWHP reserves the right to modify or cancel the reservation if the actual installation of the system differs from the proposed installation, fails inspection, is not installed by the reservation expiration date, and/or if the documents submitted fail to meet the requirements of the Handbook.

Incentive amounts and project eligibility for the CPAU SWHP are limited by a number of factors, including:

- Total eligible project costs
- Other incentives or rebates received
- Incentive step cap
- PA budget allocation
- Shade Factor (see Section 2.3) and SOF (see Section 2.4)

3.5.1 Total Eligible Project Costs

No project can receive total incentives (incentives from the CPAU SWHP combined with other programs) that exceed total eligible project costs. The Applicant must submit project cost details to report total eligible project costs and to ensure that total incentives do not exceed out-of- pocket expenses for the System Owner. Total eligible project costs cover the SWH system and its ancillary equipment. Equipment and other costs outside of the project envelope, as listed below, are considered ineligible project costs.

For large, multifaceted projects where the SWH system costs are embedded, applications must include a prorated estimate of the total eligible costs for the SWH system.

The following System Owner costs may be included in total eligible project cost:

1. Solar equipment capital costs including ancillary equipment associated with the SWH system, except back-up water heater

2. Engineering and design costs for the SWH system

3. Construction and installation costs including labor. For projects in which the SWH equipment is part of a larger project, only the construction and installation costs directly associated with the installation of the SWH equipment are eligible

4. Engineering feasibility study costs

5. Permitting costs

6. Warranty and/or maintenance contract costs associated with eligible SWH equipment

7. Sales tax and use tax

8. On-site system measurement, monitoring and data acquisition equipment not paid for by the CPAU SWHP

9. Mounting surfaces directly under the SWH collector(s) and/or the materials that provide the primary support for the collector(s)

In cases where an installation contract encompasses all costs associated with the installation of a SWH system and additional measures such as energy efficiency, other renewable generating technologies, etc., the contractor must delineate the costs for each measure separately in the agreement.

3.5.2 Reportable Project Costs

All systems receiving an incentive are required to enter the costs identified below on the CPAU SWHP application in order for the program to track SWH system cost data.

- Collector costs – the cost for collector(s)
- Tank costs – the cost for the solar storage tank(s)
- Permitting Fees – only include the cost of the permitting fees charged by the permitting agency (do not include any costs associated with time and labor in applying for permits)
- All other costs – all other eligible costs associated with the installation of the SWH system. Please see Section 3.5.1 for a description of eligible project costs

3.5.3 Other Incentives or Rebates

In no event may the combined incentives received for an SWH system from the CPAU SWHP and other funding sources exceed the total eligible project cost. Host Customers, Applicants and System Owners are required to disclose information about all other incentives, including incentives for equipment or systems ancillary to the SWH system, post-installation performance payments, or additional incentives. The Host Customer and System Owner understand that other program rebates, grants, forgiven loans, financial incentives, post-installation agreements, Renewable Energy Credits (RECs), Green Credits, and performance payments are other incentives and must be disclosed as soon as those agreements or payments are made.

CPAU SWHP incentives are distinct and separate from Energy Efficiency (EE) Program incentives, like the CPAU Commercial Advantage Program. Customers may not receive an incentive from both the CPAU SWHP and the CPAU Commercial Advantage Program for the same equipment. However, the California Energy Commission's Cash for Appliances Program is not a CPAU Energy Efficiency Program. As a result, Applicants are eligible to receive incentives from both the CPAU SWHP and the Cash for Appliances Program.

4. Incentive Application Process for CPAU SWHP

Eligible Contractors or their designee are expected to submit the Reservation Request and Incentive Claim packages. To become eligible, Contractors must first submit a Contractor Participation Application and attend either a CPAU SWHP Training Workshop or a CSI-Thermal Contractor & Self-Installer Workshop, as described in Section 2.1.4.

Single-family residential systems will apply for incentives via a one-step process. For this application process, the applicant will submit an Incentive Claim Form (ICF) and supporting documentation after the system has been installed and received a final signed-off permit. The incentive rate for each project will be determined based on the then-current rate when the application is approved by the CPAU SWHP.

A multi-family/commercial project will follow a two- step application process. For multi-family/commercial projects, applicants will submit a Reservation Request Form (RRF) prior to the installation of the system to receive a reservation based on the then-current incentive rate. A reservation of incentive dollars provides the purchaser assurance that the reserved funds will be available when the incentive claim is made. The Applicant will submit an ICF and supporting documentation after the system has been installed and received a final signed-off permit.

4.1 Single-Family Residential Project Application Process

A single-family residential project will follow a one-step application process. After a Contractor has met the eligibility requirements for program participation described in section 2.1.4, and after a SWH system has been installed and received a final signed-off permit, the Applicant must submit the following documentation:

1. Completed ICF with required signature(s)[4]
2. Copy of executed agreement of eligible SWH system purchase and installation, including demonstration that system contains eligible equipment and required warranties
3. Documentation of a completed Energy Efficiency Audit or Title 24 documentation
4. Copy of final signed-off permit or code compliance documentation
5. Copy of the Customer's CPAU bill from within the last 6 months
6. Project Cost Summary

The following documents may also be needed:

1. Copy of executed alternative system ownership agreement (If System Owner is different from Host Customer)
2. System sizing justification if the collector square footage exceeds 1.25 times the gallons per day (GPD), or 1.85 times the GPD for air systems

[4] Signatures for all submitted documentation are acceptable in the following formats:

- Original signed documents with "wet" signatures
- Copy of original signed documents

3. Stagnation protection documentation, if different from methods listed in Section 6.2

The ICF requires input of an estimated incentive. This is an estimate which may change depending on installation details and equipment or based on inspection findings. This estimate should be as close as possible to as-built systems.

4.2 Multi- Family/Commercial Project Application Process

All multi-family/commercial SWH projects will follow a two-step application process. The two steps are as follows:

1. Complete and submit a Reservation Request Form (RRF) package to get a confirmed reservation

2. Complete and submit an ICF Package to request payment

The following sections describe each step in more detail.

4.2.1 Step No. 1: Submit Reservation Request Form Package

Once the Host Customer has decided to install a SWH system and has an executed contract with an Eligible Contractor or a purchase order demonstrating proof of purchase of SWH equipment, a RRF package can be submitted. Applicants should submit the incentive RRF along with required documents prior to the installation of the system to receive a confirmed reservation at the current incentive rate. Every RRF package must contain the following documents:

1. Completed RRF with required signature(s)

2. Documentation of a completed Energy Efficiency Audit or Title 24 documentation

3. Copy of executed agreement of SWH system purchase and installation

4. Copy of the OG-100 Multi-Family/Commercial Incentive Calculator results

The following documents may also be needed:

1. Copy of executed alternative system ownership agreement (If System Owner is different from Host Customer)

2. GPD justification signed by an engineer if customer's building type is not on the Maximum GPD Guideline Table, see Appendix D.

3. Stagnation protection documentation if different than methods listed in Section 6.2

Additional documentation for Low-Income Applicants:

1. If 50% of units are participating in CPAU's Rate Assistance Program[5] (not required if property meets Public Utilities Code Section (PUC) (2861)e[6]:

   a) An affidavit that shows the property will remain low-income for at least 10 years (see Appendix G); and

   b) Documentation proving that property owners meet one of the following conditions:

      1) a documented resale restriction between the homeowner and a public entity or a qualifying nonprofit affordable housing provider;

      2) a documented equity sharing agreement for which the homeowner does not receive a greater share of equity than described in paragraph (2) of subdivision (c) of Section 65915 of the Government Code, between the homeowner and a public entity or a qualifying nonprofit affordable housing provider;

Or

2. If proving low-income status through PUC (2861)e (not required if 50% of units participate in the Rate Assistance Program), California Solar Initiative Thermal Program Handbook Rev7.0 34

   a) Documentation will be required proving 20% of the total units in the residential complex are sold or rented to lower income households for a period of not less than 30 years.

All of the above documentation must be submitted in order for the incentive to be reserved. Refer to Section 4.5 for a description of these documents.

4.2.2 Step No. 2: Submit Incentive Claim Form Package

[5] The Rate Assistance Program offers reduced energy rates to CPAU low-income customers. For more information, visit http://www.cityofpaloalto.org/gov/depts/utl/billpay/assist.asp

[6] Definition for PUC 2861(e) is referenced in Appendix B

After the SWH system is purchased, installed, received final signed-off permit and put into operation, the Applicant should submit the ICF and required supporting documentation.

The ICF package includes the following documentation:

1. Completed ICF with required signature(s)

2. Project Cost Summary

3. Final signed-off permit or code compliance documentation

The following documents may also be needed:

1. Copy of OG-100 Multi-Family/Commercial Incentive Calculator results (if installed system differs from proposed system identified on the RRF)

Refer to Section 4.5 for a description of these required documents.

4.3 Incentive Reservation Process

The CPAU SWHP will review RRF packages for completeness and current contractor eligibility before approval. An Incentive Confirmation letter and pre-populated ICF will be sent to the Contractor and the Customer for Multi-family/ Commercial projects. The Incentive Confirmation letter will identify the project site address, Customer, Contractor, estimated incentive level, and expiration date of the incentive.

A correction notice and request for additional information will be sent to the Contractor regarding any missing or incomplete documents. The CPAU SWHP may send correction notices by fax or email, and will specify the nature of the deficiency. The Applicant will have 20 calendar days to submit missing information. If, after 20 calendar days, the Applicant has not submitted the requested information, the application will be cancelled.

4.3.1 Reservation Period

The reservation period for multi-family/commercial projects is 18 months with one optional 180 calendar day extension, as described in Section 4.3.2; see Section 4.3.3 for details regarding changes to reservations.

4.3.2 Extending the Reservation Expiration Date

Reservations may receive one 180 calendar day extension. Extensions require a written request from the Contractor, which identifies the reason for the delay, and must be received before the expiration date. If a project is canceled due to not meeting the reservation period (180 calendar days), then the applicant must reapply to the program.

4.3.3 Changes to Reservations

4.3.3.1 Withdrawal

The Host Customer and System Owner agree that either of them may withdraw the project for any reason by providing written notice of such withdrawal to the CPAU SWHP. In the event the Host Customer or System Owner withdraws, the reservation will be cancelled.

The Host Customer understands that if they withdraw a project, the application will be terminated in its entirety by the CPAU SWHP and any previously reserved incentive funding will be released. In that instance, the Host Customer must re-apply for a new incentive reservation should the Host Customer still wish to participate in the program.

4.3.3.2 Installed Equipment

If the installed equipment differs from the equipment listed on the RRF, the incentive amount will be re-calculated to reflect the performance of the installed equipment. The installed equipment must be listed on the ICF, and an updated SRCC OG-100 Multi-Family/Commercial Incentive Calculator result must be submitted.

4.4 Incentive Claim Process

ICF packages will be submitted after the SWH system has been installed and received the final signed-off permit. The CPAU SWHP will review ICF packages for completeness. Once all documentation has been reviewed and approved, the project will either be processed for payment or selected for inspection. If the project is approved, an Incentive Approval letter will be sent to the Contractor and the Customer identifying the project site address, Customer, Contractor, final incentive amount to be paid,

and payee. If the project is selected for inspection, the CPAU SWHP inspector will schedule the inspection with the Customer and invite the Contractor to attend. Section 4.6 details the inspection process and notification.

A correction notice and request for additional information will be sent to the Contractor regarding any missing or incomplete documents. The CPAU SWHP may send correction notices by fax or email, and will specify the nature of the deficiency. The Applicant will have 20 calendar days to submit missing information. If, after 20 calendar days, the Applicant has not submitted the requested information, the request for payment may be denied. If the missing information is not submitted prior to the Reservation Period expiration date, the project will be cancelled.

4.4.1 Payment Process

Upon final approval of the ICF package and upon passing the onsite field inspection (if applicable), the CPAU SWHP will disburse the incentive payment. The payment is made in one lump sum to the payee identified on the ICF.

4.5 Application Forms and Documentation

Forms identified in this section are primarily submitted by attaching a photocopied document with the program application. Documents may be submitted by email, fax, or U.S. mail (see Section 1.4 Program Contact Information).

4.5.1 Contractor Participation Application

A completed Contractor Participation Application must be submitted to the CPAU SWHP prior to submittal of project documents. It must be signed by the contractor. No additional documents are required to be submitted with the Contractor Participation Application. The CPAU SWHP will review the Contractor Participation Application and notify the contractor of approval or denial. Refer to section 2.1.4.1 for further details on required information.

4.5.2 Reservation Request Form

A completed RRF must be submitted for a multi-family/commercial project. A RRF is not required for single-family SWH projects because single-family applications use a one-step application process.

The RRF must be completed and signed by the Applicant, Host Customer and System Owner (if different than the Host Customer) prior to submitting the application. For projects with a third party purchase agreement, the RRF should be filled out as follows:

- Customer – Third party purchaser who is paying for the system
- Site Information, Contact name – Person contracted with Third party to purchase energy generated by the SWH system
- Solar Contractor – Company installing the equipment
- Seller – Company selling the equipment, if different from the Contractor

4.5.3 Incentive Claim Form

A completed ICF must be submitted for all SWH projects. It must be completed and signed by the Host Customer and System Owner (if different than the Host Customer) after the SWH system has been installed.

As part of the one-step application process, this form must be submitted along with other required documents for single-family SWH projects.

For multi-family/commercial projects, this form must be submitted in Step 2 of the application process.

4.5.4 Energy Efficiency Audit or Title 24 Documentation

Refer to Section 2.6.1 for more information about energy efficiency documentation requirements.

4.5.5 Executed Agreement of SWH System Purchase & Installation

A copy of an executed agreement to purchase and install the SWH system must be submitted for all SWH projects. For single-family projects, this is submitted with the ICF package; for multi-family/commercial projects, this is submitted with the RRF package.

Agreements must be legally binding and clearly spell out the scope of work, terms, price, and SWH system components to be installed. Agreements must be signed by all parties pursuant to the contract (supplier/Solar Contractor, Host Customer, and/or System Owner).

The executed purchase and/or installation agreements must be internally consistent and must be consistent with information entered in the ICF. Agreements for the purchase and installation of a system or system equipment must be in writing and must include, at a minimum, 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

• The quantity, make and model number (as shown on the SRCC or IAPMO certified system and collector lists) for the collectors, solar storage tank, and system performance monitoring meters (if applicable)

• The total purchase price of the eligible system before tax incentives, other funding and CPAU SWHP incentives

• Language indicating the purchaser's commitment to buy the system if the system has not already been purchased

• Printed names and signatures of the purchaser and equipment seller's authorized representative.

• Payment terms (payment dates, dollar amounts and how the CPAU SWHP Incentive will be applied)

• Terms of the financing contract (if financing under the CPAU SMART Energy Rebate Program) including who will be the recipient of the CPAU SWH rebate.

• Printed names and signatures of the purchaser and the installation company's authorized representative

If the equipment seller differs from the installation contractor, separate purchase and installation agreements must be submitted.

Installation contracts must comply with the Contractors State License Board (CSLB) requirements. Please refer to the CSLB website for more information on CSLB guidelines at www.cslb.ca.gov. Entities without a valid A, B, C-4, C-36 or C-46 contractor's license may not offer installation services or charge for installation in any agreement under this program. In addition, sales representatives must be listed on the CSLB License, and installation contractors must conform to CSLB rules.

4.5.6 Copy of CPAU Bill

A copy of the project site's CPAU bill within the past 6 months from the submittal of the application is required for all retrofit SWH projects. For single-family projects, this is submitted with the ICF package; for multi-family/commercial projects, this is submitted with the RRF package. For new construction projects, a valid CPAU utility account number must be provided.

4.5.7 Executed Alternative System Ownership Agreement (If System Owner is Different from Host Customer)

If the System Owner is different from the Host Customer (an alternate System Ownership arrangement), the System Owner must provide a copy of the agreement(s) to purchase and install the system.

4.5.8 Final Signed-off Permit or Code Compliance Documentation

The ICF package must include a signed-off permit or proof of code compliance documentation that indicates the project has been installed and approved by the appropriate authority. Please refer to Section 2.2.4 for more information about permit requirements.

4.5.9 GPD justification if building type is not on Maximum GPD Guideline Table

For multi-family/commercial systems, a GPD justification document is required if the building type is not on the Maximum GPD Guideline Table, see Appendix D.

In this case, the project will be sized based on 60 days of metered hot water consumption or gas and electric consumption, as described in Section 6.3.2 and Appendix D. GPD justification documentation must be stamped by a Professional Engineer (P.E.).

4.5.10 System Sizing Justification

For single-family residential systems whose fluid collector square footage is more than 1.25 times the GPD, or 1.85 times for air collectors, Applicant must submit sizing justification showing data and calculations used to determine system size.

4.5.11 Stagnation Protection Method Documentation

If a stagnation protection method other than those listed in Section 6.2 is used, documentation describing how the system is protected against stagnation must be submitted to the CPAU SWHP.

4.5.12 OG-100 Multi-Family/Commercial Incentive Calculator Results

The 0G-100 Incentive Calculation must be submitted for Multi-Family and Commercial projects. The OG-100 calculation may be completed on the CSI-Thermal website at www.csithermal.com/calculator/commercial/. Once the OG-100 Incentive Calculation Results have been completed, you may save the results to submit with the RRF.

4.5.13 Multi-Family/Commercial Combination Systems Documentation

Combination systems that are oversized based on eligible loads and sizing requirements will require a document describing the stagnation protection/overheat protection method to be used. The documentation must also describe the entire system being installed. This must be stamped and signed by State of California licensed P.E..

4.5.14 10-year Low-Income Property Affidavit

For all low-income multi-family projects proving low-income status through the Rate Assistance Program, property owners must sign a commitment that the property will remain low-income for at least 10 years. This affidavit will be included in the RRF for multi-family projects.

4.5.15 Proof of Low-Income Status Documentation: Rate Assistance Program

For all low-income multi-family projects proving low-income status through 50% participation status of the Rate Assistance Program, applicants must provide documentation that meets one of the following conditions:

1. documented resale restriction between the building owner and a public entity or a qualifying nonprofit affordable housing provider; or

2. a documented equity sharing agreement for which the building owner does not receive a greater share of equity than described in paragraph (2) of subdivision (c) of Section 65915 of the Government Code, between the building owner and a public entity or a qualifying nonprofit affordable housing provider;

Supporting documents can be in the form of a Deed Restriction, an Affordability Covenant, or a Regulatory Agreement.

4.5.16 Proof of Low-Income Status Documentation: PUC 2861 (e)

All low-income multi-family projects proving low-income status through PUC 2861 (e), will require documentation, such as a Regulatory Agreement, proving 20% of the total units in the residential complex are sold or rented to lower income households for a period of not less than 30 years.

4.6 Onsite Field Inspection Process

A portion of all projects are subject to onsite field inspections at the CPAU SWHP's discretion. For each eligible contractor, the CPAU SWHP will conduct an onsite field inspection for the first three submitted ICFs on systems with capacity of 250 kWth or less and the first three submitted ICFs with capacity over 250 kWth. The CPAU SWHP will inspect a random sample of projects thereafter.

The CPAU SWHP may determine whether to conduct an onsite field inspection randomly and/or based on Applicant or Solar Contractors' performance in the program. Parameters that may affect frequency of onsite field inspection include, but are not limited to the following: Applicant or Solar Contractor being new to the program, frequency of new ICFs in the program, results of prior CPAU SWHP onsite field inspections, or results of prior CPAU SWHP project application review, and customer complaints.

It is highly recommended, but not required, that the Applicant attend field inspections. If neither the Applicant nor the Host Customer will be present during the inspection, the inspector must obtain permission from the Applicant or Host Customer to perform the inspection.

4.6.1 Trained Inspectors

Onsite field inspections will be performed by CPAU SWHP designated personnel trained to conduct SWH system inspections. The CPAU SWHP has developed an onsite inspector-training plan and inspection checklist, which will serve as the basis for determining trained status of onsite field inspectors. The inspectors will verify the SWH system is installed in accordance with information provided on the ICF and in compliance with Handbook requirements.

4.6.2 Tolerances

Inspectors will report measurement discrepancies that fall outside of the following tolerances:

• Tilt: ± 3°

• Azimuth: ± 5°

• Shading (Average annual availability between 10:00 am and 3:00 pm): 5%

4.6.3 Infractions

An infraction is a minor discrepancy of an installation item that is noncompliant with the inspection checklist found during the onsite field inspection. An infraction does not require corrective action by the contractor or self-installer to receive the incentive payment. CPAU SWHP will track infractions and use these data as an educational tool to inform contractors on best practices to improve future SWH system installations.

4.6.4 Failure Items

A failure is a major discrepancy regarding an installation item that is noncompliant with the program requirements. Failure items require corrective action by the contractor or self-installer to receive the incentive payment. The following are considered failure items if found to be out of compliance with program requirements or SRCC or IAPMO standards:

System

- Operation: The system must be in operational condition when inspected. A system shall be considered operational when the system is turned on, all system components are functioning, and the backup auxiliary heating system is connected.
    - For unoccupied buildings: Rebate inspection shall be requested and scheduled only when the system is in operational status. Additionally, non-tracking solar collectors and systems (OG-100 and OG-300 certified) with fluid in the collector shall be covered and secured by plywood or suitable opaque material during long unoccupied periods prior to inspection. Precautions should be taken to address freeze protection and overheat stagnation.
- Freeze Protection Measures: The system must have one of the freeze protection measures as described in Section 6.1.

- Control Lines and Sensors: All wires and connections, sensors, or other means for transmitting sensor outputs to control devices shall be sufficiently protected from degradation or from introducing false signals as a result of environmental or system operation instructions
- Operating Limits: Means shall be provided to protect the SWH system within the design limits of temperature and pressure. Limit tank temperatures to a value not to exceed the tank supplier's specified high temperature limit. The pressure/temperature relief valve shall not be used for this purpose under normal operating conditions
- Protection from Ultraviolet Radiation: Components or materials shall not be affected by exposure to sunlight to an extent that will significantly deteriorate their function during their design life. Pipe insulation and sensor wires must be protected by a minimum of two coats of the insulation manufacturer's recommended coating
- Back Thermosiphon Prevention: Means shall be provided to prevent undesired escape of thermal energy from storage through thermosiphoning action
- Protection from Leaks: All piping and components must be leak free. All roof penetrations must be properly sealed or flashed and leak free

Collector

- Must be SRCC OC-100 certified and consistent with ICF
- Must have stagnation control measures as described in Section 6.2
- Collector Flow Balance: Ensures proper flow balancing in and among collector banks by using reverse return plumbing, flow balancing valves and adhering to manufacturer's maximum collectors allowed in banks.

Solar Tank

- Capacity, make, and model must be in compliance with OG-300 system unless tank substitution applies. See Section 2.2.1. For OG-100 systems, they must be in compliance with SRCC guidelines.
- Waterproofing: Underground and above ground unsheltered storage tanks shall be waterproofed to prevent water seepage.

Plumbing and Piping

- Insulation: All interconnecting hot water piping and the final 1.5 meters (five feet) of metallic cold water supply pipe leading to the system, or the length of piping which is accessible if less than 1.5 meters, and all collector loop tubing

shall be insulated with a minimum of R-2.6 (F°-ft^2-hr/Btu) or greater insulation. All exterior piping insulation shall be protected from ultraviolet radiation, excessive temperature, and moisture damage.

Owner's Manual:

- An owner's manual or manuals shall be provided to the System Owner with each SWH system.

Refer to the inspection checklist for details on compliance with the above items. If additional major discrepancies not noted above are identified during the onsite field inspection and are found to affect health and safety, the CPAU SWHP reserves the right to issue a failure.

4.6.5 Notification of Inspection Results

The CPAU SWHP will notify in writing the Applicant, Solar Contractor, and/or of the results of the onsite field inspection.

4.6.5.1 Passed Inspection

Upon passing the onsite field inspection, the CPAU SWHP will process payment to the Payee named on the ICF. An infraction of the shading percentage found during the onsite field inspection may result in an adjusted incentive amount. The Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer will be informed of any incentive adjustment. Refer to Section 4.4.1 Payment Process for details.

4.6.5.2 Failed Inspection

Upon failing the onsite field inspection, the CPAU SWHP will notify in writing the Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer of the reason(s) for the failure.

Failure Sanction describes the required actions following failure notification.

4.6.6 Failure Sanction

Once notified of a failure, the Applicant, Host Customer, or System Owner will either accept the results or dispute the results through the appeals process found in Section 5.3, Dispute Resolution. If the results are accepted, the Solar Contractor must make the corrections to the failure items within 30 calendar days. Projects that do not pass the initial inspection will not receive the incentive payment until the necessary corrections have been made. Corrections may be verified.

5. Disqualification and Right to Audit

5.1 Grounds for Immediate Disqualification from the CPAU SWHP

An Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer will be immediately disqualified from participating in the CPAU SWHP if one or more of the following occurs:

- Solar Contractors that operate under a false CSLB number or another contractor's license
- Failure to disclose other incentives funding sources such as rebates, grants, tax credits, government funding, and/or funding from any public or private source in an attempt to claim more incentive dollars
- Installation of used SWH Equipment with the exception of de-scaled copper piping
- Claiming of an incentive for a system that was never installed
- Attempt to claim an incentive for ineligible equipment
- Submitting false information on the application in an attempt to collect more incentive dollars

If an entity has been disqualified from the CSI-Thermal Program, the CPAU SWHP reserves the right to impose an equivalent sanction within the CPAU SWHP.

5.2 Disqualification Sanctions

If an Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer is immediately disqualified due to the reasons outlined in Section 5.1, the following will occur:

- All applications associated with the Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer will be suspended;
- No CPAU SWHP Incentive payment will be made to the party that has been immediately disqualified;
- All parties identified on the application will be notified of their application status.

In cases where the Solar Contractor is disqualified from participating the CPAU SWHP due to the reasons outlined above, and if the system has not yet been installed, the Host Customer will be able to hire a new Solar Contractor to without losing its current incentive reservation and apply for an extension, if necessary.

5.3 Dispute Resolution

If an Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer dispute the findings and/or sanctions of the CPAU SWHP, he or she may appeal in writing within 30 calendar days of notification.

Written appeals should substantiate any reasons that warrant reconsideration of the failure or disqualification. The CPAU SWHP may request additional information to substantiate the written appeal. The final decision will be provided to the Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer within 60 days of receipt of the written appeal.

5.4 Right to Audit

The CPAU SWHP reserves the right to conduct spot checks to verify that project related payments were made as identified in the final invoices or agreements provided by equipment sellers and/or contractors. As part of these spot checks, the CPAU SWHP will require Applicants to submit copies of cancelled checks, credit card statements, or equivalent documentation to substantiate payments made to the equipment seller and/or contractor. The final amount legally incurred or paid to the equipment seller and/or the final amount paid to the contractor for the purchase and installation of the system must match the cost information identified in the project application.

To meet this requirement, the System Owner must submit final invoices and/or a copy of the final agreement, and cost documentation must provide sufficient information to identify clearly the equipment purchased and the labor paid. If there is no direct proof of actual payment from the System Owner to an appropriately licensed contractor or seller, the incentive will be cancelled or reduced. Applicants must explain the discrepancy if the final amount paid by the System Owner is different from the amount of the purchase and/or installation shown in any agreement or invoice or in the previously submitted RRF.

In addition, the final invoices or agreements should clearly indicate the extent to which the CPAU SWHP incentive lowered the cost of the system to the System Owner. If the System Owner has entered into an agreement to pay the equipment seller over time rather than in lump sum, the final agreement must indicate the terms of payment and the amount of any deposits or payments paid by Applicant to the equipment seller to date. The System Owner must pay the cost of any system installation prior to submitting a payment request to the CPAU SWHP.

When submitting this documentation, Applicants are encouraged to remove their personal account numbers or other sensitive information identified in the documentation.

6. Technical Requirements

It is the intent of the CPAU SWHP to provide incentives for reliable, permanent, and safe SWH systems. This Section outlines the technical installation requirements that all projects must meet in order to receive a CPAU SWHP incentive.

Systems must conform to manufacturers' specifications and with all applicable electrical, plumbing and building codes and standards. Permits are required for all SWH system installations. All systems must be installed in compliance with SRCC or IAPMO standards and guidelines. Information on standards and guidelines may be found on the SRCC or IAPMO website: www.solar-rating.org or www.iapmo.org

6.1 Freeze Protection

All installed systems must meet freeze protection requirements set forth by SRCC or IAPMO. The CPAU SWHP uses the climate zones established by the California Energy Commission (CEC) to determine eligibility of appropriate freeze protection technologies. Palo Alto is in climate zone 4.

6.1.1 Integral Collector Storage

Integral Collector Storage (ICS) systems are protected to an extent by the thermal mass of the storage in the collector down to the Freeze Tolerance Level (FTL) as certified by SRCC or IAPMO from data provided by manufacturers. However, exposed pipes to and from the ICS unit may be vulnerable in cold climate areas, and should be freeze-protected in accordance with the permitting agency's requirements and California Plumbing Code Section 312.6. If the historical 18 hour continuous low temperature for the climate zone of the project site has dropped below the FTL, the ICS system may not be installed in that climate zone due to freeze risk and high overnight heat losses. Refer to Appendix F for the 18 hour continuous low temperatures per climate zone.

6.1.2 Direct Forced Circulation

Direct Forced Circulation systems, where potable water is pumped and heated directly in the collector, are not eligible for CPAU SWHP rebates. This restriction applies whether the freeze protection is provided by an automatic valve, recirculation warm water through the collector, or any other means.

6.1.3 Indirect Forced Circulation

There are three types of Indirect Forced Circulation systems: active closed loop glycol, closed loop drainback, and closed loop recirculation.

- Active closed loop glycol systems are protected by a mixture of propylene glycol and water in the collector loop. These systems are eligible for a CPAU SWHP incentive.
- Closed loop drainback systems, in sunny conditions, pump water through the collectors capturing heat which is transferred to the potable water supply via a heat exchanger. Closed loop drainback systems circulate non-toxic water to collect solar energy, and then drain the water from the collectors when the pump shuts down. These systems are eligible for a CPAU SWHP incentive.
- Closed loop recirculation systems re-circulate water in the collector loop. These systems must have a minimum of two separate freeze protection mechanisms on each system. Manual intervention (draining, changing valve positions, etc.) is suitable as one mechanism. At least one freeze protection mechanism, in addition to manual intervention, must be designed to function in the event of power failure e.g. an Uninterruptible Power Supply (UPS) to power a freeze-protecting pump when power is lost simultaneously with freezing conditions. Freeze drain valves are not an acceptable freeze protection mechanism for these types of systems.

6.1.4 Thermosiphon

Thermosiphon systems are passive systems, and may be open or closed loop.

Closed loop Thermosiphon systems protected by a mixture of propylene glycol and water in the collector loop are acceptable in the CPAU SWHP.

Open loop Thermosiphon systems which have potable water in the collector loop are not allowed in the CPAU SWHP.

6.1.5 Air Collectors

Air collectors do not require freeze protection. Non-coupled water circulation systems maintained in enclosed space do not require freeze-protection and may be open-loop. If the water piping of the circulation system is exposed to the environment, automatic freeze protection for the piping is required. Systems with air collectors are eligible for a CPAU SWHP incentive.

6.2 Stagnation/Overheat Protection for Fluid Collectors

Stagnation is the condition in which heat transfer fluid boils off in the collector, due to prolonged solar exposure with no cooling flow.

Closed loop drainback systems must be equipped with a controller that shuts the pump off when the storage tank reaches its high limit.

Closed loop systems with a glycol and water mixture shall be able to withstand prolonged periods of stagnation without significant system deterioration and with no maintenance. Acceptable stagnation control measures in closed loop glycol systems and closed loop thermosiphon systems include, but are not limited to, the items outlined in Sections 6.2.1 through 6.2.6. For OG-300 systems, stagnation and overheat protection measures must be those that are in the manufacturers installation manual approved by SRCC or IAPMO for the specific system. For multi-family/commercial systems using OG-100 collectors, stagnation protection is also required.

Additional stagnation or overheat protection measures may be allowed at the CPAU SWHP's discretion; however, Applicant must provide documentation if an alternate stagnation protection method is used.

6.2.1 Advanced Controller with a Vacation or Holiday Mode

This function controls the system to shut the pump off when the tank reaches its high limit and to run the pump at night to cool the tank temperature down, reducing the risk of stagnation of the glycol mixture in the collector. The controller must be programmed by the System Owner to activate Vacation or Holiday mode.

6.2.2 Advanced Controller with a Thermal Cycling Function

This function allows the tank temperature to exceed its high limit in order to maintain a lower temperature of the fluid in the collector. This provides the capability of the controller to turn the pump on periodically while solar energy is available, even after the tank temperature has reached its high temperature limit. The solar energy is collected and transferred to the tank, causing the tank temperature to rise above the high limit setting, therefore reducing the risk of stagnation of the glycol mixture in the collector.

6.2.3 Heat Dump Radiator

A heat dump radiator allows heat from the glycol mixture to be dissipated to the atmosphere, therefore cooling the temperature of the glycol mixture and reducing the risk of stagnation.

6.2.4 Swimming Pool and Spa Heat Dump

The CSI-Thermal Program will allow for the use of a swimming pool and spa as an alternative heat dump with the following restrictions:

- This will apply for fluid collectors only.
- System cannot be oversized based on program sizing guidelines if swimming pool or spa is used as heat dump.
- Heat dump will only be activated when collector sensor triggers upper temperature limit or stagnation set point, and not to exceed 180°F.
- Heat dump will be turned off when the collector loop sensor temperature reaches 20°F below stagnation set point or the solar storage temperature drops to 20°F below the tank high limit setting.
- Water temperature entering pool or spa shall not exceed 100°F.

6.2.5 Steam back

The steam back function allows water in the water/glycol mixture to boil at high temperatures in the collector. Steam produced from the boiling water pushes the liquid glycol out of the collector and into the expansion tank or heat dump radiator. This function reduces the risk of stagnation of the glycol mixture in the collector.

6.2.6 Pressure Stagnation Protection (PSP)

This stagnation/overheat protection method allows over-sizing of the pressure relief valve to 150 pounds per square inch (psi), which allows the system pressure to rise with stagnation temperature, thus delaying stagnation. This protects the fluid from overheating and preserves the properties of the glycol by keeping it in a liquid form at higher temperatures.

6.2.7 Hartstat

This is an overheat protection kit for Solahart thermosiphon systems that consists of exposed (uninsulated) copper tubing with a reservoir. This stagnation protection method is required for collectors with selective surface paint on the absorber.

6.2.8 Unglazed Collectors

Unglazed flat plate collectors that operate at temperatures that do not exceed the maximum operating temperatures of heat transfer fluids.

6.3 System Sizing

Over-sizing the SWH system will not be permitted in the CPAU SWHP as this may:

- Generate excessive temperatures which could damage equipment or heat transfer fluids
- Release hot fluids from relieve valves exposing humans to risk of scalding
- Accelerate scale accumulation
- Reduce life cycle cost-effectiveness

Accurately estimating the GPD of hot water consumption is important for the selection of fluid collector area to prevent the generation of excessive temperatures.

6.3.1 Single-Family Projects

Single-family residential systems should be sized according to the number of occupants in the household or based on actual hot water usage, as determined through metering prior to installation. The following guidelines are required for maximum system sizing for single-family SWH systems:

Step 1: Determine Demand

- For retrofit projects: Use the occupant method. Assume 20 GPD of hot water usage by the first occupant, 15 GPD by the second occupant, and 10 GPD by each additional occupant.
- For new construction projects where demand is unknown: Use the bedroom method. Assume 20 GPD of hot water usage for the first bedroom, 15 GPD for the second bedroom, and 10 GPD for each additional bedroom.

Step 2: Determine Collector Area Needed

- Systems that exceed a fluid collector square feet of 1.25 times the GPD, or 1.85 times for air collectors, are considered over-sized and must submit justification to the CPAU SWHP.

Step 3: Select an OG-300 system with the appropriate square footage of collector area. The following is a sizing example for fluid collectors:

- GPD demand: three occupants use approximately 45 gallons of hot water per day
- OG-300 system with a maximum collector area of 56.3 square feet

If the system is sized outside of the above guidelines, Applicants must submit sizing justification showing data and calculations used to determine the system size.

6.3.2 Multi-Family/Commercial Projects

6.3.2.1 Gallons Per Day Sizing Validations

There are several options that can be used for GPD sizing of Multi-family/Commercial projects. Depending on the type of structure (existing versus new construction), the options vary as outlined below.

For existing structures or retrofits, the following options are available:

1. Maximum GPD Guideline Table (Appendix D): SWH systems for the building types listed in the Maximum GPD Guidelines Table may be sized using the GPD value in this table for the appropriate building type. The GPD values in the table are maximum values. Systems may also be sized using a lesser GPD assumption.

2. Actual Metered Consumption: Applicants that choose not to use Appendix D or applications with building types not listed in Appendix D must do one of the following:

    a. Meter hourly actual hot water consumption using a flow meter with accumulator for an appropriate period of time to capture the full range of usage and adjust for seasonal variability to obtain an annual average GPD and hourly usage profile. Hot water consumption calculation and explanation must be stamped by a P.E. Refer to Appendix E for more information.

    b. Meter hourly natural gas, electric, or propane consumption at the water heater for an appropriate period of time to capture the full range of usage and adjust for seasonal variability to obtain an annual average GPD and an hourly usage profile. Water heater gas, electric, or propane meter consumption calculation and explanation must be stamped by a P.E. Refer to Appendix E for more information.

3. Independent Study/Report: Applicants can choose to submit independent government/educational studies or reports from third party organizations in order to accurately estimate GPD. A P.E. must certify that the study or report is relevant to the specific project considering project demographics and end uses, and must develop a typical

hourly load profile. All data including reports or studies must be submitted to the program administrator along with relevant calculations.

4. Small Systems for Building Types not in Appendix D: For systems with less than 85 square feet of collector area which are not OG-300 certified, Applicants may select the "Small Commercial System" option in the CSI-Thermal database and calculator[7]. The applicant must then select the building type whose load profile best represents the building hot water usage. For example; if the business has 9:00 am -5:00 pm weekday hours, the Office Buildings load profile should be selected. The calculator will assume a hot water load of 64.3 GPD[8].

6.3.2.2 Collector and Solar Storage Tank Sizing Validations

- Fluid collector square footage cannot exceed 1.25 times the GPD, or 1.85 times for air collectors.
- Systems with two or more tanks must have a minimum of one gallon of storage per square foot of collector. Systems with two or more tanks with unglazed collectors must have a minimum of 0.33 gallons of storage per square foot of collector. Systems with two more tanks using air collectors must have a minimum of 1 gallon of storage per GPD.
- One-tank systems must have a minimum of 1.25 gallons of storage per square foot of collector. One-tank systems with unglazed collectors must have a minimum of 0.41 gallons of storage per square foot of collector. One-tank systems with air collectors must have a minimum of 1 gallon of storage per GPD.

Reduced solar storage tank volume may be justified under some circumstances as long as overheat protection is maintained. For systems not meeting the solar storage volume requirements, documentation justifying the reduced storage and indicating how overheat/stagnation will be prevented must be submitted and stamped and signed by a State of California licensed Professional Engineer (P.E.). Reduced storage justification should explain the need to size outside the above parameters.

Drainback systems are inherently protected from overheat/stagnation and therefore require only a reduced storage justification document. This document does not need to indicate how overheat/stagnation will be prevented and does not require a P.E. stamp and signature.

6.4 Metering, Monitoring, and Communication Requirements

[7] Found at www.csithermal.com/calculator/commercial/. This calculation is a required document, see section 3.4.2.

[8] Hot water usage of 64.3 GPD is consistent with the hot water load assumption used in OG-300 ratings.

This section contains detailed information on the metering, monitoring, and communication requirements for participation in the CPAU SWHP. There are two purposes for metering: program measurement and evaluation (M&E) and customer performance monitoring (CPM).

6.4.1 Measurement & Evaluation

The CPAU SWHP will select projects that will be required to have M&E metering. Customers selected for M&E metering must agree to allow a third party M&E contractor to install metering on their system. There are no M&E costs borne by the contractor. The cost for the M&E metering equipment on this sample will be borne by the CPAU SWHP.

6.4.2 Requirements for Customer Performance Monitoring (systems > 30 kW_{th})

These minimum metering requirements were developed to increase owner knowledge of system performance and to foster adequate system maintenance. All systems with capacity over 30 kW_{th} must have metering and monitoring equipment to measure system performance (the quantity of energy generated or displaced by the system). The one-time and ongoing costs are born by the System Owner while the contractor is responsible for maintenance of meters and communications.

6.4.2.1 Required Equipment

Required equipment consists of a BTU meter, i.e., a flow meter, a temperature sensor pair, and a calculator.

6.4.2.2 Equipment Accuracy Standards

- Flow meter must have a maximum permissible error ± 2% at full flow.
- Temperature sensors must have a maximum permissible error of ± 1° F within the range of temperatures being monitored (e.g. In the case of collector loop monitoring the range would be the minimum collector supply temperature to the maximum collector return temperature).

6.4.2.3 Equipment Location

Metering equipment may be installed either on the collector loop or potable water side of the SWH system.

6.4.2.4 Communication Requirements

For a period of five years from start of operation, System Owner must have the means to determine if the system is operating. At a minimum, the CPM equipment must provide the quantity of solar energy delivered to the System Owner.

Appendix A: Acronyms

AB: Assembly Bill

AFUE: Annual Fuel Utilization Efficiency rating

Btu: British Thermal Unit

CEC: California Energy Commission

CPAU: City of Palo Alto Utilities

CPAU SWHP: City of Palo Alto Utilities Solar Water Heating Program

CPM: Customer Performance Monitoring

CPC: California Public Utilities Commission

CSI: California Solar Initiative

CSI-Thermal Program: California Solar Initiative Thermal Program

CSLB: Contractors State License Board

DHW: Domestic Hot Water

FTL: Freeze Tolerance Level

GPD: Gallons Per Day

IAPMO: International Association of Plumbing and Mechanical Officials

ICF: Incentive Claim Form

kWh: Kilowatt-hour

kW_{th}: Kilowatt-thermal

M&E: Measurement and Evaluation

NREL: National Renewable Energy Laboratory

OG: Operating Guidelines

PE: Professional Engineer

RRF: Reservation Request Form

SOF: Surface Orientation Factor

SRCC: Solar Rating and Certification Corporation

SWH: Solar Water Heating

Appendix B: Definitions and Glossary

Applicant: The Applicant is the entity that completes and submits the CPAU SWHP application and serves as the main contact person for the CPAU SWHP throughout the application process. The eligible Solar Contractor or Self-Installer will be the Applicant for CPAU SWHP applications.

Array: A group of interconnected solar collectors

Azimuth: Azimuth is the horizontal angular distance between the vertical plane containing a point in the sky and true south. All references to azimuth within the CPAU SWHP, unless expressly stated otherwise, refer to true, not magnetic, azimuth.

British Thermal Unit (Btu): A traditional unit of equal to about 1.06 kilojoules. It is approximately the amount of energy needed to heat one pound of water one degree Fahrenheit.

Commercial: For the purposes of the CPAU SWHP, commercial customers are considered to be all customer classes other than single-family and multi-family customers.

Contractor: A person or business entity who contracts to erect buildings, or portions of buildings, or systems within buildings. Under the CPAU SWHP, all contractors must be appropriately licensed California contractors in accordance with rules and regulations adopted by the State of California Contractors State License Board.

Contractors State License Board (CSLB): Installation contracts for photovoltaic systems installed under the CSI Program must comply with the Contractors State License Board (CSLB) requirements. Please refer to the CSLB website for more information on CSLB guidelines at: www.cslb.ca.gov.

Customer Performance Monitoring (CPM): A service that monitors and reports the performance of the SWH system to the System Owner.

Domestic Hot Water (DHW): Water used, in any type of building, for domestic purposes, principally drinking, food preparation, sanitation and personal hygiene (but not including end uses such as space heating, space cooling, swimming pool heating).

Equipment Seller: Equipment Seller in the CPAU SWHP refers to retail sellers such as manufacturers, distributors, retail businesses. An Equipment Seller is not an in-home sales representative.

Host Customer: Host Customer is, in most cases, the utility customer of record at the location where the SWH system will be located. Any class of customer is eligible to be a Host Customer. The Project Site must be within the service territory of, and receive retail level gas or electric service from CPAU.

International Association of Plumbing and Mechanical Officials (IAPMO): IAPMO is a certifying agency that performs independent testing, research, and technical services in the plumbing and mechanical industries. IAPMO provides SWH ratings equivalent to OG-300 standards.

In-Home Sales Representative: All individuals who visit homes to sell home improvements are required to be listed as sales personnel affiliated with the contractor's license.

Kilowatt Hour (kWh): The use of 1,000 watts of electricity for one full hour. kWh is a measure of energy, not power, and is the unit on which the price of electrical energy is based. Electricity rates are most commonly expressed in cents per kilowatt hour.

Kilowatt Thermal (kW_{th}): A unit of measurement developed by a consortium of international solar rating agencies in 2004 to approximate the amount of energy produced by solar thermal collectors. Each M^2 of collector space equals 0.7 kW_{th} Based on this calculation, 30 kW_{th} is equivalent to 462 square feet of fluid collectors or 855 square feet of air collectors. Fluid collectors include unglazed, glazed, evacuated tube collectors.

Multi-Family Dwellings: Multi-family complexes are defined as those with five (5) or more dwelling units. Duplexes, triplexes, and four-plexes will be qualified as single-family homes for the purposes of determining income eligibility.

New Construction Project: 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.

OG-100: Operating Guidelines 100 (OG-100) is a certification and rating program for solar collector developed by the Solar Rating and Certification Corporation (SRCC). The purpose provides a means for evaluating the maintainability of solar collectors and a thermal performance rating characteristic of all-day energy output of a solar collector under prescribed rating conditions.

OG-300: Operating Guidelines 300 (OG-300) is the SWH system rating and certification program developed by the Solar Rating and Certification Corporation (SRCC). The purpose of this program is to improve performance and reliability of solar products and is based upon the determination by SRCC or IAPMO that the system successfully meets its minimum criteria for design,

reliability and durability, safety, operation and servicing, installation, and operation and maintenance manuals. OG-300 is a comprehensive certification of the entire SWH system.

One-Tank System: A system where the storage tank is heated by both thermal solar and a back-up heat source.

Payee: The person, or company, to whom the CPAU SWHP incentive check is made payable.

Project: For purposes of the CPAU SWHP, the "Project" is the installation and operation of the SWH system, as described by the submitted application.

Public Utilities Code 2861(e): Public Utility Code 2861(e) defines "Low-income residential housing" meaning either of the following:

(1) Residential housing financed with low-income housing tax credits, tax-exempt mortgage revenue bonds, general obligation bonds, or local, state, or federal loans or grants, and for which the rents of the occupants who are lower income households, as defined in Section 50079.5 of the Health and Safety Code, do not exceed those prescribed by deed restrictions or regulatory agreements pursuant to the terms of the financing or financial assistance.

(2) A residential complex in which at least 20 percent of the total units are sold or rented to lower income households, as defined in Section 50079.5 of the Health and Safety Code, and the housing units targeted for lower income households are subject to a deed restriction or affordability covenant with a public entity that ensures that the units will be available at an affordable housing cost meeting the requirements of Section 50052.5 of the Health and Safety Code, or at an affordable rent meeting the requirements of Section 50053 of the Health and Safety Code, for a period of not less than 30 years.

Residential: Residential entities are private household establishments that consume energy primarily for space heating, water heating, air conditioning, lighting, refrigeration, cooking, and clothes drying. The classification of an individual consumer's account, where the use is both residential and commercial, is based on principal use. A power purchase agreement on a residence is considered a residential application. It should be noted that the incentive rate will be determined by the utility rate schedule of the Host Customer (may require more than one application). If the requested incentive rate differs from the classification of the Host Customer utility rate schedule, the CPAU SWHP may allow the requested incentive rate given that the Host Customer change its utility rate schedule.

Retrofit Project: A retrofit is a modification of an existing building or facility to include new systems or components.

Self-Installer: Homeowners or building owners that install the SWH system on their individual property without the assistance of a contractor.

Shade Factor: A variable in the incentive calculation where for each percent of average annual availability below 100 percent on the solar collector(s) between 10:00 am and 3:00 pm, there will be an equal percentage reduction in the system incentive payment down to 85 percent.

Single-Family Residential Dwelling Unit: Group of rooms, such as a house, a flat, an apartment, or a mobile home which provides complete single-family living facilities in which the occupant normally cooks meals, eats, sleeps, and carries on the household operations incident to domestic life.

Site: The Host Customer's premises, consisting of all the real property and apparatus employed in a single enterprise on an integral parcel of land undivided, excepting in the case of industrial, agricultural, oil field, resort enterprises, and public or quasi-public institutions divided by a dedicated street, highway or other public thoroughfare or railway. Automobile parking lots constituting a part of and adjacent to a single enterprise may be separated by an alley from the remainder of the premises served. Separate business enterprises or homes on single parcel of land undivided by a highway, public road, and thoroughfare or railroad would be considered as separate sites. Each individual site must be able to substantiate sufficient hot water usage to support the proposed system size.

Solar Rating and Certification Corporation (SRCC): SRCC is a non-profit organization that operates as an independent third party certification entity. SRCC administers a certification, rating, and labeling program for solar collectors and a similar program for complete SWH systems.

SWH Energy Delivered: Measuring the flow and cold water temperature into the solar storage tank and the resultant solar-hot water temperature delivered to the back-up water heater is an accurate method of determining energy delivered to the customer due to SWH. In the case of a one tank system, solar energy delivered is defined as the difference between the total energy delivered by the entire system and the energy consumed by the auxiliary heat source, multiplied by the efficiency of the auxiliary heat source.

SWH Energy Displaced: The amount of energy, that would have otherwise been needed from the back-up water heater is equal to SWH Energy Delivered divided by the assumed AFUE water heater efficiency of 82 percent for natural gas and 98 percent for electric.

SWH Energy Production: Measuring the flow and temperature difference of the solar collector loop provides a measure of solar production that has the potential of displacing energy.

System Owner: The owner of the SWH system at the time the incentive is paid. For example, in the case when a vendor sells a turnkey system to a Host Customer, the Host Customer is the System Owner. In the case of a leased system, the lessor is the System Owner.

Therm: A unit of heat energy equal to 100,000 British thermal units (BTU). It is approximately the energy equivalent of burning 100 cubic feet of natural gas.

Tilt: The number of degrees a collector is angled from horizontal.

Appendix C: Surface Orientation Factor (SOF) Chart[9]

The ideal SOF is a value of 1.0 and the minimum SOF required to receive an incentive is 0.75. Azimuth directions are true orientation: 0° is True North and 180° is True South. Add magnetic declination to the compass magnetic orientation to get true orientation. Azimuth and title for evacuated tube collectors with adjustable absorber orientations are determined by the azimuth and tilt of the absorbers within the tubes.

		Tilt (degrees)								
		0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-90
True Azimuth (degrees)	0-59	NE	NE	NE	NE	NE	NE	NE	NE	NE
	60-69	0.85*	0.8	0.75	NE	NE	NE	NE	NE	NE
	70-79	0.85*	0.8	0.75	NE	NE	NE	NE	NE	NE
	80-89	0.85*	0.8	0.75	0.75	NE	NE	NE	NE	NE
	90-99	0.85*	0.85	0.85	0.8	NE	NE	NE	NE	NE
	100-109	0.85*	0.85	0.85	0.8	NE	NE	NE	NE	NE
	110-119	0.85*	0.9	0.9	0.9	0.9	NE	NE	NE	NE
	120-129	0.85*	0.9	0.9	0.9	0.9	NE	NE	NE	NE
	130-139	0.85*	0.9	0.9	0.9	0.9	NE	NE	NE	NE
	140-149	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	NE
	150-159	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	NE
	160-169	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	NE
	170-179	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	NE
	180-189	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	NE
	190-199	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	NE
	200-209	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	NE
	210-219	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	NE
	220-229	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	NE
	230-239	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	NE
	240-249	0.85*	0.85	0.85	0.85	0.75	0.75	0.75	NE	NE
	250-259	0.85*	0.85	0.85	0.85	0.75	0.75	0.75	NE	NE
	260-269	0.85*	0.85	0.85	0.85	0.75	0.75	0.75	NE	NE
	270-279	0.85*	0.8	0.75	0.75	0.75	0.75	0.75	NE	NE
	280-289	0.85*	0.8	0.75	0.75	0.75	0.75	0.75	NE	NE
	290-300	0.85*	0.8	0.75	0.75	0.75	0.75	0.75	NE	NE
	301-360	NE	NE	NE	NE	NE	NE	NE	NE	NE

NE = Not Eligible

* Please reference the manufacturer instructions for collectors tilted at 0°

[9] Source: Craig Christensen (NREL) and Greg Barker (Mountain Energy Partnership), ***Effects of Tilt and Azimuth on Annual Incident Solar Radiation for United States Locations***; Proceedings of Solar Forum 2001: Solar Energy: The Power to Choose, 2001. This data is for 33° North Latitude. The source SOF charts have been climate-adjusted; the differences between the charts for six representative California cities (Arcata, San Francisco, Santa Maria, Los Angeles, Long Beach and San Diego) are inconsequential. Therefore, the Surface Orientation Chart for San Diego is adopted for the state of California.

Appendix D: Maximum Gallon per Day (GPD) Guideline Table for Sizing Multi-Family/Commercial Projects[10]

Type of Building	GPD
Apartments/Condos: Number of Units	
2 to 20	42 per unit
21 to 50	40 per unit
51 to 100	38 per unit
101 to 200	37 per unit
201 plus	35 per unit
Student Housing	13 per person
Military Barracks	13 per person
Hotels/Motels	15 per unit
Retirement/Nursing Homes	18 per bed
Office Building	1.0 per person
Restaurants	
Meal Service Restaurants	2.4 per full meal served per day
Quick Service Restaurants	0.7 per meal served per day
Elementary schools	0.6 per student
Junior and senior high schools	1.8 per student
Coin-op Laundries	2 per pound of laundry washed per day

[10] The GPD table is only a maximum justification and predates low-flow fixtures and appliances. Data should not be used for sizing requirements.

Appendix E: Multi-Family and Commercial Sizing Instructions for "Meter Actual Consumption" Method

The purpose of this section is to outline the requirements for sizing multi-family and commercial projects using the "Meter Actual Consumption" method described in Section 6.3.2. The results of this metering will determine a GPD value and a Load Profile for the OG-100 Calculator.

BACKGROUND AND REQUIREMENTS

For system sizing, one of the options available is metering actual consumption. Applicants may opt to use this method or the other methods outlined in Section 6.3.2.In order to meter actual consumption, applicants must to do one of the following:

- Meter hourly hot water consumption using a flow meter with accumulator for an appropriate period of time to capture the full range of usage and adjust for seasonal variability. Hot water consumption calculation and explanation must be stamped by a P.E.
- Meter hourly natural gas or electric consumption at the water heater for an appropriate period of time to capture the full range of usage and adjust for seasonal variability. Water heater gas or electric meter consumption calculation and explanation must be stamped by a P.E.

STATE OF CALIFORNIA LICENSED PROFESSIONAL ENGINEER (P.E.) RESPONSIBILITIES

The metered data collected for the appropriate period of time must be quality checked and processed by a State of California Licensed Professional Engineer (P.E.). The P.E. is responsible for the following:

- Determination of appropriate metering period to capture full range of hot water usage
- Verification of correct mounting and location of the meter (either flow meter or water heater gas or electric meter)
- Accuracy of the start/stop recording dates and times
- Extrapolation of the metered data to one year, accounting for down days (e.g., weekends or seasonal down periods)
- Development of a load profile from the collected time interval data in accordance with the data format Table H1 Load Profile Template.
- Determination of a single GPD value to be used for system sizing and incentive calculation

DATA FORMAT

The load profile must show hourly hot water gallon demand for a typical year (8760 hours).

- Hourly Hot Water Gallon Demand: Hour number one must represent the first 60 minutes of the first day of the year from midnight-1:00 am.
- Hot Water Draw, Gallons Per Hour: Gallons consumed in a given hour.
- Recirculation Loop Pump Status: On (1) or off (0) in a given hour.

Table E1 below is an example template of the required data. The Applicant will be asked to attach this table when using the OG-100 Calculator for building types not listed in the Maximum GPD Table in Appendix D or if the value in the Maximum GPD Table is too low for the building use. The results of the data will create a custom load profile for their proposed system.

Table E1
Load Profile Data Example

Elementary Schools (10-month)		
Hour	**Hot Water Draw Gallons/Hour**	**Recirculation Loop Pump Status 1=On: 0=Off**
1	0.000	0
2	0.000	0
3	0.000	0
4	0.000	0
5	0.000	0
6	0.000	0
7	0.000	0
8	73.75	1
9	43.22	1
10	70.27	1
11	40.82	1
12	20.06	1
13	22.64	1
14	28.07	1
15	28.64	1
16	12.55	1
17	11.06	1
18	0.000	0
19	0.000	0
20	0.000	0
…8760	0.000	0

DOCUMENTATION SUBMITTAL

The following items must be stamped by a P.E. and submitted as the “Customer Load Profile”.

- The load profile data must be submitted to the CPAU SWHP in an Excel document using the format provided in Table 5.
- The actual monitoring data.
- The assumptions used to extrapolate the monitored data for an appropriate period of time.

Appendix F: Historic Minimum Sustained Temperatures in California Energy Commission's Climate Zones

Table F1
California Climate Zone Chart

CEC Climate Zone	18-hour Minimum Temperature (°F)[11]
1	31
2	38
3	34
4	38
5	43
6	49
7	48
8	48
9	41
10	40
11	28
12	29
13	31
14	25
15	43
16	7

[11] The analysis used to reach the 18-hour minimum temperature chart is based on historic air temperature readings for representative stations of each of the 16 California climate zones. Thirty years of air temperature data was obtained for each station from the National Climatic Data Center. The maximum available history was used for stations with less than 30 years. This data was then analyzed for the minimum temperature sustained for 18 continuous hours. When sub-hourly interval data was provided it was processed into hourly average temperatures for analysis. Gaps in data less than 2 hours were filled using interpolation. However, gaps in data over 2 hours were not filled. Hourly air temperature data was then analyzed to determine the minimum temperature sustained at or below for 18 hours.

The CPAU SWH Program does not warrant that any ICS system placed in these climate zones will be protected from freezing. It is the responsibility of the system designer to evaluate freeze risk and provide additional freeze protection, or to not risk freezing or excessive heat loss by installing ICS systems in marginal zones. Consider the following factors that may not be reflected in the published Freeze Tolerances Limits:

1. Micro-climates that are not reflected by the "representative city"
2. Shorter duration freeze snaps, compounded by clear-sky conditions that worsen the freeze risk
3. System design factors such as type of glazing, paint, cylinder wall thickness, insulation, etc.

Finally, consider that the weakest link in ICS or thermosiphon systems may be the pipes to and from the system. Extra measures may be required by the permitting agency to protect exposed piping.

Appendix G: Affidavit: Low Income Property Conditions

By signing this affidavit ("Affidavit"), _____ ("Host Customer") and _____ ("System Owner", if different than the "Host Customer"), jointly referred to as "Parties", with respect to the solar water heating system project ("Project") at _____(site address), which is partially funded by the _____ ("Program Administrator") City of Palo Alto Solar Water Heating Program under Application ID _____, each certify and declare under penalty of perjury under the laws of the State of California that each of the statements in the paragraphs below are complete, true and correct.

Parties attest that the statements in the following paragraphs are true.

1) The property for which the solar water heating system will be installed is and will remain low-income for at least 10 years from the time of installation, including property ownership restrictions and income rental protections, and appropriate enforcement of these conditions.

2) The property for which the solar water heating system will be installed meets one of the following conditions (check all that apply):

- a documented resale restriction between the homeowner and a public entity or a qualifying nonprofit affordable housing provider; or

- a documented equity sharing agreement for which the homeowner does not receive a greater share of equity than described in paragraph (2) of subdivision (c) of Section 65915 of the Government Code, between the homeowner and a public entity or a qualifying nonprofit affordable housing provider.

Each of the undersigned certifies under penalty of perjury that the foregoing is true and correct and that each is duly authorized to sign this Affidavit.

Host Customer	**System Owner**
Signature:	**Signature:**
Name Printed:	**Name Printed:**
Title:	**Title:**
Date:	**Date:**