

Solar Water Heating Rebate Program Handbook

January 2020



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January 2020 Handbook:

What's New

This January 2020 version of the Handbook corrects an error from the October 2019 version of the Handbook which erroneously listed the Multifamily/Commercial low-income residential rebate level as \$36.90/therm. The Multifamily/Commercial low-income residential rebate is \$24.89 per therm saved annually.

Table 2 has been updated to reflect this change.

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1. Program Background

The City of Long Beach Solar Water Heating Rebate Program (SWHP) provides rebates to qualifying solar water heating (SWH) systems installed by natural gas customers served by City of Long Beach Energy Resources Department (Energy Resources). The SWHP aims to help customers manage their utility costs by reducing the amount of natural gas used for water heating, contribute to California's efforts to reduce greenhouse gas (GHG) emissions and support the development of a sustainable solar water heating industry.

In 2017, the California State Legislature passed Assembly Bill (AB 797), which requires publicly owned utilities to adopt, implement and finance a solar water heating rebate program. Accordingly, Long Beach City Council adopted a resolution to fund the SWHP, to be implemented through Energy Resources. In designing the SWHP, the City aimed to maintain consistency with the existing California Solar Initiative Thermal Program (CSI-Thermal), which is administered by three of California's largest investor-owned utilities (PG&E, SoCalGas and SDG&E), and provides rebates for SWH systems.

SWH systems receiving rebates through SWHP must displace natural gas use in existing water heating equipment. The Program is available to existing and new residential, commercial, and industrial natural gas customers of Energy Resources service territory. This program will offer rebates on a first come, first served basis within three rebate categories- Single-Family Residential, Multifamily/Commercial and Industrial Applications. The program will also have two rebate rates- the General Market rebate rate and a Low-Income/Disadvantaged Communities budget that offers higher rebates for income-qualified customers.

This Program Handbook details customer and technology eligibility requirements, rebate levels and the rebate application process. The Handbook serves as the single point of reference for program requirements and will be updated and made available online through the Energy Resources website, as program requirements change.

1.1. Program Goals

Energy Resources provides over 91 million therms of natural gas per year to approximately 147,000 customers.

The SWHP aims to provide rebates to qualifying solar water heating systems. Rebates will be split across project types with varying rebate levels. Based on estimated participation by different project types, and assuming a 20-year expected useful life for a typical solar thermal system, the Program anticipates offsetting up to 995,000 therms of natural gas through the installation of up to 60 SWH systems.

1.2. Program Budget

Energy Resources has approved rebates to be distributed between General Market customers, Low-Income Residential properties and buildings located in Disadvantaged Communities (LI/DAC), and Industrial Applications.

Rebates are available on a first-come, first-served basis. All budget categories will utilize a two-step process for first reserving, and then subsequently claiming rebates. This will help ensure that rebate funds are available prior to the actual installation of a solar water heating system.

If any of these budget categories become depleted prior to the end of the program, Energy Resources reserves the right to shift rebate funds from under-utilized budget categories.

1.3. Program Contact Information

The City of Long Beach SWHP is administered by the Center for Sustainable Energy. Any questions about the program can be directed to the Program Administrator (PA).

Center for Sustainable Energy
Attn: City of Long Beach Solar Water Heating Rebate Program
3980 Sherman St. Suite 170
San Diego, CA 92110

Email: swhp@longbeach.gov
Telephone: 562-570-2116

2. Program Eligibility

2.1. Single-Family Residential – Domestic Hot Water

2.1.1. Definition

All domestic hot water (DHW) end uses will be eligible in the Long Beach Solar Water Heating Rebate Program. DHW is defined as water used, in any type of building, for domestic purposes, principally drinking, food preparation, sanitation and personal hygiene. DHW does not include hot water used for space heating or cooling, swimming pool or spa heating, or combination systems that use heated water for both water and space heating.

2.1.2. Eligible Customers

To be eligible for a rebate, the project site must be within the service territory of Energy Resources, and the site must receive retail-level natural gas service from Energy Resources. Additionally, the solar water heating system must displace the use of a natural gas back-up water heater.

Systems may be installed by an SWHP eligible contractor or may be self-installed by the Host Customer. Systems installed as a part of new construction, or as a retrofit to an existing building are eligible.

Single-family residential customers can qualify for rebates under the general market or low-income and/or disadvantaged communities budget program.

2.1.2.1. General Market

To be eligible for a general market rebate, the Host Customer must be a natural gas customer of Energy Resources. The customer may install a SWH system on a new or existing home, as long as the system is displacing natural gas water heating.

2.1.2.2. Low-Income/Disadvantaged Communities

SWHP provides higher rebates to qualifying single-family, low-income customers. The disadvantaged communities component offers rebates to customers located within disadvantaged communities at the general market single-family rebate rate. The customer may install a SWH system on a new or existing home, as long as the system is displacing natural gas water heating.

To qualify for the low-income rebate level, the following conditions must be met:

1. The host site must be occupied by either the homeowner or a renter.
2. The SWH must be owned by the homeowner.
3. The property must meet one of the following conditions:
 - a. Low-income housing, as defined by Public Utilities Code Section 2861(e); or
 - b. The household must be currently enrolled, or previously participated in either the Energy Resources Low-Income Discount program, or the Low-Income Home Energy Assistance Program (LIHEAP); and
 - c. The property at which the system is installed must have a resale restriction, either documented or presumed as a result of inclusion in a Targeted Employment Area (TEA), Qualified Census Tract (QCT) as defined by Internal Revenue Service Code Section 143(j)(2) or neighborhood revitalization strategy, or be subject to an 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.

For questions regarding eligibility for the low-income rebate level, please contact the Program Administrator.

2.1.3. Rebates

Rebates are calculated based on the estimated annual energy savings from the installed SWH system, and the rebate level for the relevant budget category. Table 1 displays the rebate levels for General Market and Low-Income customers.

Table 1 *Single family residential rebate levels and maximum rebates*

Budget category	Rebate per therm displaced (\$/therm)	Maximum rebate (\$)
General Market	\$29.85	\$4,366
Disadvantaged Community	\$29.85	\$4,366

Low-Income Residential	\$36.90	\$5,397
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2.2. Multifamily Residential / Commercial

2.2.1. Definition

SWHP rebates will be available to all DHW end uses in multifamily residential and commercial buildings. To qualify for this budget category, the hot water must be directly consumed by the end use and may not be used a medium to carry heat for an alternative end use, such as solar cooling or process heating. Industrial process heating applications are eligible for an SWHP rebate and are described in Section 2.4.

Some examples of DHW use in multifamily residential and commercial buildings include, but are not limited to, apartment buildings with central boiler systems, hotels/motels, restaurants, car washes and commercial laundry facilities.

2.2.2. Eligible Customers

To be eligible for a rebate, the Project site must be within the service territory of Long Beach and receive retail level natural gas service from Energy Resources. Additionally, the SWH system must displace the use of a natural gas back-up water heater.

Systems may be installed by an SWHP eligible contractor or may be self-installed by the Host Customer. Systems installed as a part of new construction, or as a retrofit to an existing building are eligible.

Multifamily residential customers can qualify for rebates under the general market or low-income and/or disadvantaged communities budget program.

2.2.2.1. General Market

To be eligible for a general market rebate, the Host Customer must be a natural gas customer of Energy Resources. The customer may install a SWH system on a new or existing home, as long as the system is displacing natural gas water heating.

2.2.2.2. Low-Income/Disadvantaged Communities

SWHP provides higher rebates to qualifying low-income multifamily residential properties. The disadvantaged communities component offers rebates to customers located within disadvantaged communities at the general market multifamily/commercial rebate rate. The SWH system may be installed on a new or existing property as long as the system is displacing natural gas water heating.

To qualify for the low-income rebate level, the following conditions must be met:

1. The host site must be occupied by either the homeowner or a renter.
2. The benefits of the SWH system must be passed on to the residents. The total value of the benefits to the residents shall be no less than 30% of the total rebate amount. The Applicant will submit an affidavit, signed by the Host Customer and System Owner, detailing how benefits from the SWH system will be passed on to low-income tenants.

3. The property must meet one of the following conditions:
 - a. Low-income housing, as defined by Public Utilities Code Section 2861(e); or
 - b. At least 50 percent of all units are occupied by ratepayers that are currently enrolled, or previously participated in the Energy Resources Low-Income Discount program; and
 - c. The property at which the system is installed must have a resale restriction, either documented or presumed as a result of inclusion in a Targeted Employment Area (TEA), Qualified Census Tract (QCT) as defined by Internal Revenue Service Code Section 143(j)(2) or neighborhood revitalization strategy, or be subject to an 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.

For questions regarding eligibility for the low-income rebate level, please contact the Program Administrator.

2.2.3. Rebates

Rebates are calculated based on the estimated annual energy savings from the installed SWH system, and the rebate level for the relevant budget category. Table 2 displays the rebate levels for General Market and Low-Income customers.

Table 2 *Rebate levels and maximum rebates for multifamily residential and commercial properties*

Budget category	Rebate per therm displaced (\$/therm)	Maximum rebate (\$)
General Market	\$20.19	\$100,000
Disadvantaged Community	\$20.19	\$100,000
Low-Income Residential	\$24.89	\$100,000

A maximum of one multifamily/commercial rebate will be allowed per SWH system and the total rebates for a site cannot exceed the rebate maximums described in Table 3. Example: A college campus installs solar water heating on three dormitories. Each building has a distinct natural-gas displacing SWH system that serves as a pre-heat for a distinct central boiler system. A separate rebate will be allowed for each building as long as the combined total of the rebates for all of the buildings on the site do not exceed the \$100,000 maximum rebate.

2.3. Commercial Pools

2.3.1. Definition

SWHP rebates will be available for solar pool heating systems that displace natural gas use for pool heating at multifamily residential, public, nonprofit or commercial properties.

SWHP rebates are not available for solar pool heating systems for single family residential pool or spa heating systems.

2.3.2. Eligible Customers

Eligible customers must receive retail-level natural gas service from Energy Resources and must currently be using a natural gas heating system to heat their pool.

2.3.3. Rebates

Table 3 displays the rebate rate per therm for commercial pool systems. The total rebates for solar pool heating systems cannot exceed 50% of the total project costs. A maximum of one rebate will be allowed per SWH system and the total rebates for a site cannot exceed the rebate maximums described in Table 4. The definition of a site is the same as that of the Multifamily/Commercial program, described in Section 2.2.3.

Table 3 *Rebate levels and maximum rebates for commercial pools*

Budget category	Rebate per therm displaced (\$/therm)	Maximum rebate (\$)
Commercial Pools	\$7.00	\$100,000 or 50% of total system cost

Commercial pools may only apply for rebates from the General Market budget and are not eligible for rebates from the LI/DAC budget.

2.4. Industrial Applications

2.4.1. Definition

For the purposes of SWHP, industrial applications will include process heating applications that use heat to produce basic materials and commodities. Where solar water heating is used for process heat, the solar-heated water is not consumed as part of the process, but rather serves as a medium to carry heat for the process.

2.4.2. Eligible Customers

To be eligible for the Industrial Applications budget category, the Host Customer must receive retail-level natural gas service from Energy Resources. The SWH system may be installed as part of new construction, or on an existing facility, and must displace natural gas use for the process heating application.

2.4.3. Rebates

Table 4 displays rebate level and maximum rebates for the Industrial Applications budget. Rebates for industrial applications will be based on estimated annual energy savings.

Table 4 *Rebate levels and maximum rebates for Industrial Applications*

Budget category	Rebate per therm displaced (\$/therm)	Maximum rebate (\$)
Industrial Applications	\$20.19	\$100,000

2.5. Participants in the Program

To participate in the City of Long Beach SWHP, project sites must receive retail level natural gas service from the City of Long Beach Energy Resources. Non-contractor participants must consent to being surveyed by Energy Resources, or any third-party evaluators that Energy Resources may contract with for program evaluation services.

2.5.1. Host Customer

The Host Customer is defined as the utility customer of record at the location where the SWH system is installed and will be identified as such on rebate application forms. The PA will verify the Host Customer's status either through their submission of a copy of a recent utility bill, or through verification with Energy Resources.

2.5.2. System Owner

The System Owner is defined as the owner of the SWH system at the time that the rebate is paid. The system owner will be designated on rebate application forms. SWHP allows for third-party owned SWH systems, such as leased systems or power purchase agreements (PPAs). In the case of a third-party owned system, the system owner must be designated as such in the purchase agreement, and must be party to project documentation, including, but not limited to the Reservation Request Form (RRF) and Rebate Claim Form (RCF).

2.5.3. Applicant

The applicant is the entity that completes and submits the SWHP application documentation to the Program Administrator. This is typically the SWHP eligible contractor, but may be the property owner in the case of a self-installed single family system. The Applicant will be the main point of contact for the PA.

2.5.4. Solar Contractor

2.5.4.1. Contractor Participation

Contractors wishing to become eligible to apply for City of Long Beach SWHP rebates must meet all of the license and training requirements described herein, must provide warranties as required by this Handbook, and must complete and submit a Contractor Participation Application form to the PA prior to submitting any rebate application material. A list of SWHP eligible contractors will be made available on the program website.

2.5.4.2. License Requirements

SWHP eligible contractors must be licensed by the California State License Board (CSLB) and hold an active license in any of the following five categories: A (Engineer), B (General), C-4 (Boiler, Hot Water Heating and Steam Fitting), C-36 (Plumbing), or C-46 (Solar). The Program Administrator may request documentation from the contractor to confirm compliance with CSLB requirements.

2.5.4.3. Training Requirements

To be eligible to apply for SWHP rebates, a contractor must either complete a CSI-Thermal Contractor and Self-Installer Workshop, or an ad hoc LBSWHP Contractor and Self-Installer Workshop. Any CSI-Thermal eligible contractor will also be eligible for SWHP. The SWHP PA will offer a free Contractor and Self-Installer workshop in an online, webinar-style format, at the contractor's request. Requests for an online workshop can be made via email to swhp@longbeach.gov. Please allow at least two weeks to schedule and carry out the online webinar. The workshop covers program processes and requirements and is not intended as training on how to design or install SWH systems.

2.5.4.4. Suspended Contractors

If a contractor's license becomes suspended or inactive during the program, the PA will remove the contractor from the list of eligible contractors, and existing projects will be treated as follows:

- New Reservation applications will not be confirmed, and all applications associated with the suspended contractor will also be suspended
- No rebate payments will be made unless the final signed-off permit is dated prior to the date of suspension from the program
- All parties identified in application materials will be alerted to the suspension
- Host Customers with existing reservations may hire a new contractor to complete their system and apply for their rebate. The new contractor must be an LBSWHP eligible contractor.

2.5.5. Self-Installer

A single-family property owner may choose to install a SWH system on their own property. To be eligible for a SWHP rebate, the self-installer must complete a Contractor and Self-Installer workshop, must submit their Reservation Request Form within 12 months of completion of the workshop, and must follow all applicable local laws, codes, regulations and SWHP requirements.

2.5.6. Equipment Sellers

Equipment Sellers that are different from the Solar Contractor must be indicated on the Program Application, and the seller's contact information must also be provided on the application.

3. Equipment Eligibility

SWHP rebates will be available for SWH systems that offset the use of natural gas from an existing water heater or boiler. All SWH system components must be new and unused, with the following exceptions where an existing system is being replaced:

- Existing copper piping that has been de-scaled
- Existing racking may be used, but requires a stamp and signature from a State of California licensed Professional Engineer (P.E.)
- Existing storage tanks in multifamily/commercial projects that meet the following conditions:

- Meets or exceeds volume requirements detailed in this Handbook
- Must be free of leaks and in workable condition
- Must have at least R12 insulation
- Reused equipment must conform to manufacturer’s system specifications

3.1. End-use Eligibility

3.1.1. Single Family End Uses

Single family SWH systems must have a current OG-300 certification from either ICC-SRCC or IAPMO, and installations must match the OG-300 certification. Exceptions to this requirement are as follows:

- Expired OG-300 certification. An SWH system with an expired OG-300 certification must have been purchased and the Purchase Agreement must have been fully executed, prior to the certification expiration date.
- Solar storage tank substitutions. The Applicant may install a certified solar storage tank of equal or greater performance to that of the tank listed on the OG-300 certification. The tank must meet or exceed the insulation R-value and storage volume of the original tank, must be installed in the same configuration, and must use the same heat exchanger as specified in the OG-300 certification. A drainback tank may be exchanged for a pressurized tank, and vice versa. A tank substitution will not change the rebate calculation.
- Tankless auxiliary water heaters. Where the OG-300 certification specifies a tank-type water heater, a tankless auxiliary water heater may be used in place of the tank-type water heater. However, if the OG-300 certification specifies a tankless water heater, a tank-type water heater may not be substituted. The tankless water heater must use natural gas as its heating source.

3.1.2. Multifamily/Commercial and Commercial Pool End Uses

Multifamily/commercial SWH systems must use solar collectors with a current OG-100 certification from either ICC-SRCC or IAPMO. OG-300 certified systems, as described in section 3.1.1 will also be eligible for multifamily/commercial rebates. For projects where the Applicant plans to install multiple OG-300 systems at the same project site, please contact the PA.

OG-100 collectors with expired certifications are eligible, provided they were purchased and the Purchase Agreement was fully executed prior to the certification expiration date.

3.2. Ineligible Technology and System Application

The following SWH system types are ineligible for SWHP rebates:

- Direct Forced Circulation (DFC) where potable water is pumped through the collector and solar heat is captured directly in the collector. Note that this does not apply to passive Integral Collector Storage (ICS) systems.

- Open loop (direct) thermosiphon systems where potable water is circulated throughout the collector loop. Closed loop (indirect) thermosiphon systems are eligible for SWHP rebates.
- Portable systems, or systems that are not permanently installed.

3.3. Permit Code Compliance Requirements

All SWH systems installed as part of a SWHP rebate claim must comply with local laws, codes and regulations, and must have received all final signed-off permit(s) from the appropriate authority having jurisdiction (AHJ). Rebate claims must be made within 24 months of the date the final signed-off permit was acquired and must be made prior to the SWHP closure date.

3.4. Warranty

All SWH systems receiving an SWHP rebate must have a manufacturer's warranty of at least 10 years that covers defects and no more than a 15 percent performance degradation. Additionally, contractor-installed systems must have a minimum 1-year warranty on installation labor and workmanship.

3.5. Pipe Insulation

All exposed and accessible hot water piping, including that of recirculation loops, must have insulation with a rating of at least R2.6. Insulation is not required on commercial pool SWH systems.

3.6. Performance and Permanency

SWH systems receiving an SWHP rebate are intended to remain at the project site, and in use for the duration of their expected useful life. Rebate applications must demonstrate to the PA adequate assurances of both physical and contractual permanence. Equipment must be installed on a permanent surface, and there must be no indication of portability.

Contractual performance is to be for the duration of the warranty period, and no less than 10 years. Purchase agreements, and agreements for third-party ownership are to be submitted to the PA for review and must demonstrate that the system will remain in place for at least 10 years.

A system may be removed and re-installed at another site within the Energy Resources service territory. The system owner must notify the PA in writing at least 60 days prior to moving the system, and the system must be reinstalled and functional within six months. The system will not be eligible for an additional rebate when it is reinstalled. All relocated equipment will be subject to a mandatory site inspection.

4. System Sizing

Appropriate system sizing is critical to the proper functioning, safety and longevity of a SWH system. SWHP will not provide rebates for oversized systems.

4.1. Single Family Projects

The following are maximum sizing guidelines for single family residential SWH systems.

4.1.1. Determine Demand

If the exact hot water usage for the home is not known, the occupant method can be used to estimate demand. Estimate 20 gallons of hot water per day (GPD) for the first occupant, 15 gallons per day for the second occupant, and 10 gallons per day for each additional occupant.

4.1.2. Determine Collector Area

Multiply the GPD from the previous step by 1.25 to determine the maximum collector area, or 1.85 for air collectors. SWH systems exceeding 1.25 square feet of solar collectors per GPD of hot water demand will be considered oversized for the purposes of LBSWHP.

For example, a household with four occupants would have an estimated hot water demand of 55 GPD. That means the maximum collector square footage would be 56.25 ft². The applicant would be encouraged to select an OG-300 system closest to, but that does not exceed 56.25 ft².

4.2. Multifamily/Commercial Projects

4.2.1. Gallons per Day Sizing Validations

Maximum sizing guidelines are provided in Appendix E of this Handbook. The values in Appendix E are maximum values, used to determine the maximum allowable amount of solar collector area. SWHP participants are encouraged to measure actual GPD demand, which may result in smaller SWH system design.

If Applicants do not use Appendix E to estimate GPD, they may measure actual hourly hot water consumption through the use of a flow meter. These measurements must cover an appropriate time period to account for daily and seasonal variation in usage, and must be signed and stamped by a State of California licensed P.E.

Alternatively, the applicant may submit an independent study or report that estimates hot water GPD for the specific use case. A P.E. must certify that the study is based on a typical hourly load profile and is relevant to the specific use case that is applying for an SWHP rebate.

4.2.2. Collector and Solar Storage Tank Sizing Validations

The total square footage of solar collectors may not exceed 1.25 times the hot water GPD for fluid collectors, of 1.85 times the hot water GPD for air collectors.

Solar storage tanks must have at least 1 gallon of storage per square foot of solar collector for systems with two or more tanks. For a system with only one tank, solar storage must have at least 1.25 gallons of storage per square foot of collector.

4.3. Commercial Pool Projects

SWH systems for commercial pools are typically designed with 75-100% of unglazed solar collector per square foot of pool surface area. Because pools may have different target temperatures, and stagnation/overheating is not an issue with unglazed collectors, SWHP does not place a limit on the square footage of unglazed collectors for solar pool systems.

5. Rebate Calculations

The CSI-Thermal Program provides a free online calculator tool that may be used to estimate LBSWHP rebates. The inputs and outputs of this calculator are explained in the accompanying User Guide.

Calculators are available for the following project types:

- OG-300 certified systems: <https://www.csithermal.com/calculator/>.
- Commercial/Multifamily systems: <https://www.csithermal.com/calculator/commercial/>
- Commercial Pool systems: <https://www.csithermal.com/calculator/pool/>

The actual rebate amount paid to an approved system will be calculated using the following equation:

Rebate Amount (Not to exceed the Program's set rebate maximum)	$OG-100 \text{ or } OG-300 \text{ rating} * SOF * \text{Shade Factor} * \text{rebate rate}$
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5.1. Shade factor

Shading reduces the performance of a SWH system and will thus reduce the amount of the rebate awarded. The solar contractor is responsible for conducting a shade analysis for each site. For each percentage of solar access lost between the hours of 10:00 am and 3:00 pm, the rebate will be reduced by an equal percentage. For example, a system with 90% solar access will have its rebate reduced by 10%.

5.2. Surface Orientation Factor (SOF)

The SOF is a combination of the solar collectors' tilt (measured from horizontal, not from the roof's surface), and the collectors' azimuth, adjusting for magnetic declination at the project site. Appendix C includes a range of SOF based on the tilt and the azimuth. Each percentage reduction in the SOF will result in an equal percentage reduction in the calculated rebate. For example, a system with an SOF of 0.8 would have its rebate reduced by 20%. An SWH system with an SOF of less than 0.6 will not be eligible for an SWHP rebate.

5.3. Multiple Orientation Arrays

Sites with multiple arrays of collectors will need to calculate a weighted SOF and shade factor. The weighted average SOF and shade factor will be based on the SOF and shade factor of each array, and the square footage of the solar collectors in each array as a proportion of total solar collector square footage.

5.4. Calculator Outputs

The online calculators produce an estimate of annual energy savings, in therms, resulting from reduced natural gas use for water heating. The output also includes a rebate calculation based on current rebate levels, adjusted for the shade factor and SOF as input by the Applicant. This calculator output will be the basis for calculating the rebate amount to be reserved, and is included on the Reservation Request Form.

6. Rebate Limitations

SWHP rebates are calculated based on the factors described in Section 5. The PA will conduct field inspections of a sample of systems that claim rebates and reserves the right to adjust or cancel rebates if the installed SWH system is found to be different from what was stated on the Rebate Claim Form and/or entered as calculator inputs. Details of the field inspection process, including tolerances for variation, infraction items and failure items are described in detail in Section 10.

6.1. Total Eligible Project Costs

Eligible SWH costs include the following:

- Capital costs for equipment, including solar collectors, storage tank and any auxiliary equipment that is not related to the back-up water heating system
- Mounting surfaces that provide primary support for the solar collectors
- Engineering feasibility study and design costs associated with the SWH system
- Labor costs for construction and installation – only labor directly associated with the SWH system installation should be included
- Permitting costs
- Maintenance contracts and/or ongoing monitoring and measurement associated with only the SWH system
- Sales tax

Where a Purchase Agreement includes costs for multiple technologies – for example if both a solar photovoltaic (PV) and SWH system are being installed at the same site – the Purchase Agreement must itemize costs related only to the SWH system.

6.2. Reportable Project Costs

The Applicant is required to report the following itemized costs for the SWH system:

- Solar collector costs
- Solar storage tank costs
- Permitting fees – this is to cover only the actual cost of the permit, not labor associated with preparing materials for permit application
- All other costs – any other eligible costs associated with SWH system installation

6.3. Other Rebates or Incentives

The combination of all rebates that a SWH system has already received, or expects to receive, may not exceed the total eligible costs of the system. The Applicant is responsible for disclosing any additional rebates that the SWH system will receive. Failure on the part of a Host Customer, System Owner, Applicant or Equipment Seller to disclose additional rebates may result in removal from the program.

7. Technical Requirements

Section 7 describes the technical requirements SWH systems must meet to be eligible for a SWHP rebate. These requirements broadly fall into two categories: 1) Freeze protection, to

ensure that the SWH system is not damaged in the event of sustained low temperatures, and 2) Stagnation/overheat protection, to ensure that the SWH system is not damaged, or the quality of the heat transfer fluid is not degraded, during a period of extended non-operation.

While the following freeze and stagnation protection mechanisms do not represent all the options available for SWH systems, they have been chosen as the most reliable and robust protection mechanisms and are thus required for participation in SWHP.

7.1. Freeze Protection

All SWH systems must meet freeze protection requirements, as set forth by ICC-SRCC and IAPMO. The California Energy Commission (CEC) climate zone of a project site will be used to determine eligibility of different freeze protection technologies. The City of Long Beach is located in CEC climate zone 8.

7.1.1. Integral Collector Storage

Integral Collector Storage (ICS) systems are freeze tolerant as a result of higher thermal mass of the water contained in the collector. The OG-300 certification for ICS systems will include a Freeze Tolerance Limit (FTL). If the historical 18-hour continuous low temperature for the climate zone exceeds the FTL for a particular ICS system, the system is not appropriate for the climate zone. Climate zone 8 has a historic minimum sustained temperature of 48 °F. Energy Resources does not warrant that ICS systems installed in this climate zone, or with an FTL below the historic low, will be free from freeze damage. It is the responsibility of the solar contractor to evaluate freeze risk for the specific application.

7.1.2. Direct Forced Circulation

Direct Forced Circulation SWH systems for non-pool end uses are not eligible for SWHP rebates. For commercial pools, only direct forced circulation systems that use automatic drainback for freeze protection will be allowed. To ensure adequate drainback ability, all solar collector risers must be installed with the manufacturer's recommended minimum slope, or ¼" of vertical rise for each foot of collector, whichever is greater.

7.1.3. Indirect Forced Circulation

Indirect Forced Circulation systems include active closed loop glycol systems, closed loop drainback systems and closed loop recirculation systems.

Closed loop glycol systems use a mixture of propylene glycol and water as the heat transfer fluid. The low freezing point of propylene glycol ensures freeze protection.

Closed loop drainback systems use water as a heat transfer fluid. When there is no heat to be collected from the solar collectors, the water drains out of the collectors and into a drainback tank located indoors.

Closed loop recirculation systems circulate water from the solar storage tank to the solar collectors when the temperature of the water in the collectors drops and poses a freezing risk. Closed loop recirculation systems must have at least two separate freeze protection mechanisms, and at least one of these mechanisms must be designed to function in the event of a power failure during low temperature conditions.

7.1.4. Thermosiphon

Thermosiphon systems using a propylene glycol/water mixture as the heat transfer fluid are eligible for SWHP rebates, while systems using potable water as a heat transfer fluid are not eligible.

7.1.5. Air Collectors

Air collectors are not at risk of freeze damage and thus do not require freeze protection.

7.2. Stagnation/Overheat Protection for Fluid Collectors

SWH systems exposed to prolonged periods of solar exposure without any hot water load are vulnerable to stagnation conditions. Under stagnation conditions, the heat transfer fluid in the collectors reaches boiling, which can cause the fluid to degrade and corrode the inside of the SWH system. Stagnation conditions may occur as a result of:

- Oversizing a system, so that actual hot water demand is much less than the heat captured by the SWH system
- Temporarily low hot water demand – for example if a family goes on vacation during a hot period during the summer, or a school dormitory that is largely vacant during the summer months.
- Poor system design, whereby the heat collected by the SWH system is not effectively transferred to the domestic hot water supply.

ICS systems that contain potable water in the collector, and direct forced circulation commercial pool systems do not require stagnation protection.

All closed loop glycol systems must have one of the following stagnation protection mechanisms, to ensure that the system can withstand extended periods of stagnation conditions without system degradation. Manufacturer recommendations for stagnation protection must be followed.

7.2.1. Advanced Controller with a Vacation or Holiday Mode

This mechanism shuts off the system's pump when the solar storage tank has reached its upper limit. The pump will turn on at night, allowing the system to radiate heat out to the night sky, effectively cooling the system. This mechanism requires that the system is programmed and subsequently activated by the Host Customer or System Owner.

7.2.2. Advanced Controller with a Thermal Cycling Function

This mechanism allows the solar storage tank to exceed its high temperature limit. In this way, the solar storage tank is able to continue to act as a heat sink, allowing the glycol mixture in the solar collectors to avoid stagnation temperatures.

7.2.3. Heat Dump Radiator

A heat dump radiator is located outside and allows heat from the heat transfer fluid to be dissipated to the atmosphere, thus cooling the heat transfer fluid.

7.2.4. Swimming Pool and Spa Heat Dump

A swimming pool or spa may serve as a heat dump, and thus provide a stagnation protection mechanism. Water entering the pool or spa may not exceed 100 °F, and the heat dump mechanism may only be activated when the fluid in the collector reaches the upper stagnation limit, and is not to exceed 180 °F.

7.2.5. Steam Back

A steam back system with an expansion tank allows water in the glycol/water mixture to boil at high temperature, creating steam. This steam then pushes the remaining heat transfer fluid out of the solar collectors and into an expansion tank or heat dump radiator, where it can cool.

7.2.6. Pressure Stagnation Protection (PSP)

This mechanism employs an over-sized pressure relief valve of 150 pounds per square inch. This higher pressure allows the heat transfer fluid to reach higher temperatures before boiling, keeping it in a liquid form.

8. Metering Requirements

Metering is recommended for all SWH systems, to ensure that the system is functioning well, and providing benefit to the customer. Additionally, metering of systems can help to alert the Host Customer to issues with the SWH system. For smaller SWH systems, installing advanced metering may represent a large cost as a proportion of the total system cost, and may therefore be cost prohibitive.

SWHP requires that all SWH systems with a capacity of 30 kilowatt-thermal (kWth) or greater install a Customer Performance Meter (CPM). The CSI-Thermal Program maintains an approved list of CPM which can be used as reference for SWHP and is accessible at <https://www.csithermal.com/meters/>. If the solar contractor wishes to use a CPM not included in the CSI-Thermal list, please contact the PA. CPM equipment consists of a flow meter, temperature sensors, and a calculator.

Approved CPM must have a maximum permissible error of $\pm 2\%$ at full flow for the flow meter, and $\pm 1\%$ for the temperature sensors.

The CPM equipment may be installed on either the demand side or on the collector loop of the SWH system.

9. Onsite Field Inspection Process

The SWHP PA will be responsible for conducting onsite field inspections at no cost to the Applicant. The first three rebate claims submitted by a new contractor for systems less than or equal to 250 kWth, and the first three rebate claims for projects greater than 250 kWth will be subject to mandatory inspection. Once the three mandatory inspections have been completed, a random sample of that contractor's subsequent projects will be subject to field inspection. The SWHP PA reserves the right to perform field inspections on all projects that claim a rebate, regardless of whether the contractor has already completed their first three inspections.

The PA will contact the Host Customer and Applicant to schedule onsite field inspections. While the contractor is not required to attend field inspections, it is strongly encouraged.

9.1. Tolerances

SWHP will tolerate the following discrepancies for the SOF and shade factors:

- Tilt: $\pm 3^{\circ}$
- Azimuth: $\pm 5^{\circ}$
- Shading: $\pm 5\%$

A rebate recalculation will be required for any project that falls outside of these tolerances. Additionally, other discrepancies between the RCF and what was found on-site by the inspector may trigger a rebate recalculation. These discrepancies include, but are not limited to, the number and size of collectors, the solar storage tank capacity, the heat exchange configuration and heat transfer fluid, and set points for the SWH or the backup water heater.

9.2. Infractions

Minor discrepancies found during the field inspection will result in an infraction. An infraction does not require a rebate recalculation or corrective action, but multiple infractions may result in a failure. An infraction will be issued for the following items:

- A rebate recalculation that is $\pm 5\%$ of the original rebate
- Failure to provide accurate documentation on a timely and consistent basis

9.3. Failure items

An inspection will result in a failure in the following cases:

- A rebate recalculation that is $\pm 10\%$ of the original rebate
- Major discrepancies between what was installed and what was included on the RCF and/or failure to meet program requirements. A complete list of failure items can be found on the Inspection Checklist, accessible at: www.longbeach.gov/energyresources/information/rebates/

Failure items require corrective action by the solar contractor to claim the rebate. Inspection failures will be tracked by contractor and can result in suspension or removal from the program.

9.4. Notification of Inspection Results

The PA will notify the Host Customer and solar contractor of the results of the field inspection via email. If the project passed its field inspection, the PA will process the rebate claim for payment.

If the project failed its field inspection, the solar contractor will have 30 days to address any failure items and alert the PA to their correction. The PA may accept photographic proof of correction to failure items or may elect to conduct an additional field inspection to verify the corrections.

9.5. Failure Sanctions

9.5.1. Probation

A solar contractor that receives three failures in a rolling twelve-month period will be placed on a six-month probation. During that period, the solar contractor must attend a

free Contractor and Self-Installer workshop. All applications associated with the contractor will be put on hold until they have completed the workshop.

9.5.2. Suspension

A solar contractor that receives five failures in a rolling twelve-month period will be suspended from the program for six months. During this suspension period, all projects associated with the contractor will also be suspended. The suspended contractor will be required to complete a Contractor and Self-Installer workshop prior to being reinstated to the program.

9.5.3. Disqualification

A solar contractor may be immediately disqualified from the program for fraudulent behavior or gross negligence, including, but not limited to, the following:

- Operation under a false CSLB number or a CSLB number belonging to another contractor
- Failure to disclose additional sources of rebates for the SWH system
- Claiming a rebate for a system that was not installed
- Forged paperwork
- Purposefully providing false information or installing ineligible equipment

In the event that a solar contractor is disqualified from the program, the Host Customer will have the opportunity to hire a new solar contractor to complete work under their existing rebate reservation.

10. Rebate Claim Process

All SWHP projects will be subject to two-step applications, whereby rebate funds are first reserved for a project, and then claimed at a later date once the SWH system has been installed and received a final permit sign-off by the AHJ. This section details the steps for reserving and claiming a rebate.

All application documents should be submitted as PDF via email to the SWHP Program Administrator at: swhp@longbeach.gov

Hard copies may be mailed to the PA at the following address:

Center for Sustainable Energy
Attn: City of Long Beach Solar Water Heating Rebate Program
3980 Sherman St. Suite 170
San Diego, CA 92110

10.1. Step 1. Submit Reservation Request Form Package

All SWHP projects will begin by submitting a Reservation Request package. The Reservation Request package includes the following items:

- A completed Reservation Request Form (RRF) with all required signatures

- Proof of a completed energy audit or Title 24 documentation from no more than three years prior to the date of RRF submission. This requirement does not apply to Commercial Pools
- A copy of City of Long Beach Utility Services natural gas bill for the project site that shows natural gas usage for the previous 12 months
 - The bill must be from the previous six months, and the Host Customer name, address, and account and meter numbers must be visible and legible
 - For new construction projects where there is no historical natural gas usage, verification of natural gas service to the project site will be required in lieu of actual natural gas bills
- A copy of a fully executed purchase agreement for the SWH system, and any alternative system ownership agreements in the case of a third-party owned SWH system. The purchase agreement must include the following:
 - Name, address and contractor license number of the company installing the SWH system
 - Site address for the system installation
 - Description of the work to be performed
 - Quantity, make and model for the collectors, storage tank and CPM (if applicable). These should correspond to the make and model listed on the OG-100 or OG-300 certifications
 - Purchase price of the SWH system before any rebates, tax credits or other subsidies
 - Language indicating the purchaser's commitment to purchase the system – i.e. this should not simply be a quote where there is no intent to purchase on the part of the Host Customer or System Owner
 - Printed names and signatures of the purchaser, installation company and equipment seller (if different from the installation company)
 - Payment terms, including dates or milestones and dollar amounts
 - Estimated SWHP rebate amount and how the rebate will be applied
- A copy of the rebate calculator results used to estimate the rebate for the project
- For projects that exceed the maximum GPD sizing guidelines – a justification document signed by a State of California licensed P.E.
- Supporting documentation for low-income applicants that substantiates the low-income status of both the Host Customer and the property where the SWH system will be installed (see Section 2 for low-income requirements)

A reservation is not confirmed until written notice has been provided by the PA. Any costs incurred by the Host Customer, solar contractor or any other party involved in the installation or ownership of the SWH system are at the party's own risk prior to receiving a confirmed rebate reservation.

Once the PA has reviewed, approved and deemed complete the submitted documentation, confirmation will be provided to the Applicant and Host Customer via email.

10.2. Step 2. Submit Rebate Claim Form Package

Single family residential projects will have 6 months from the date of reservation confirmation to complete their project and claim their rebate. Multifamily/Commercial, Commercial Pools and Industrial Applications will have 18 months from the date of reservation confirmation to complete the project and claim their rebate.

Once the SWH system has been installed, is operational and has passed inspection by the appropriate AHJ, the Applicant may submit the rebate claim package. The rebate claim package includes the following documents:

- Rebate Claim Form (RCF) with all required signatures
- Final signed-off permit from the AHJ, issued no more than 24 months prior to the RCF submittal date
- Updated rebate calculator results, if the installed equipment differed from that included on the RRF

Note that the final rebate will be determined by the actual SWH equipment installed at the site and may differ from the reserved amount. If program rebate funds become fully subscribed, projects where the final calculated rebate is greater than the reserved rebate amount may only be awarded the original reservation amount.

The PA will review the submitted documentation and provide written notice via email if the documentation has been deemed complete, or if additional documentation is needed. If a field inspection is required, the PA will provide notice via email to the Applicant and Host Customer that the documentation has been deemed complete and will begin to schedule the field inspection. If a field inspection is not required, the PA will process the rebate application for payment.

10.3. Extending the Reservation Expiration Date

If the Applicant fails to submit the rebate claim package by the reservation expiration date, the PA reserves the right to cancel the rebate reservation. Written notice will be provided to the Applicant and the Host Customer via email if a reserved rebate is cancelled.

If the Applicant will be unable to submit the rebate claim package prior to the reservation expiration date, they may request a maximum of one 180-day extension. An extension request must be submitted in writing to the PA and must provide compelling justification for requiring additional time to complete the project. Common justifications include unforeseen delays in obtaining materials or permits and unforeseen technical issues that delay

installation. The PA reserves the right to deny an extension request if the reason for delay could have been reasonably foreseen by the parties involved.

10.4. Payment Process

Once all project documentation has been deemed complete, and the project has passed its field inspection (if required), the PA will provide written notice of rebate approval, and will process the rebate application for payment. Payment will be made to the Payee indicated on the RCF within 90 days of the rebate approval.

11. Right to Audit

The PA reserves the right to conduct spot checks or audits to verify that rebate payments have been made as identified on the RCF. To complete this audit, the PA may ask program participants to submit cancelled checks, credit card statements or other documentation to substantiate payments that have been made. Applicants will be allowed to remove sensitive information from this documentation prior to submittal.

Appendix A: Acronyms

- AB: Assembly Bill
- CSE: Center for Sustainable Energy
- CEC: California Energy Commission
- CPM: Customer Performance Metering
- CSI: California Solar Initiative
- CSI-Thermal: California Solar Initiative Thermal Program
- CSLB: Contractors State License Board
- DAC: Disadvantaged Community
- DHW: Domestic Hot Water
- ESAP: Energy Savings and Assistance Program
- FTL: Freeze Tolerance Level
- GPD: Gallons Per Day
- IAPMO: International Association of Plumbing and Mechanical Officials
- RCF: Rebate Claim Form
- kWth: Kilowatt-thermal
- SWHP: Long Beach Solar Water Heating Incentive Program
- LIWP: Low-income Weatherization Program
- LIHEAP: Low-income Home Energy Assistance Program
- M&E: Measurement and Evaluation
- PA: Program Administrator
- P.E.: State of California licensed Professional Engineer
- RRF: Reservation Request Form
- SOF: Surface Orientation Factor
- SRCC: Solar Rating and Certification Corporation
- SWH: Solar Water Heating

Appendix B: Definitions

Applicant: The Applicant is the entity that completes and submits the application and serves as the main contact person for the PA throughout the application process. The eligible solar contractor or self-installer will be the Applicant for 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 SWHP, unless expressly stated otherwise, refer to true, not magnetic, azimuth.

Collector Area: Solar thermal collector specifications often refer to multiple areas including gross, aperture, and absorber. For the purposes of SWHP, the gross collector area will be used when referring to collector area.

Commercial: Commercial customers in SWHP will be determined by their natural gas service and are considered to be all customer classes other than single family residential and multifamily residential customers.

Contractor: A person or business entity who contracts to erect buildings, or portions of buildings, or systems within buildings. Under SWHP, the term contractor refers to a contractor licensed by the California State License Board (CSLB).

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

Disadvantaged Community (DAC): A community identified by the California Environmental Protection Agency (CalEPA) pursuant to Section 39711 of the Health and Safety Code. CalEPA's Office of Environmental Health Hazard Assessment defines a disadvantaged community as "the highest scoring 25% of census tracts from CalEnviroScreen 3.0, as well as census tracts with a score in the top 5% of CalEnviroScreen's Pollution Burden but do not have an overall CalEnviroScreen score because of unreliable socioeconomic or health data.

Domestic Hot Water (DHW): Heated water that is used for domestic purposes, including, but not limited to drinking, food preparation, sanitation and personal hygiene. Domestic hot water does not include end uses where the heated water is not consumed, such as space heating, space cooling or swimming pool heating.

Equipment Seller: Equipment Seller in SWHP refers to retail sellers of solar water heating equipment, 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 solar thermal system will be located. Any class of customer is eligible to be a Host Customer.

Industrial Application/Process Heat: For SWHP, an industrial application is a process heating application that uses heat to produce basic materials and commodities. Where solar water heating is used for process heat, the solar-heated water is not consumed as part of the process, but rather serves as a medium to carry heat for the process.

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 solar thermal ratings equivalent to OG-100 and OG-300 standards.

Kilowatt-thermal (kWth): A unit of measurement that approximates the amount of energy produced by solar thermal collectors. Each square meter of collector space equals 0.7 kWth. Based on this calculation, 30 kWth is equivalent to 462 square feet of fluid collectors or 855 square feet of air collectors. Fluid collectors include unglazed, glazed, evacuated tube collectors.

Lessor: A person or entity who rents property to another under a lease. Under the CSI Program, in the case of a third-party owned system (or leased system, for example), the lessor is classified as the System Owner.

Multifamily residential properties: Multifamily 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 rebate levels and 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. To be eligible for SWHP rebates, a new construction project must have natural gas service, and intend to use natural gas for water heating.

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 certification provides a means for evaluating performance of solar collectors under a certain standard set of operating conditions.

OG-300: Operating Guidelines 300 (OG-300) is a comprehensive certification standard for an entire SWH system. The OG-300 certification was developed by SRCC and aims to improve performance and reliability of solar products by establishing minimum criteria for design, reliability and durability, safety, operation and servicing, installation, and operation and maintenance manuals.

One-Tank System: A system where the solar storage and auxiliary heater heat the same tank in such a way that the solar contribution cannot be individually monitored.

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

Pool Heating: A solar pool heating system is a solar energy device that has the primary purpose of reducing consumption of natural gas for heating pool water. For SWHP, solar pool heating systems include multifamily residential, governmental, educational, commercial and nonprofit solar pool heating systems, but do not include single-family residential solar pool heating systems or seasonal commercial pools.

Program Administrator (PA): For purposes of SWHP, the Center for Sustainable Energy is the Program Administrator.

Project: For SWHP, a “Project” is a SWH system installation at a project site within the Energy Resources territory that receives retail level natural gas service from Long Beach Energy Resources and submits a SWHP rebate claim.

PUC 2861: Public Utility Code 2861(e) defines “Low-income residential housing” to mean either of the following:

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.

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.

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 solar thermal system on their individual property without the assistance of a solar contractor.

Shade Factor: This is a measure of the amount of shading of solar collectors in a SWH installation. For SWHP, shade factor is measured between 10:00 am and 3:00 pm. A site that receives no shade during this time period will receive a shade factor of 1.0.

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: A site is defined as the Host Customer’s premises, consisting of all the real property and apparatus located on a contiguous parcel of land. An exception to this definition is a parcel of land under the same ownership that is divided by a dedicated street, highway or other public thoroughfare or railway.

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 solar thermal systems.

Solar Thermal System: A solar thermal system uses collectors to capture energy from the sun to produce heat for a variety of applications. For the purposes of SWHP, eligible applications include heating water for domestic use and providing process heating for industrial applications.

Surface orientation factor (SOF): The surface orientation factor refers to the orientation of the SWH system collectors relative to the sun, and is comprised of both the tilt (as measured from

horizontal) and the azimuth of the collectors (true north). The ideal SOF is a value of 1.0 and the minimum SOF required to receive an incentive is 0.60.

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 propane, 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 solar thermal system at the time the incentive is paid. For projects where a vendor sells a SWH system to a Host Customer, the Host Customer becomes the system owner. For leased systems, the lessor would be 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.

Two-Tank System: A system where solar heat is delivered to a water storage tank that is separate from the auxiliary heating system. The solar contribution can be individually monitored in a two-tank system.

Appendix C: Surface Orientation Factor (SOF) Chart

The chart below shows SOF based on various tilt and azimuth configurations. For the sake of consistency with similar SWH rebate programs, this chart has been reproduced from the CSI-Thermal Program Handbook. To be eligible for an SWHP rebate, a system must have a minimum SOF of 0.6. “NE” indicates that the SOF resulting from the combination of tilt and azimuth is less than 0.6, and a system with that orientation would thus not be eligible for an SWH rebate.

		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	0.7*	0.65	0.6	NE	NE	NE	NE	NE	NE
	60-69	0.8*	0.8	0.75	0.65	0.6	NE	NE	NE	NE
	70-79	0.85*	0.8	0.75	0.7	0.65	NE	NE	NE	NE
	80-89	0.85*	0.8	0.75	0.75	0.7	0.6	NE	NE	NE
	90-99	0.85*	0.85	0.85	0.8	0.75	0.65	0.6	NE	NE
	100-109	0.85*	0.85	0.85	0.8	0.8	0.7	0.65	NE	NE
	110-119	0.85*	0.9	0.9	0.9	0.9	0.75	0.7	NE	NE
	120-129	0.85*	0.9	0.9	0.9	0.9	0.8	0.75	0.6	NE
	130-139	0.85*	0.9	0.9	0.9	0.9	0.8	0.8	0.7	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	0.6
	160-169	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	0.6
	170-179	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	0.6
	180-189	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	0.6
	190-199	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	0.6
	200-209	0.85*	1.00	1.00	1.00	1.00	0.85	0.85	0.75	0.6
	210-219	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	0.6
	220-229	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	0.6
	230-239	0.85*	0.95	0.95	0.95	0.95	0.85	0.85	0.75	0.6
	240-249	0.85*	0.85	0.85	0.85	0.75	0.75	0.75	0.7	0.6
250-259	0.85*	0.85	0.85	0.85	0.75	0.75	0.75	0.65	0.6	
260-269	0.85*	0.85	0.85	0.85	0.75	0.75	0.75	0.65	NE	
270-279	0.85*	0.8	0.75	0.75	0.75	0.75	0.75	0.6	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	0.65*	0.6	NE							

Appendix D: Maximum Gallons per Day (GPD) Guidelines for multifamily/commercial projects

To maintain consistency with other similar SWH rebate programs, sizing guidelines from the CSI-Thermal Program have been adopted for SWHP. These guidelines have been reproduced from the CSI-Thermal Program Handbook. Any changes to the CSI-Thermal guidelines would require independent review by the SWHP PA and will not necessarily be effective for SWHP.

TYPE OF BUILDING	GPD
APARTMENTS/CONDOS: # OF UNITS	
2 – 20	42 per unit
21 – 50	40 per unit
51 – 100	38 per unit
101 – 200	37 per unit
201 +	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



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