

CALIFORNIA SOLAR INITIATIVE-THERMAL



PROGRAM HANDBOOK

December 2011



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December 2011 Handbook: What's New

On November 10, 2011, the CPUC modified Decision 10-01-022 to allow payment of incentives to solar water heating systems that displace propane usage for electric customers of PG&E, SCE and SDG&E. In addition, a separate decision was issued to accept solar water heating certifications rendered by the International Association of Plumbing and Mechanical Officials (IAPMO). These decisions required certain handbook modifications requested in the Pacific Gas & Electric Advice Letter 3264-G/3968-E, submitted on December 9, 2011, which was jointly filed by Southern California Edison, Advice Letter 2671-E, Southern California Gas Company, Advice Letter 4308-G, and the California Center for Sustainable Energy, Advice Letter 26. These Advice Letters made the following changes to the Handbook:

*Introduction to CSI-Thermal Program
Affected Sections 1.1 and 1.2*

*Program Eligibility Criteria and Requirements
Affected Sections 2.1.1.1, 2.1.1.3, 2.2.3 and 2.2.4*

*CSI-Thermal Program Incentive Structure
Affected Sections 3.1, 3.2 and 3.4*

*Application Forms and Documentation
Affected Sections 4.7.4*

*Onsite Field Inspection Process
Affected Sections 4.8.4*

*Technical Requirements
Affected Sections 6.1 and 6.2*

*System Sizing
Affected Section 6.3.1*

*Meter, Monitoring, and Communication Requirements
Affected Section 6.4.4.3*

Appendix A: Acronyms

Appendix B: Definition and Glossary

Appendix H: Instructions for "Meter Actual Consumption" Method

Table of Contents

1. Introduction to CSI-Thermal Program	1
1.1 Program Background	1
1.2 Program Budget	2
1.3 Program Goals	3
1.4 Program Administrator Contact Information.....	3
1.5 CSI-Thermal Handbook Structure.....	4
2. Program Eligibility Criteria and Requirements	4
2.1 Participants in the CSI-Thermal Program	4
2.1.1 Host Customer	4
2.1.2 System Owner.....	6
2.1.3 Applicant	6
2.1.4 Solar Contractor.....	6
2.1.5 Suspended Solar Contractor.....	7
2.1.6 Self-Installer	8
2.1.7 Equipment Sellers	8
2.1.8 Program Performance Data Providers.....	8
2.2 Equipment Eligibility and Requirements.....	8
2.2.1 Eligible Equipment	8
2.2.2 End Use Eligibility	10
2.2.3 Ineligible Technology and System Applications.....	10
2.2.4 Permit Requirements	11
2.3 Shade Factor.....	11
2.4 Surface Orientation Factor	12
2.5 Warranty Requirements	12
2.5.1 Contractor-Installed Systems.....	12

Table of Contents

2.5.2 Self-Installed Systems.....	12
2.6 Energy Efficiency Requirements	13
2.6.1 Energy Efficiency Audit	13
2.6.2 Pipe Insulation.....	13
2.7 Metering Requirements	13
2.7.1 Measurement and Evaluation	14
2.7.2 Customer Performance Monitoring (capacity over 30 kW _{th}).....	15
2.7.3 70/30 True-Up (capacity over 250 kW _{th}).....	15
2.8 Performance and Permanency Requirements.....	15
2.9 Onsite Field Inspections	15
3. CSI-Thermal Program Incentive Structure	16
3.1 Single-Family Incentives	16
3.1.1 Natural Gas	17
3.1.2 Electric/Propane.....	17
3.2 Multi-Family/Commercial Incentives	18
3.2.1 Natural Gas	18
3.2.2 Electric.....	19
3.2.3 Lump-sum and 70/30 True-up Incentive Payments for Multi-Family/Commercial Systems.....	19
3.3 Multiple Orientation Arrays.....	21
3.3.1 Determine Weighted Average SOF	21
3.3.2 Determine Weighted Average Shade Factor	21
3.4 CSI-Thermal Program Incentive Calculator	21
3.4.1 OG-300 Incentive Calculator.....	21
3.4.2 OG-100 Multi-Family/Commercial Incentive Calculator	22
3.5 Incentive Limitations.....	23

Table of Contents

3.5.1 Total Eligible Project Cost.....	23
3.5.2 Reportable Project Costs	24
3.5.3 Other Incentives or Rebates	24
4. Application Process for CSI-Thermal Program	25
4.1 Single-Family Residential Project Application Process.....	26
4.2 Multi-Family/Commercial Project Application Process (capacity of 30 kW _{th} or less).....	26
4.2.1 Step No. 1: Submit Reservation Request Form Package.....	27
4.2.2 Step No. 2: Submit Incentive Claim Form Package.....	27
4.3 Multi-Family/Commercial Project Application Process (capacity over 30 kW _{th}).....	28
4.3.1 Step No. 1: Submit Reservation Request Form Package.....	28
4.3.2 Step No. 2: Submit Proof of Project Milestone Package	31
4.3.3 Step No. 3: Submit Incentive Claim Package	31
4.4 Application Review Process.....	32
4.4.1 Incomplete Reservation Request Form Package	32
4.4.2 Approval of Reservation Request Form Package.....	32
4.4.3 Reservation Period.....	32
4.5 Changes to Reservations.....	33
4.5.1 System Changes.....	33
4.5.2 Withdrawal	33
4.5.3 Extending the Reservation Expiration Date	33
4.5.4 Transfer of Reservation from one Site to Another	34
4.6 Payment Process	35
4.6.1 Incomplete Incentive Claim Form Packages	35
4.6.2 Incentive Check Payment and Terms	35
4.7 Application Forms and Documentation	36

Table of Contents

4.7.1 Reservation Request Form	36
4.7.2 Incentive Claim Form	36
4.7.3 Energy Efficiency Audit or Title 24 Documentation.....	36
4.7.4 Executed Agreement of SWH System Purchase and Installation	36
4.7.5 Executed Alternative System Ownership Agreement	37
4.7.6 Final Signed-off Permit.....	37
4.7.7 Federal Government's Certificate of Acceptance	37
4.7.8 Authorization to Receive Customer Information or Act on a Customer's Behalf	38
4.7.9 Application Fee	38
4.7.10 GPD justification (If building type is not on Maximum GPD Guideline Table)	38
4.7.11 System Sizing Justification	38
4.7.12 Stagnation Protection Method Documentation	38
4.7.13 Certificate of Calibration.....	38
4.7.14 Reduced Solar Storage Tank Justification (If volume is less than requirements stated in Section 6.3.2.2)	38
4.7.15 Multi-Family/Commercial Combination Systems Documentation	39
4.8 Onsite Field Inspection Process.....	39
4.8.1 Trained Inspectors	39
4.8.2 Tolerances	39
4.8.3 Infractions.....	39
4.8.4 Failure Items	40
4.8.5 Notification of Inspection Results.....	41
4.8.6 Failure Sanction	42
5. Disqualification and Right to Audit	42
5.1 Grounds for Immediate Disqualification from the CSI-Thermal Program	42

Table of Contents

5.2 Disqualification Sanctions	43
5.3 Dispute Resolution	43
5.4 Right to Audit.....	43
6. Technical Requirements.....	44
6.1 Freeze Protection	44
6.1.1 Integral Collector Storage	44
6.1.2 Direct Forced Circulation.....	44
6.1.3 Indirect Forced Circulation	45
6.1.4 Thermosiphon	45
6.1.5 Air Collectors	45
6.2 Stagnation/Overheat Protection for Fluid Collectors.....	46
6.2.1 Advanced Controller with a Vacation or Holiday Mode.....	46
6.2.2 Advanced Controller with a Thermal Cycling Function	46
6.2.3 Heat Dump Radiator	46
6.2.4 Swimming Pool and Spa Heat Dump.....	46
6.2.5 Steam back	47
6.2.6 Pressure Stagnation Protection (PSP).....	47
6.2.7 Hartstat.....	47
6.3 System Sizing.....	47
6.3.1 Single-Family Projects	48
6.3.2 Multi-Family/Commercial Projects	48
6.4 Minimum Metering Equipment Requirements	49
6.4.1 Requirements for Opt-In Program Measurement and Evaluation (M&E)	49
6.4.2 Requirements for Customer Performance Monitoring (systems >30 kW _{th})	50
6.4.3 Requirements for 70/30 True-Up Payment Customers (> 250 kW _{th}).....	51

Table of Contents

6.4.4 Minimum Program Performance Data (PPD) Requirements for 70/30 True-up and all Opt-in M&E Metering	52
Appendix A: Acronyms	57
Appendix B: Definitions and Glossary	59
Appendix C: Surface Orientation Factor (SOF) Chart.....	64
Appendix D: GPD Guidelines for Multi-Family/Commercial Projects.....	65
Appendix E: Instructions for Qualifying as a PPD Provider	66
Appendix F: Record Low Temperatures in CEC Climate Zones.....	73
Appendix G: Metering Equipment Approval Process.....	74
Appendix H: Multi-Family and Commercial Sizing Instructions for	77

1. Introduction to CSI-Thermal Program

1.1 Program Background

In 2006 the California Public Utilities Commission (CPUC) authorized the California Solar Initiative (CSI), a \$2.16 billion incentive program to promote solar development through 2016. The CSI program was authorized by Public Utilities Code 2851, created by Senate Bill (SB) 1 (Murray, 2006). The solar program has a goal to install 1,940 megawatts (MW) of new solar generation and to help create a sustainable solar industry. The CSI program is funded from the distribution rates of the electric ratepayers of Pacific Gas and Electric Company (PG&E), Southern California Edison Company (SCE) and San Diego Gas & Electric Company (SDG&E). (See Decisions (D.) 06-01-024 and D.06-12-033). The CPUC allowed \$100.8 million of total CSI funds to be used for incentives for solar thermal technologies that displaced electricity usage, but deferred allowing solar water heating (SWH) technologies to be eligible for CSI until after a pilot program for SWH was conducted in SDG&E territory. Starting in July 2007, the California Center for Sustainable Energy (CCSE) administered a \$2.59 million pilot program for SWH incentives in the SDG&E territory. In D.08-06-029, the CPUC made minor modifications to the pilot and allowed it to run until December 31, 2009 or until the budget is exhausted, whichever occurred first.

In 2007, the legislature authorized the extension of the solar program by allowing a new program to be funded by natural gas ratepayer with the passage into law of Assembly Bill (AB) 1470 (Huffman, 2007). AB 1470 created Public Utilities Code 2860-2867 which authorizes the CPUC to create a \$250 million incentive program to promote the installation of 200,000 SWH systems in homes and businesses that displace the use of natural gas by 2017. The statute requires the CPUC to evaluate data from the SWH Pilot Program and determine whether an SWH program is "cost effective for ratepayers and in the public interest" before designing and implementing an incentive program for gas customers.

On January 21, 2010, the CPUC established the CSI-Thermal Program in D.10-01-022, allocating funds for both natural gas- and electric-displacing solar thermal system incentives, including SWH technologies in all investor-owned utility territories. The CPUC established the incentive structure, the program administration details, and other key CSI-Thermal Program rules. The CPUC designated that the Program Administrators (PAs) for the CSI-Thermal Program are PG&E, Southern California Gas Company (SCG), SCE, and CCSE for the SDG&E service territory. This CSI-Thermal Program Handbook (Handbook) contains the detailed requirements and guidelines for participation in the CSI-Thermal Program, and this Handbook is consistent with both Public Utilities Code and Commission D.10-01-022.

On November 10, 2011, the CPUC issued D.11-11-005 which modifies D.10-01-022 to allow for payment of incentives to solar water heating systems that displace propane usage for electric customers of PG&E, SCE or SDG&E. In addition, also on November 10, 2011, the CPUC issued D.11-11-004 which modifies D.10-01-022 to include the International Association of Plumbing and Mechanical Officials (IAPMO) as an accredited listing agency for the CSI-Thermal Program along with Solar Rating and Certification Corporation (SRCC). The Decision notes that when SWH systems have SRCC ratings from two or more certifying entities, the CSI-Thermal Program will accept only the lowest of the ratings, to eliminate motivation for solar equipment manufacturers to "shop around" for the highest rating.

1.2 Program Budget

The total incentive budget for the CSI-Thermal Program is approximately \$280.8 million. Of this total, \$180 million is allocated for natural gas-displacing SWH systems (not including low-income incentives¹), as authorized by AB1470, and up to \$100.8 million for electric-displacing and propane-displacing² systems, as authorized by SB1. Incentive dollars will be allocated between two customer classes, single-family residential and multi-family/commercial, as follows:

- 40 percent of the total gas incentive budget is reserved for single-family residential customer SWH systems, and
- 60 percent of the total gas incentive budget is reserved for multi-family/commercial SWH systems. Funds may be moved from the multi-family/commercial budget to the single-family residential budget, but not vice versa;

The incentive budget is split proportionately among the PAs based on the size of their respective service territory. Table 1 displays the incentive allocation percentage and budget amount by PA for natural gas-displacing SWH systems. Table 2 displays the incentive allocation percentage and budget amount by PA for electric/propane-displacing SWH systems.

**Table 1
Total Incentive Allocation per Program Administrator for
Natural Gas-Displacing SWH Systems**

PA	Budget Allocation	Total Incentive Budget (in millions)
PG&E	39.0%	\$70.2
CCSE	10.0%	\$18.0
SCG	51.0%	\$91.8
Total	100.0%	\$180.0

**Table 2
Maximum Incentive Allocation per Program Administrator for
Electric/Propane-Displacing SWH Systems**

PA	Budget Allocation	Maximum Incentive Budget (in millions)
PG&E	43.7%	\$44.0

¹ Decision 10-01-022 sets aside \$25 million for low-income customers. However, to implement the CSI Thermal Program in early 2010, the Commission decided to address the detailed comments by parties on the design of a low-income CSI Thermal Program in a separate decision.

² On November 10, 2011 the CPUC modified Decision 10-01-022 to allow payment of incentives to solar water heating systems that displace propane usage for customers of PG&E, SCE and SDG&E. Incentives for propane-displacing systems will count against Step 10 of the CSI general market photovoltaic program.

CCSE	10.3%	\$10.4
SCE	46.0%	\$46.4
Total	100.0%	\$100.8

1.3 Program Goals

The CSI-Thermal Program is designed to significantly increase the adoption rate of SWH technologies into the California marketplace. The program strategy and design principles will address the barriers to growth, namely installation costs, lack of public knowledge about SWH, permitting costs and requirements, and a potential shortage of experienced installers. The primary goals of the CSI-Thermal Program include the following:

- Significantly increase the size of the SWH market in California by increasing the adoption rate of SWH technologies, including:
 - Achieving the installation of natural gas-displacing systems that displace 585 million therms (equivalent to 200,000 single-family residential systems) over the 25-year life of the systems;
 - Achieving the installation of electric-displacing SWH systems that displace 275.7 million kilowatt hour (kWh) per year (equivalent to 100,800 single-family residential systems); and
 - Achieve an expansion of the market for other solar thermal technologies that displace natural gas and electricity use, in addition to SWH.
- Support reductions in the cost of SWH systems of at least 16 percent through a program that increases market size and encourages cost reductions through market efficiency and innovation;
- Engage in market facilitation activities to reduce market barriers to SWH adoption, such as high permitting costs, lack of access to information, and lack of trained installers;
- Increase consumer confidence and understanding of SWH technology and their benefits.

1.4 Program Administrator Contact Information

California Center for Sustainable Energy (SDG&E territory):

CSI-Thermal Program
 8690 Balboa Ave Suite 100
 San Diego, CA 92123
 Phone: (877) 333-SWHP
 Email: swh@energycenter.org
 Website: www.energycenter.org/swh

Pacific Gas and Electric:

PG&E Solar and Customer Generation: CSI-Thermal
 PO Box 7433
 San Francisco, CA 94120

Overnight Deliveries

PG&E Solar and Customer Generation
245 Market St., MC N7R
San Francisco, CA 94105-1797
Phone: (877) 743-4112
Email: solar@pge.com
Website: www.pge.com/csithermal

Southern California Gas Company:
CSI-Thermal Program
555 W. Fifth Street ML GT22H4
Los Angeles, CA 90013
Phone: (800) GAS-2000
Email: sw@socialgas.com
Website: www.socialgas.com/rebates/solar

Southern California Edison:
Attn: CSI Thermal Program Administrator
P.O. Box 800
Rosemead, CA 91770-0800
Phone: (866) 584-7436
Email: CSIGroup@sce.com
Website: www.sce.com/csithermal

CSI-Thermal Program website: www.gosolarcalifornia.org/solarwater

1.5 CSI-Thermal 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 of 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

Items listed throughout Section 2 address the criteria and requirements that must be met for a project to be deemed eligible for an incentive. Many of these items are further detailed in Section 4, which outlines the application process.

2.1 Participants in the CSI-Thermal Program

2.1.1 Host Customer

For the CSI-Thermal Program, the 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. To be eligible to receive an incentive, the Project Site must be within the service

territory of, and receive retail level gas or electric service³ from, PG&E, SCE, SCG, or SDG&E. The Host Customer shall always be party to the CSI-Thermal Program contract and will retain sole rights to the incentive and the reservation for multi-family/commercial projects.

In circumstances where the Host Customer is not on the Gas or Electric Service Provider Account, a letter of explanation must be sent to the PA explaining the relationship of the Host Customer to the person(s) who is on the utility service account.

2.1.1.1 Customer Class

This program consists of two customer classes: single-family residential and multi-family/commercial. For purposes of the CSI-Thermal Program, commercial customers include all non-residential customer classes. Each class is further broken down into natural gas water heating customers, electric water heating customers, and propane water heating customers.

The CSI-Thermal Program customer class and incentive rate will be determined by the utility rate schedule of the Host Customer. In cases where the requested customer class differs from the classification of the Host Customer utility rate schedule, the customer must work with their respective utility to have their rate schedule changed prior to receiving the incentive payment. Rate schedule changes are subject to the conditions of the utility rates.

2.1.1.2 Natural Gas-Displacing SWH Customer

To be eligible for a SWH natural gas-displacing incentive, the Host Customer must be a natural gas customer of PG&E, SDG&E or SCG. The customer must be installing SWH on a new or existing home or facility to offset natural gas water heating. If SWH becomes mandatory for new home construction in the state of California, new homes will no longer be eligible for incentives under this program.

2.1.1.3 Electric-Displacing SWH Customer

To be eligible for a SWH electric-displacing incentive, the Host Customer must be an electric customer of PG&E, SCE, or SDG&E. The customer must be installing SWH on an existing home or business to offset electric water heating. SWH systems installed with electric back-up water heating on new construction projects are not eligible for an incentive through the CSI-Thermal Program. A residential building is considered “new construction” 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.

2.1.1.4 Propane-Displacing SWH Customer

To be eligible for a SWH propane-displacing incentive, the Host Customer must be an electric customer of PG&E, SCE, or SDG&E. The customer must be installing SWH on an existing home

³ “...retail level electric or gas service...” means that the Host Customer pays for and receives distribution services, as defined by their respective utility rate schedule

or business to offset propane water heating. SWH systems installed with propane back-up water heating on new construction projects are not eligible for an incentive through the CSI-Thermal Program. A residential building is considered “new construction” 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.

Propane water heating customers will be held to the same customer eligibility requirements and incentive levels of the CSI-Thermal electric-displacing program and the same equipment eligibility requirements of the CSI-Thermal gas-displacing program. Propane-displacing systems are eligible for a CSI-Thermal Program incentive if a final permit was signed-off after June 14, 2011.

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 CSI-Thermal Program application. If different from the Host Customer, the System Owner must also be a party to the CSI-Thermal Program contract. The PA may require documentation substantiating equipment ownership.

2.1.3 Applicant

The Applicant is the entity that completes and submits the CSI-Thermal Program 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 CSI-Thermal Program applications.

2.1.4 Solar Contractor

2.1.4.1 Contractor Participation

All contractors installing SWH systems through the CSI-Thermal Program 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. Each contractor who meets these requirements will be added to the program’s list of eligible contractors. This list is available publicly on the program’s www.csithermal.com website.

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. PAs may request documentation from the contractor proving that they have the minimum insurance requirements mandated by the CSLB.

If a contractor's license expires or becomes suspended during the program, the PAs will deactivate their eligible standing as a CSI-Thermal Program contractor until their license becomes active again. See Section 2.1.5 for further details regarding treatment of applications once a contractor license expires.

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 attend a designated CSI-Thermal Program training workshop. Attendance is required by the CSLB license owner and is encouraged for other employees involved with the CSI-Thermal application process. Only contractors who participate in this workshop will be eligible to apply for incentives from the program. Completing a workshop in any PA territory will allow a contractor to be eligible program wide.

2.1.4.4 CSI-Thermal Program Training Workshop

Contractors and self-installers are required to attend a designated no-cost CSI-Thermal Program training workshop. All PAs conduct training in their respective service territories. Availability of these workshops is publicized on each PA website, see Section 1.4.

The CSI-Thermal Program training workshop is intended to familiarize Applicants with program rules and requirements; it is not a course on the basics of solar thermal installation. The workshop provides an overview of the Handbook, application process, program requirements, technical requirements, and additional related resources. Upon completion of this designated CSI-Thermal Program training workshop and meeting other said requirements, Applicants will receive a key that will allow them to register and be eligible to apply for CSI-Thermal Program incentives in any PA territory.

2.1.5 Suspended Solar Contractor

If it is determined that a contractor's CSLB license was suspended during the application process or that the Solar Contractor has been suspended from the CSI-Thermal Program, the following will occur:

- Reservations will not be confirmed and all applications associated with the contractor will be suspended;
- No CSI-Thermal 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.

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- 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.
 - If it is determined that an Applicant, System Owner, Seller, and/or Host Customer is suspended from the program, the PA will notify all parties involved in the application of the suspension. The PA 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, the PA, in most cases, will only pay the Host Customer for the project.

2.1.6 Self-Installer

Self-installations are permitted in the CSI-Thermal Program. Homeowners or building owners who choose to install a SWH system on their property must attend the CSI-Thermal Program training workshop, see Section 2.1.4.4.

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 percent of the system has been purchased in place of the installation agreement outlined in Section 4.7.4. PAs reserve the right to request proof of property ownership from Self-Installers.

2.1.7 Equipment Sellers

Equipment Seller in the CSI-Thermal Program refers to retail sellers such as manufacturers, distributors, retail businesses, and contractors. If the equipment seller is not the contractor, indicate the contact information for the seller on the project application when applying for an incentive. An Equipment Seller is not an in-home sales representative, see Section 2.1.4.2.

2.1.8 Program Performance Data Providers

Program Performance Data (PPD) providers in the CSI-Thermal Program refer to the entity that provides SWH energy delivered monitoring and reporting services to the PAs. The data will serve as the basis for 70/30 true-up incentive payments; see Section 6.4.4 for details, and Measurement and Evaluation (M&E) studies.

For SWH systems with capacity over 250 kW_{th} and those that opt into M&E metering, the System Owner must contract with an eligible PPD. See Section 6.4.3 and Section 6.4.1 respectively for more details.

2.2 Equipment Eligibility and Requirements

2.2.1 Eligible Equipment

To receive a CSI-Thermal Program 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)⁴ OG-300 System Certification, except for the following:

- Substitution of Solar Storage Tank: The PAs will allow Applicants to substitute a solar storage tank of equal or greater performance than the solar tank specified 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), and a 2-tank system may not be replaced with a one-tank system (and vice versa). The incentive payment will not change based on tank substitutions from the original OG-300 calculations. The Applicant is required to report solar storage tank substitutions on the Incentive Claim Form.
- Substitution of Auxiliary Tank with Tankless: For 2-tank systems, the PAs will allow Applicants to 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 or IAPMO, e.g. if the fuel source is electric, then the tankless water heater must be for an electric system, not natural gas or propane. The auxiliary tankless is required to have a modulating heater. This substitution is only allowed for two tank systems. For OG-300 systems with tankless auxiliary heaters, the PAs will not allow a tankless auxiliary to be substituted with an auxiliary non-tankless water heater. The incentive payment will not change 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.
- Solar collectors used in multi-family/commercial water heating must have SRCC OG-100 Collector Certification. Systems in compliance with OG-300 standards will also be eligible to receive multi-family/commercial incentives.

⁴ The CSI-Thermal Program currently has two approved listing agencies - Solar Rating and Certification Corporation (SRCC) and International Association of Plumbing and Mechanical Officials (IAPMO). References to individual listing agency will be identified in the Handbook if needed. Otherwise, the Handbook will refer only to the OG-300 certification going forward with the understanding that the systems are listed with at least one of the two listing agencies.

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- All components must be new and unused. Exceptions include the following:
 - 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 CSI-Thermal Program. 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 Multi-Family/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 CSI-Thermal Program incentives. Examples of eligible DHW end uses 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 based on the above eligible load, and sizing requirements, 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 4.7.15). The incentive payment will only be based on eligible load.

2.2.3 Ineligible Technology and System Applications

The CSI-Thermal Program will only 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) Closed loop recirculation systems that recirculation water in the collector loop, see Section 6.1.3.
- (d) Systems that heat pools and spas. (Note: Pools and spas may be used as an alternative heat dump. See section 6.2.4)
- (e) Combination systems that violate the OG-300 certification or single family residential sizing guidelines. (For information on multi-family/commercial combination systems; see section 2.2.2.2)
- (f) 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.
- (g) Systems with a Surface Orientation Factor of less than 0.75, see Section 2.4.
- (h) Portable systems or systems that are not permanently installed.
- (i) A SWH system that replaces a SWH system which previously received a CSI-Thermal Program incentive.
- (j) A SWH system that received incentives from a utility Energy Efficiency program. Water heater replacements can be eligible for an EE program incentive, however, that work needs to be contractually and physically distinguishable from the SWH system.⁵

2.2.4 Permit Requirements

Necessary local permits are required for SWH system installations. A final signed-off permit issued by the appropriate permitting agency is a key requirement in determining project completion. In most cases, a permit will be signed-off by a City or County building department official. To be eligible for the CSI-Thermal Program incentive, a customer must apply for their incentive within 24 months of the date on the final signed-off permit. Permits for propane displacing systems must have final permits signed-off after July 14, 2011. 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.

2.3 Shade Factor

⁵ The California Energy Commission's Cash for Appliances Program is not a utility Energy Efficiency Program. Applicants may receive a CSI-Thermal incentive and a Cash for Appliances incentive.

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.

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. For example, if the shade analysis reveals a 95 percent average annual availability between 10:00 am and 3:00 pm, the PAs 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 and tilted at latitude of the project site. The minimum SOF permitted to receive a CSI-Thermal Program incentive is 0.75. Collectors positioned outside of the ideal range will receive a SOF between 0.75 and 1.0 as defined in Appendix C, and the incentive will be decreased accordingly.

In cases where there are multiple arrays with various tilts and azimuths, refer to Section 3.4 which addresses 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:

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- 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 CSI-Thermal Program, 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 CSI-Thermal Program.

2.6.1 Energy Efficiency Audit/Survey

An energy efficiency audit/survey is required for all existing residential and commercial buildings in order to receive a CSI-Thermal Program incentive. The audit/survey must have been performed during the past three years. Acceptable audit/survey protocols consist of an online audit/survey, telephone audit/survey, or onsite audit/survey provided by the utilities, PA, or a qualified independent vendor or consultant. Audit/survey information can be found at your utility website. A copy of the completed Energy Efficiency Audit/Survey must be submitted with the project application.

Applicants may submit proof of Title 24 energy efficiency compliance issued within the last three years as an alternate to an energy efficiency audit/survey. A Title 24 report would be required for new buildings to satisfy energy efficiency requirements.

2.6.2 Pipe Insulation

To be eligible for a CSI-Thermal Program incentive, 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

Accurate measurement of system performance is necessary to ensure cost effectiveness for System Owners and ratepayers. The CSI-Thermal Program requires metering for three separate purposes and has different metering requirements for each one. For technical metering specifications see Section 6.4. The three types of metering are as follows:

- Measurement and Evaluation (M&E): A sample of all systems will be selected by the PAs to be metered for M&E purposes and will be funded by the CSI-Thermal Program. Any

participant in the program must agree to allow their system to be metered for M&E, if selected. Customers are also able to opt into M&E, see Sections 2.7.1.2 and 6.4.1.

- **Customer Performance Monitoring (CPM):** Systems with a capacity over 30 kW_{th} (equivalent to 462 square feet of fluid collectors⁶) are required to have CPM to ensure System Owner's can effectively monitor the system's performance, see Sections 2.7.2 and 6.4.2.
- **70/30 True-Up:** Metering and monitoring is required for all systems with capacity over 250 kW_{th} for the purposes of the 70/30 true-up payment, see Sections 2.7.3 and 6.4.3.

2.7.1 Measurement and Evaluation

Metering for M&E will help the PAs and the CPUC evaluate program and technology performance over time. Data and information collected through the M&E process will not be used by the PAs to inform customers directly on the performance of their systems. Metering participation for M&E purposes can be required by the program or customers may opt in as described below.

2.7.1.1 Program-Selected M&E Metering

Under the program-selected M&E method, PAs will select projects that will be required to have M&E metering. The PAs will select a sample of projects for metering and will notify the customer 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 PAs through their M&E budgets.

Systems selected for M&E metering may also require CPM monitoring, see Section 2.7.2. M&E metering would only meet the CPM monitoring requirement, if it provides System Owners with system performance monitoring. See Section 6.4.2.4 for more details.

2.7.1.2 Opt-In Method

Customers with systems of all sizes may have the option to participate in M&E metering. The CSI-Thermal Program will pay an additional \$500 to the contractor to offset the M&E metering costs. Under the opt-in metering method, contractors nominate projects for participation on the ICF. This is available on a first come, first serve basis and will be limited to one \$500 payment per System Owner.

The \$500 is a one-time payment intended to offset equipment, monitoring, and labor costs associated with meter installation. Payment will be provided after metering requirements have been met and upon validation of the first quarter M&E data.

The metered data must be provided to the PAs designee on a quarterly basis for a period of five years.

⁶ 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 M². Fluid collectors include unglazed, glazed, and evacuated tube collectors. 30 kW_{th} is also equivalent to or 855 square feet of air collectors.

Systems that opt into M&E metering may also require CPM monitoring, see Section 2.7.2. M&E metering would only meet the CPM monitoring requirement, if it provides System Owners with system performance monitoring. See Section 6.4.2.4 for more details.

PAs will set aside 10 percent of their gas and electric M&E budgets for those that opt-in to M&E. This results in an M&E opt-in budget of \$500,000 and \$125,000 for gas and electric, respectively.

See Section 6.4.1 for M&E metering, monitoring and communication requirements.

2.7.2 Customer Performance Monitoring (capacity over 30 kW_{th})

Customers that have a system with capacity over 30 kW_{th} 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.

2.7.3 70/30 True-Up (capacity over 250 kW_{th})

Performance metering and monitoring equipment is required on all SWH systems with capacity over 250 kW_{th}. The Host Customer or designee will provide the PAs with interval data to pay the 70/30 true-up incentive payment after one year. The cost for 70/30 true-up metering equipment will be borne by the System Owner or Host Customer.

Systems that require 70/30 metering also require CPM monitoring, see Section 2.7.2. The 70/30 metering would only meet the CPM monitoring requirement, if it provides System Owners with system performance monitoring. See Section 6.4.2.4 for more details.

Since 70/30 metering equipment is more accurate than those required for opt-in M&E metering, customers may opt into M&E metering and get a one-time \$500 payment if they provide M&E data for an additional four years.

See Section 6.4.3 for 70/30 true-up metering, monitoring and communication requirements.

2.8 Performance and Permanency Requirements

Equipment installed under the CSI-Thermal Program is intended to be in place for the duration of its useful life. Only permanently installed systems are eligible for CSI-Thermal Program incentives. This means that the SWH system must demonstrate to the satisfaction of the PAs 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.

2.9 Onsite Field Inspections

A portion of all CSI Thermal Program projects are subject to onsite field inspections at the PAs discretion. For each eligible contractor, PAs will conduct an onsite field inspection for the first

three submitted ICFs with capacity of 250 kW_{th} or less and at least the first three ICFs that displace over 250 kW_{th}. PAs will inspect a random sample of projects thereafter.

Please refer to Section 4.8 for details on the inspection process.

3. CSI-Thermal Program Incentive Structure

Part of the goal of the CSI-Thermal Program is 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 will use the online incentive calculation tool provided by the program, as described in Section 3.5.

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. If a PA receives applications accounting for more dollars than what is left in the budget allocation for a given step, a lottery may determine which projects receive the higher incentive level. Table 3 below displays the dollar amount per therm in each step and the total program budget allocation per step. The budget allocations per step in Table 3 are divided among the PAs per the percentages shown in Table 1.

Table 3
Natural Gas-Displacing System Incentive Steps
and Total Program Budget Allocations

Step	Incentive per annual therm displaced	Total Program Budget Allocation (in millions)
1	\$12.82	\$50
2	\$10.26	\$45
3	\$7.69	\$45
4	\$4.70	\$40

As incentives decline under the natural gas-displacing program, a corresponding step reduction occurs to the electric/propane-displacing incentive. Electric/propane-displacing SWH installations will count against the MW trigger in Step 10 of the general market CSI program. If the Step 10 budget is insufficient, the PAs may use funds from Step 9. See the CSI Program Handbook for details on the CSI step changes. The electric/propane-displacing incentive budget allocation is divided among the PAs per the percentages shown in Table 2.

Incentive step changes will move independently in each service territory⁷ and for each class of customer. Incentives will be paid on a first come, first serve basis. The most current information on incentive step status per customer class will be posted on (www.csithermal.com/tracker).

3.1 Single-Family Incentives

⁷ Southern California Edison incentive step changes will correspond with Southern California Gas Company gas incentive step changes for each customer class.

Single-family residential system incentives are calculated using the OG-300 rating (i.e., the estimated annual therm or kWh savings) in the appropriate 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:

$$\text{Incentive} = \text{system's OG-300 rating} * \text{incentive rate} * \text{SOF} * \text{Shade Factor}$$

not to exceed the PAs current step maximum

The system's OG-300 rating is generally displayed in annual kWh savings. To convert kWh to therms, multiply kWh by 0.03412128. For example, 3,000 kWh equals 102.4 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 OG-300 system incentive calculator is described in Section 3.4.1.

3.1.1 Natural Gas

Table 4 displays the single-family natural gas-displacing system incentive steps and budget allocations.

Table 4
Single-Family Natural Gas-Displacing System Incentive Steps

Step	Incentive per therm displaced	Maximum Incentive Single-Family Residential Projects	Total Program Budget Allocation (in millions)
1	\$12.82	\$1,875	\$20
2	\$10.26	\$1,500	\$18
3	\$7.69	\$1,125	\$18
4	\$4.70	\$688	\$16

3.1.2 Electric/Propane

Table 5 displays the dollar incentive rate per kWh in each step for electric/propane-displacing systems.

Table 5
Single-Family Electric/Propane-Displacing System Incentive Steps

Step	Electric/Propane-Displacing Incentive (\$/kWh)	Maximum Incentive for Residential System
1	0.37	\$1263

2	0.30	\$1025
3	0.22	\$750
4	0.14	\$475

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 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 \$500,000 for natural gas displacing systems or \$250,000 for electric/propane 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. 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, 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 a single parcel of land undivided by a highway, public road, and thoroughfare or railroad would be considered for purposes of CSI-Thermal Program 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 CSI-Thermal Program incentive. A separate incentive will be allowed for each building, as long as the combined total of the incentives do not exceed \$500,000 for the site.

3.2.1 Natural Gas

Table 6 displays the dollars per therm displaced incentive amount for each incentive step, the maximum incentive amount per project and each PAs budget allocation.

**Table 6
Multi-Family and Commercial Natural Gas-Displacing System Incentive Steps**

Step	Incentive per annual therm displaced	Maximum Incentive for Commercial/Multi-Family SWH projects	Budget Allocation (in millions)
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1	\$12.82	\$500,000	\$30
2	\$10.26	\$500,000	\$27
3	\$7.69	\$500,000	\$27
4	\$4.70	\$500,000	\$24

3.2.2 Electric/Propane

Table 7 displays the dollar incentive rate per kWh in each step for electric/propane-displacing systems and the maximum incentive amount for electric/propane-displacing multi-family/commercial systems.

**Table 7
Multi-Family and Commercial Electric/Propane-Displacing System Incentive Steps**

Step	Electric/Propane-Displacing Incentive (\$/kWh)	Maximum Incentive for Multi-Family/Commercial System
1	0.37	\$250,000
2	0.30	\$250,000
3	0.22	\$250,000
4	0.14	\$250,000

3.2.3 Lump-sum and 70/30 True-Up Incentive Payments for Multi-Family/Commercial Systems

3.2.3.1 Lump-Sum Payments

Multi-family/commercial systems with capacity of 250 kW_{th} or less 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 has passed the inspection (if applicable).

3.2.3.2 70/30 True-Up Incentive Payments

The PA pays the incentive for large multi-family/commercial systems with capacity over 250 kW_{th} incentive in two parts, called the “70/30 true-up method.”

1. The multi-family/commercial incentive calculator estimates annual energy savings based on Applicant-provided OG-100 incentive calculator inputs, see Section 3.4.2.1. The PA reviews the inputs and confirms initial incentive amount using current step incentive rate.
2. PA pays 70 percent of the incentive amount to the Payee after the customer completes the project and the PA inspects (as applicable) and approves the ICF. The PA reserves the right to adjust the previously confirmed incentive amount based on any differences between the Applicant-provided inputs and actual field conditions.

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- The system installation must include special metering equipment that measures thermal solar energy delivery from the solar tank to the back-up water heater or building, as applicable. The equipment measures the solar energy delivery for twelve consecutive months, from the date the PA approves the ICF. The PA will adjust the metered data to reflect the back-up water heater efficiency. This is done by dividing the metered data by an Annual Fuel Utilization Efficiency (AFUE) factor of 82 percent for natural gas and propane back-up systems or an AFUE factor of 98 percent for electric back-up systems. The result of this calculation is the energy savings to be used in the true-up payment calculation. The following equations illustrate this calculation for 1-tank and 2 or more-tank systems.

1-tank System:

$$\text{Energy Saved} = \frac{\text{Total BTUs Delivered}}{\text{Aux Heater Efficiency (AFUE)}} - \text{Backup consumption}$$

2 or more-tank System:

$$\text{Energy Saved} = \frac{\text{Solar BTUs Delivered}}{\text{Aux Heater Efficiency (AFUE)}}$$

For a list of meter data requirements, see Table 10. For a list of equipment and placement requirements, see Section 6.4.3.

- The PA determines the final incentive amount based on twelve consecutive months of metered energy savings using the incentive rate shown in Step No. 1.
- PA pays the true-up incentive amount by subtracting the initial 70 percent incentive payment from the final incentive amount. If the difference is positive, PA pays no more than 110 percent of estimated incentive on the ICF. If the difference is negative, the PA pays no true-up amount.

The following three examples all assume a SOF of 1.0 and a Shade Factor of 100 percent:

Example No. 1 (Actual energy savings less than expected): Customer's estimated energy savings is 12,000 therms per year with a natural gas back-up water heater and program is in step one, which equates to a \$153,840 incentive. Once the project is completed, approved, and inspected (if applicable), PA pays 70 percent of this amount, or \$107,688. Customer's energy savings is then measured for twelve months and is found to be 10,500 therms. Based on the actual metered energy delivered from the SWH system, the total incentive amount is \$134,610, or 10,500 therms * \$12.82 per therm. PA then pays the true-up incentive payment of \$26,922, which is \$134,610 less the \$107,688 upfront lump sum incentive.

Example No. 2 (Actual energy savings more than 110 percent of expected savings): Customer's estimated energy savings is 12,000 therms per year and program is in step one, which equates to a \$153,840 incentive, or 12,000 therms * \$12.82. Once the project is completed, approved, and inspected (if applicable), PA pays 70 percent of this amount, or \$107,688. Customer's energy savings is then measured for twelve months and is found to be 13,800 therms, or 120 percent of expected. Total incentive is \$169,224, or 12,000 therms * 110% * \$12.82 per therm. PA then

pays true-up incentive payment of \$61,536, which is \$169,224 less \$107,688 upfront lump sum incentive. Note: Customer will not be paid more than 110 percent of the estimated incentive amount for system that produce more than the estimated energy savings.

Example No. 3 (Incentive limited by \$500,000 cap): A commercial natural gas customer's estimated energy savings is 100,000 therms per year and the program is in step one. Multiplying 100,000 therms * \$12.82 per therm yields \$1,282,000; however, the incentive is reduced to \$500,000 due to the program cap. Once the project is completed, approved, and inspected (if applicable), PA cuts an initial lump-sum check to Payee in the amount of \$350,000, or 70 percent of the maximum incentive. Customer's energy savings is measured for twelve months and is 100,200 therms. Multiplying the actual 100,200 therms * \$12.82 per therm yields, \$1,284,564, but the incentive is capped at \$500,000, or maximum amount for multi-family/commercial natural gas displacing systems. PA cuts true-up incentive payment to Payee of \$150,000, which is \$500,000 minus the initial lump-sum paid of \$350,000.

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:

3. Determine the Shade Factor of each array.
4. 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 CSI-Thermal Program Incentive Calculator

An online calculator tool is available to estimate natural gas, electric, or propane displacement for SWH systems based on system location, design and expected performance. The calculators are embedded in the application processing database and can also be accessed separately for incentive estimation purposes at (www.csithermal.com).

3.4.1 OG-300 Incentive Calculator

The installation of an OG-300 system uses 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 = system's OG-300 rating * incentive rate * SOF * Shade Factor
not to exceed the PAs current step maximum incentive

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. Please refer to the Calculator User Guide (www.csithermal.com/calculator/commercial) for details regarding the calculator inputs.

3.4.2.2 Calculator Outputs

The multi-family/commercial calculator produces 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

3.4.2.3 Calculator Modifications

The PAs in conjunction with the CPUC developed a calculator that helps Applicants determine their incentives. As it gains experience with the calculator, the CPUC reserves the right to modify the calculator at any time without advance notice to Applicants.

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

If changes to the calculator affect the Applicant's confirmed reservation, the PA 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 neither lose their place in the queue nor their application fee.

If the Applicant has not yet received a confirmed reservation before a calculator change, the PA 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 PA within 30 calendar days that they wish to withdraw their application. If the Applicant chooses to withdraw their application, the PA will reimburse the application fee without interest and cancel the project. If Applicant withdraws their application after 30 calendar days, they will forfeit their application fee.

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 PA will pay an incentive to the entity designated as the incentive recipient. The PA 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 CSI-Thermal Program 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 CSI-Thermal Program 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

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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 CSI-Thermal Program
 9. Mounting surfaces directly under the SWH collector(s) and/or the materials that provide the primary support for the collector(s)
 10. Opt-in metering costs, if applicable, net of any metering allowance received from the PA, see Section 2.7.1.2.

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 in the CSI-Thermal Program's online database so PAs can 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

Customers may not receive CSI-Thermal Program incentives for the same SWH equipment from more than one PA (i.e., PG&E, SCE, SoCalGas and CCSE). For projects receiving incentives under other programs, the CSI-Thermal Program incentive may be reduced, depending on the source of the other incentive.

CSI-Thermal Program incentives are distinct and separate from Energy Efficiency (EE) Program incentives, like DHW heater replacement programs. Customers may not receive an incentive from both a CSI-Thermal Program and an EE Program for the same equipment. For instance, if a customer wants to utilize an EE Program to support the energy efficient replacement of their DHW heater, that work needs to be contractually and physically distinguishable from the SWH system. However, the California Energy Commission's Cash for Appliances Program is not a utility Energy Efficiency Program. As a result, Applicants are eligible to receive incentives from both the CSI-Thermal Program and the Cash for Appliances Program.

For projects that receive other incentives for the same SWH equipment that are funded by California investor-owned utility ratepayers (e.g., utility or CEC public goods charge programs), the incentive is discounted by the amount of the other incentive. For projects that receive other incentives funded from other sources than utility ratepayers (e.g., federal and state grants, air district grants or tax credits) no adjustment is made to the CSI-Thermal Program incentive, except where total incentives exceed total costs.

In no event may the combined incentives received from CSI-Thermal Program 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.

4. Application Process for CSI-Thermal Program

Through the CSI-Thermal Program, funding for multi-family/commercial projects may be reserved for projects where there has been a commitment to purchase and install an eligible SWH system.

Applications for both single-family residential and multi-family/commercial projects are completed online, through a dedicated CSI-Thermal Program web-based application at (www.csithermal.com). The online application tool simplifies the application process and makes document submission more efficient for the Applicant. All documents should be submitted through the online application tool. Documents that cannot be submitted online must be delivered to the PA via U.S. mail or overnight mail. E-mails, faxes or hand deliveries will not accepted to initiate a project.

Single-family residential systems apply for incentives via a one-step process. For this application process, the applicant submits an 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 PA.

Depending on the size of the SWH system, a multi-family/commercial project will follow either a two- or three-step application process. For multi-family/commercial projects, applicants 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 submits an ICF and supporting documentation after the system has been installed and received a final signed-off permit.

**Table 8
Application Process by Customer Type & Project Size**

Sector	Application Process
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Single-Family Residential	1-Step
Multi-family / Commercial (30 kW _{th} or less)	2-Step
Multi-family / Commercial (over 30 kW _{th})	3-Step

4.1 Single-Family Residential Project Application Process

A single-family residential project will follow a one-step application process. Once a SWH system has been installed and a final signed-off permit is received, the Applicant submits the following documentation:

1. Completed ICF with required signature(s)⁸, including agreement to allow system to be monitored and data used for program evaluation purposes
2. Documentation of a completed Energy Efficiency Audit/Survey or Title 24 documentation
3. Copy of executed agreement of eligible SWH system purchase and installation, including demonstration that system contains eligible equipment and required warranties
4. Copy of final signed-off permit

The following documents may also be needed:

1. Copy of executed alternative system ownership agreement (If System Owner is different from Host Customer)
2. Authorization to Receive Customer Information or Act on a Customer's Behalf (only required for SDG&E applicants)
3. System sizing justification if the fluid collector square footage exceeds 1.25 times the gallons per day (GPD)
4. Stagnation protection documentation, if different from methods listed in Section 6.2

All of the above documentation must be submitted in order for the payment to be issued. Refer to Section 4.7 for a description of these documents.

4.2 Multi-Family/Commercial Project Application Process (capacity of 30 kW_{th} or less)

All multi-family/commercial SWH projects with capacity of 30 kW_{th} or less will follow a two-step application process. The two primary steps are as follows:

⁸ Signatures for all submitted documentation are acceptable in the following formats:

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

Although "wet" signatures are not required on submitted documents, original signed documentation must be maintained by the Applicant, Host Customer and/or System Owner for at least five years from the date of submission. PAs reserve the right to request original signed documents within the five-year period.

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1. Complete and submit a 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 a solar 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 and program contract signed by the Applicant, Host Customer and System Owner (if different from Host Customer)⁶
2. Documentation of a completed Energy Efficiency Audit/Survey or Title 24 documentation
3. Copy of executed agreement of SWH system purchase and installation

The following documents may also be needed:

1. Copy of executed alternative system ownership agreement (If System Owner is different from Host Customer)
2. Authorization to Receive Customer Information or Act on a Customer's Behalf (only required for SDG&E Applicants)
3. GPD justification stamped and signed by a State of California licensed Professional Engineer (P.E.) if customer's building type is not on the Maximum GPD Guideline Table, see Appendix D and Appendix H.
4. Stagnation protection documentation if different than methods listed in Section 6.2
5. Documentation describing the stagnation/overheat protection method that needs to be stamped and signed by a State of California licensed Professional Engineer (P.E.) for combination systems that are oversized based on eligible loads, and sizing requirements. The document must also describe the entire system being installed.
6. Solar storage tank volume justification stamped and signed by a State of California licensed Professional Engineer (P.E.) if the solar storage tank volume is less than the requirements outlined in Section 6.3.2.2

All of the above documentation must be submitted in order for the incentive to be reserved. Refer to Section 4.7 for a description of these documents.

4.2.2 Step No. 2: Submit Incentive Claim Form Package

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 signed by the Host Customer and System Owner (if different from Host Customer)⁶
2. Final signed-off permit or Federal Government's Certificate of Acceptance (in lieu of the final signed-off permit)

Refer to Section 4.7 for a description of these required documents.

4.3 Multi-Family/Commercial Project Application Process (capacity over 30 kW_{th})

All multi-family/commercial SWH projects with capacity over 30 kW_{th} will follow a three-step application process. In cases where the executed agreement exists at the time of RRF submittal, Applicants may submit documentation for steps one and two together to get a confirmed reservation. The three steps are as follows:

1. Complete and submit a RRF package and application fee to get conditional reservation
2. Complete and submit a Proof of Project Milestone (PPM) package to get confirmed reservation
3. Complete and submit a ICF package to request payment

The following sections describe each of the three steps in more detail.

4.3.1 Step No. 1: Submit Reservation Request Form Package

Once the Host Customer has decided to install a SWH system, a RRF package can be submitted. Applicants must submit the incentive RRF along with requirements documents prior to the installation of the system to receive a conditional reservation at the current incentive rate.

The RRF package includes the following documentation:

1. RRF and program contract signed by the Applicant, Host Customer and System Owner (if different from Host Customer)⁶
2. Documentation of a completed Energy Efficiency Audit/Survey or Title 24 documentation
3. Application fee

The following documents may also be needed:

1. Authorization to Receive Customer Information or Act on a Customer's Behalf (only required for SDG&E Applicants)
2. GPD justification stamped and signed by a State of California licensed Professional Engineer (P.E.) if customer's building type is not on the Maximum GPD Guideline Table, see Appendix D and Appendix H.

3. Stagnation protection documentation if different than methods listed in Section 6.2
4. Documentation describing the stagnation/overheat protection method that needs to be stamped and signed by a State of California licensed Professional Engineer (P.E.) for combination systems that are oversized based on eligible loads, and sizing requirements. The document must also describe the entire system being installed.
5. Solar storage tank volume justification stamped and signed by a State of California licensed Professional Engineer (P.E.) if the solar storage tank volume is less than the requirements outlined in Section 6.3.2.2

All of the above documentation must be submitted in order for the incentive to be reserved. Refer to Section 4.7 for a description of these documents.

4.3.1.1 Application Fee Process

In addition to the RRF and required documents, Applicants are required to submit an application fee for systems larger than 30 kW_{th}. The application fee is based on the following table of system capacity ranges:

**Table 9
Application Fee Schedule for Large Multi-Family/Commercial Systems**

Capacity (kWth)		Capacity (kWth)		Application Fee
30	-	260	=	\$1,250
261	-	520	=	\$2,500
521	-	780	=	\$5,000
781	-	1,040	=	\$10,000
1,041	-	No Limit	=	\$20,000

Applicants should send the application fee to the PA, via U.S. mail or overnight mail, at the same time they submit the RRF.

The Applicant has 30 calendar days from the day the PA receives the complete RRF packet to submit the application fee to secure a conditional reservation. The payment must reference the project by Host Customer name and application ID number, e.g., SCG-000007 or PGE-000012.

If needed, Applicant may request an invoice for the application fee from the PA after the RRF has been submitted. Once the PA has invoiced the Applicant, Applicant has 30 calendar days to submit the application fee.

PAs will accept payments from either the Applicant or a third party on behalf of the Host Customer for a particular project; however, a refunded application fee will be paid as described in Section 4.3.1.3, Refund of Application Fee.

PAs will only accept application fees in the form of a check. Cash, credit cards, money orders, promissory notes, etc. will not be accepted.

Application fees will be linked to application ID numbers, not to the project sites; therefore, the project must be completed under the same application ID number as the one linked to the application fee.

Once systems are considered complete by the PA, the application fee will be refunded. No interest will be paid on refunded application fees.

4.3.1.2 Failure to Submit Application Fee

Failure to submit payment within 30 calendar days will result in the cancellation of the application.

Application fee checks returned by the bank for insufficient funds will result in the PA rejecting the application. Applicants will be asked in writing to reimburse PA for any insufficient fund charges or fees.

4.3.1.3 Refund of Application Fee

Application fees will be refunded in the following cases:

1. Once systems are complete, the application fee will be refunded. No interest will be paid on refunded application fees.
2. If upon eligibility screening the project does not qualify for the CSI-Thermal Program, the application fee will be refunded. No interest will be paid on refunded application fees.
3. If the application fee was invoiced and a refund is due, PAs will pay the invoiced party.
4. If the application fee was not invoiced and a refund is due, PAs will pay the party that submitted the application fee.

4.3.1.4 Forfeit of Application Fee

Application fees will be forfeited in the following cases:

1. Once a conditional reservation is granted and the PA rejects the project for failing to meet adequate proof of project milestone or reservation expiration date requirements, the application fee will be forfeited.
2. Once a confirmed reservation is granted and the project is cancelled or withdrawn by the Applicant and/or Host Customer, the application fee will be forfeited.
3. If a project reservation is allowed to lapse and the project is later built under a new reservation, the application fee for the previous reservation will be forfeited.

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4. If a confirmed reservation is granted and the incentive level has been reduced (due to CPUC directive, moving to the next step, etc.), the Applicant and Host Customer will be notified and given 20 calendar days to submit in writing a request to withdraw their reservation request without losing their application fee. Upon receipt of a request to withdraw, the application fee shall be returned to the Host Customer. If the Applicant fails to withdraw the reservation request within 20 calendar days, the application will be processed at the new, lower incentive level. If the application is not withdrawn within the 20-day period, the Applicant will forfeit the application fee if it subsequently withdraws or fails to pursue its project.

All forfeited application fees will be re-allocated to the PAs CSI-Thermal Program budget.

4.3.1.5 Effect of Change of System Change on Application Fee

Application fees will be retained until the completion of the proposed project and will not be adjusted due to changes in collector size.

4.3.2 Step No. 2: Submit Proof of Project Milestone Package

The PPM demonstrates to the PA that that project is progressing. The conditional reservation is valid only until the PPM date. The PPM date will be 60 calendar days for private entities or 90 calendar days for government, non-profit, or public entities after the date the conditional reservation is issued. The following documentation must be submitted on or before the PPM date indicated on the conditional reservation notice:

1. Copy of executed agreement of SWH system purchase and installation
2. Copy of executed alternative system ownership agreement (If System Owner is Different from Host Customer)

For more information on the above-referenced documentation, see Section 4.7.

Once the Applicant has sufficiently demonstrated that the project is advancing, the PA will issue a confirmed reservation notice.

4.3.2.1 Incomplete Proof of Project Milestone

If submitted PPM documentation is received by the PPM date but requires clarification or is missing required documentation, the PA will request the information necessary to process that application further. Applicants have 20 calendar days to respond with the necessary information. If, after 20 calendar days, the Applicant has not submitted the requested information, the application will be cancelled.

4.3.2.2 Proof of Project Milestone Extensions

In general, no extensions to the PPM date are permitted.

4.3.3 Step No. 3: Submit Incentive Claim Package

Upon project completion, receipt of final signed-off permit and prior to the reservation expiration date, Applicants must submit a completed ICF along with all of the necessary documentation to request an incentive payment. The ICF package includes the following documentation:

1. Completed ICF signed by the Host Customer and System Owner (if different from Host Customer)⁶
2. Final signed-off permit or Federal Government's Certificate of Acceptance (in lieu of the final signed-off permit)
3. Certificate of Calibration (required for systems with a capacity >250kW_{th}). See Section 4.7.13 for more details.

4.4 Application Review Process

Once received, the PA will review the application package for completeness and determine eligibility.

4.4.1 Incomplete Reservation Request Form Package

If the PA finds that an application requires clarification or is missing required documentation, the PA will request the information necessary to process that application further. Applicants have 20 calendar days to respond to the requested clarification with the necessary information. If after 20 calendar days, the Applicant has not submitted the requested information the application will be cancelled.

This does not preclude an Applicant from resubmitting their project to the PA for an incentive. All resubmitted application packages will be treated as new applications, i.e., all required documents must be resubmitted and will be processed in sequence along with other new applications.

4.4.2 Approval of Reservation Request Form Package

Once a RRF package is determined to be complete and eligible, the PA will lock-in the current incentive rate, reserve funds for the specified system, and send a conditional or confirmed reservation notice to the Applicant.

For a two-step process, the confirmed reservation will state that an incentive amount has been reserved for a project. The confirmed reservation notice will list, at a minimum, the approved incentive amount and the date by which the ICF must be submitted.

For a three-step process, the conditional reservation confirms that an incentive amount has been reserved for a project. The conditional reservation notice will list, at a minimum, the approved incentive amount and the date by which the PPM package must be submitted to confirm the reservation. Refer to Sections 4.3.2 and 4.7 for more information on the PPM requirements.

4.4.3 Reservation Period

The reservation period for multi-family/commercial projects is 18 months with one optional 180 calendar day extension; see Section 4.5 for details regarding changes to reservations.

4.5 Changes to Reservations

4.5.1 System Changes

If an incentive increases due to installed systems differing from the system submitted on the RRF, the difference in energy savings will be paid at the then-current incentive rate. Applicant may only submit system changes at PPM or ICF stages.

4.5.2 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 PA. 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 PA 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.

4.5.3 Extending the Reservation Expiration Date

A request to extend the reservation expiration date is limited to a maximum of 180 calendar days of additional time. An extension request must include a written explanation of why the extension is required. Approval of a request for a change in reservation expiration date will not change or modify any other reservation condition.

Failure to submit the ICF package by the original or extended reservation expiration date will result in a cancellation of the application.

The Applicant must submit a time extension request in writing to the PAs before the reservation expiration date. In describing the reason for the time extension request, the Applicant must provide information on the following to aid the PAs in their decision to grant an extension:

1. For circumstances beyond the control of the reservation holder that prevented the system from being installed as described in the RRF, the Applicant must describe the situation that occurred and reasons for such circumstances.
2. If there was a problem in the permitting process and it was the cause of delay, the Applicant must provide documentation, such as any correspondence with the building department, to support this assertion.
3. Documentation of any equipment installed at the site and expenses incurred to date. Cost documentation must demonstrate that the system purchaser has incurred at least 50 percent of the reserved system's total purchase price. However, in cases where this amount exceeds the purchaser's contribution, the purchaser may still retain 10 percent of the total system cost and meet this cost documentation requirement. Attach copies of paid invoices, checks or other verifying documentation with the extension request.

In order for any project to receive a reservation extension, the Applicant may need to show documentation of a purchase order or commitment from SWH system manufacturer to supply the necessary equipment.

The PA reserves the right to perform a site inspection to verify the status of the project installation prior to granting the request for extension. If required, the PA shall notify the Applicant and schedule the site visit within 10 days of notification.

4.5.4 Transfer of Reservation from one Site to Another

Applicants can request a transfer of a reservation from one site to another as long as it is for the same Host Customer. Applicants should contact their PA as soon as they realize a Reservation Transfer is necessary. A request to transfer a CSI-Thermal Program reservation from one site to another within a single utility service territory may be considered in accordance with the following provisions:

1. Reservation Transfer requests must be made within 180 days of the conditional or confirmed reservation notice. Projects that have been cancelled or have withdrawn are ineligible for a retroactive Reservation Transfer.
2. To transfer a reservation, Host Customers must demonstrate to the PA that they have spent a non-negligible amount of money on project development at the first site reserved, and must provide documentation proving that this first site is not viable for SWH system project development.
3. Host Customers must provide documentation and demonstrate to the PA that the second site, to which the application will be moved, is viable for SWH system project development.
4. A reservation may only be transferred once.
5. Reservations can only be transferred to another site within the same PA service territory.
6. Transferred Reservations that increase overall energy savings following the Reservation Transfer are eligible to receive incentives for additional energy savings only at the current incentive levels in that service territory and subject to other Handbook provisions on system up-sizing. The original reservation cannot be changed with respect to the amount of energy savings that is eligible for incentives. This means that if incentive levels decline between the time of the initial reservation and when the Reservation Transfer occurs, any energy savings in excess of the initial reservation will be reserved at a lower (i.e., the current) incentive level, if it is eligible.
7. Once a Reservation Transfer has been granted by the PA, the project timeline resets as per the date of the Reservation Transfer and the project will be eligible for the full implementation time allowed to their project class (e.g., multi-family, commercial) in the Handbook.

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8. Once a Reservation Transfer has been granted by the PA, the application fee becomes non-refundable.

4.6 Payment Process

Once a project is deemed completed, Applicants may request payment of the incentive amount listed on their ICF. A project is considered complete when it is completely installed, received final signed-off permit, paid for, passed site inspection (if required) and capable of producing energy savings in the manner and in the amounts for which it was designed.

To receive the incentive, all program requirements must be met and a complete ICF package submitted prior to the reservation expiration date. Applicants are required to keep a copy of the ICF package along with all required documentation for five years. The application processing sections of this Handbook contain more detailed information on the ICF package and submittal process.

Upon final approval of the ICF package and completed onsite field inspection (if applicable), the PA will disburse the incentive payment with the exception of systems with capacity over 250 kW_{th}. For these systems, a 70/30 true-up incentive payment method will be applied. See Section 3.2.3.2 for more details.

4.6.1 Incomplete Incentive Claim Form Packages

If an ICF package is incomplete or is found to require clarification, the PA will request the information necessary to process that application further. Applicants have 20 calendar days to respond to the requested clarification with the necessary information.

If after 20 calendar days, the Applicant has not submitted the requested information, the request for payment may be denied.

If an ICF package is not received by the expiration date of the ICF, or the ICF package indicates that the project is otherwise ineligible, the PA will send a written notice stating the reasons why the project is ineligible and the project will be rejected. If this is the case, the Applicant or Host Customer may reapply for an incentive reservation but will be subject to the eligibility requirements, incentive levels, and funding available at that time of re-application.

4.6.2 Incentive Check Payment and Terms

Upon final approval of the ICF documentation and completed onsite field verification visit (if required), the PA will issue the incentive payment. Payment will be made to the payee as indicated on the ICF, and will be sent to the address provided via U.S. mail. As the reservation holder, the Host Customer may assign payment to a third party on the ICF.

The payee must submit their tax ID number and tax status to the PA.

4.7 Application Forms and Documentation

Forms identified in this section are primarily submitted by attaching a PDF image of the document in the program online application processing system. Documents may also be submitted by U.S. mail.

4.7.1 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 signed⁶ by the Applicant, Host Customer and System Owner (if different than the Host Customer) prior to submitting the application.

4.7.2 Incentive Claim Form

A completed ICF must be submitted for all SWH projects. It must be completed and signed⁶ 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 with capacity of 30 kW_{th} or less, this form must be submitted in Step 2 of the application process. For multi-family/commercial projects with capacity over 30 kW_{th}, this form must be submitted in Step 3 of the application process.

4.7.3 Energy Efficiency Audit/Survey or Title 24 Documentation

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

4.7.4 Executed Agreement of SWH System Purchase and Installation

For single-family and multi-family/commercial projects with capacity of 30 kW_{th} or less, the Applicant must submit a copy of an executed agreement to purchase and install the SWH system in Step 1 of the application process.

An executed SWH system purchase and installation agreement for multi-family/commercial Projects with capacity over 30 kW_{th} must be submitted in Step 2 of the application process.

Applicants must submit a copy of executed contract for purchase and installation of the system, and/or alternative System Ownership agreement. 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:

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- 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 CSI-Thermal Program 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 CSI-Thermal Program Incentive will be applied)
 - 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.

4.7.5 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), then the System Owner must provide a copy of the agreement(s) to purchase and install the system.

4.7.6 Final Signed-off Permit

The ICF package must include a signed-off permit 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.

4.7.7 Federal Government's Certificate of Acceptance in lieu of the final signed-off Permit

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.

4.7.8 Authorization to Receive Customer Information or Act on a Customer's Behalf

CCSE is the only non-investor owned utility PA, and therefore does not have direct access to SDG&E customer accounts. To verify program eligibility, SDG&E customers must complete and submit the Authorization to Receive Customer Information or Act on Customer's Behalf with the application. This form is not required with applications submitted to PG&E, SoCalGas, and SCE.

4.7.9 Application Fee

For all systems with capacity over 30 kW_{th}, Applicants will also be required to submit an application fee based on the collector square footage. See Section 4.3.1.1 for more information on application fees.

4.7.10 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. GPD justification documentation must be stamped by a P.E. See Section 6.3.2 and Appendix H for more information.

4.7.11 System Sizing Justification

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

4.7.12 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 PA.

4.7.13 Certificate of Calibration (For systems with a capacity >250kW_{th} only)

This document is required to verify that the temperature sensor pair meet the accuracy requirements for all systems with a capacity >250kW_{th} and participating in the 70/30 true-up payment process. The document can also be referred to as a sensor calibration report.

4.7.14 Reduced Solar Storage Tank Justification (If volume is less than requirements stated in Section 6.3.2.2)

For multi-family/commercial systems, a solar storage tank sizing justification is required if the tanks size is less than the requirements described in Section 6.3.2.2. The document should justify

the reduced storage and indicate how overheat/stagnation will be prevented. This document must be stamped and signed by a State of California licensed Professional Engineer (P.E.)

4.7.15 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 that needs to be stamped and signed by State of California licensed Professional Engineer (P.E.). The document must also describe the entire system being installed.

4.8 Onsite Field Inspection Process

A portion of all projects are subject to onsite field inspections at the PAs discretion. For each eligible contractor, PAs will conduct an onsite field inspection for the first three submitted ICFs on systems with capacity of 250 kW_{th} or less and the first three submitted ICFs with capacity over 250 kW_{th}. PAs will inspect a random sample of projects thereafter.

The PAs 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 CSI-Thermal Program onsite field inspections, or results of prior CSI-Thermal Program 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.

4.8.1 Trained Inspectors

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

4.8.2 Tolerances

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

- Tilt: $\pm 3^\circ$
- Azimuth: $\pm 5^\circ$
- Shading (Average annual availability between 10:00 am and 3:00 pm): 5%

4.8.3 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. PAs track infractions on a program-wide basis and use these data as an educational tool to inform contractors on best practices to improve future SWH system installations.

4.8.4 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
- 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 OG-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.
- Surface Orientation Factor: Collectors must have an SOF value of between 0.75 and 1.0 as defined in Appendix C and Section 2.4.

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, shall be insulated with R-2.6 degrees Fahrenheit (ft²-hr /Btu) or greater insulation. All exterior piping insulation shall be protected from ultraviolet radiation, excessive temperature, and moisture damage.
- Mixing Valve: SWH DHW systems must be equipped with a means for automatically limiting the temperature of the hot water at the fixtures to a selectable temperature.

Owner's Manual

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

Meters

- The meter's make, model and serial number will be compared to what was submitted on the ICF.
- Meter location and proper installation will also be verified.

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, PAs reserve the right to issue a failure.

4.8.5 Notification of Inspection Results

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

4.8.5.1 Passed Inspection

Upon passing the onsite field inspection, the PA will process payment to the Payee named on the ICF. An infraction of the SOF or 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 4.6 Payment Process for details.

4.8.5.2 Failed Inspection

Upon failing the onsite field inspection, the PA will notify in writing the Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer of the reason(s) for the failure. See Section 4.8.6, entitled Failure Sanction, for a description of the required actions following failure notification.

4.8.6 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, entitled 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 at the PAs discretion via an onsite re-inspection or through acceptable photos of the correction items.

PAs reserve the right to revoke the contractor's program eligibility status if contractor fails to correct the failure items identified at the onsite field inspection. Correction of failure items does not remove the failure from the contractor's record. The failure will still count towards the maximum allowable failures in a rolling 12-month period.

Companies that receive three failures in a rolling 12-month period across all PA territories will be put on probation for six months and required to once again attend the CPUC designated contractor / self-installer training workshop. Additional applications from this contractor will not be processed until completion of the workshop. Probation may entail inspections of 100 percent of systems installed by the sanctioned contractor at the PAs discretion. The fifth program-wide failure received in a rolling 12-month period by an Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer will result in disqualification from participating in the program for a minimum of six months at the PAs discretion.

5. Disqualification and Right to Audit

5.1 Grounds for Immediate Disqualification from the CSI-Thermal Program

An Applicant, Solar Contractor, System Owner, Seller, and/or Host Customer will be immediately disqualified from participating in the CSI-Thermal program 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 in other CPUC Programs, to include but not limited to CSI general market program, Multi-Family Affordable Solar Housing (MASH), Single Family Affordable Solar Housing (SASH), or Self Generation Incentive Program (SGIP), CSI-Thermal Program PAs reserve the right to impose an equivalent sanction within the CSI-Thermal Program.

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 CSI 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 CSI-Thermal Program 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 disputes the findings and/or sanctions of the PA, he or she may appeal in writing to the PA within 30 calendar days of notification.

A panel of non-sanctioning PAs and a representative from the Energy Division of the CPUC will review the appeal. Written appeals should substantiate any reasons that warrant reconsideration of the failure or disqualification. The PAs may request additional information to substantiate the written appeal. The final decision will be provided to the PA, 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 PAs reserve 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 PAs 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 CSI Thermal 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 PA.

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 CSI-Thermal Program 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 CSI-Thermal Program 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.

www.iapmo.org

6.1 Freeze Protection

All installed systems must meet freeze protection requirements set forth by SRCC or IAPMO. The CSI-Thermal Program uses the 16 California climate zones established by the CEC to determine eligibility of appropriate freeze protection technologies. The CEC Climate Zone Handbook is available on www.gosolarcalifornia.com.

6.1.1 Integral Collector Storage

Integral Collector Storage (ICS) systems are protected by the thermal mass of the storage in the collector down to the Freeze Tolerance Level (FTL) as certified by SRCC. If the historical 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 record low temperatures per climate zone.

6.1.2 Direct Forced Circulation

There are two methods of freeze protection for Direct Forced Circulation systems (also known as open-loop systems): automatic freeze drain valves and active pump recirculation. The only primary freeze protection method recognized by SRCC is the automatic freeze drain valve, which does not depend on grid power. The automatic freeze drain valves open at 45°F, and allow a small but continuous stream of water to evacuate the collector. A second option is to use an Uninterruptible Power Supply.

Active pump recirculation freeze protection protects potable water in the collector from freezing by turning on the recirculation pump to move warm water from the tank through the collector when the collector temperature is less than 41°F. This method is not recognized by SRCC as a reliable freeze protection method, due to the risk of power loss with freezing conditions. There is no loss of water; however, the storage medium is cooled.

Direct Forced Circulation systems will not be allowed in the CSI-Thermal Program, pending the results of a technical task force study on the feasibility of these freeze protection methodologies in California.

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 an incentive in all CEC climate zones.
- 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, then drain the water from the collectors when the pump shuts down. These systems are eligible for an incentive in all CEC climate zones.
- Closed loop recirculation systems re-circulate water in the collector loop. These systems must have a minimum of two 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, shall be designed to protect components from freeze damage, even in the event of power failure. For example, 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, which 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 all CEC climate zones.

Open loop Thermosiphon systems which have potable water in the collector loop are not allowed in the CSI-Thermal Program.

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.

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 recommended maintenance. Acceptable stagnation control measures in closed loop glycol 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. The PAs may request for stagnation protection method justification on multi-family /commercial systems if the OG-100 calculator predicts a high collector temperature.

Additional stagnation or overheat protection measures may be allowed at the PAs 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 Program will allow for the use of a swimming pool and spa as an alternative heat dump under the following conditions:

- This will apply for fluid collectors only.

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- 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

Hartstat 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.

6.3 System Sizing

Over-sizing the SWH system will not be permitted in the CSI-Thermal Program 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.⁹

⁹ Air collectors are exempt from the collector sizing requirements listed in Section 6.3.

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. PAs will use the following guidelines to determine 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, are considered oversized and must submit justification to the PA.

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

Annual average GPD is estimated based on the Maximum GPD Guideline Table (Appendix D). If the guideline table does not have an entry for the customer's building type, then the customer must meter their usage for 60 days as outlined in Appendix H.

- Maximum GPD Guideline Table: SWH systems for the building types listed in the Maximum GPD Guidelines Table must 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 be sized using a lesser GPD assumption.
- Meter Actual Consumption: Building types not listed in the Maximum GPD Guideline Table must do one of the following:
 - Meter hourly actual hot water consumption using a flow meter with accumulator for a minimum of 60 calendar days and adjust for seasonal variability to obtain an annual average GPD and hourly usage profile. Hot water consumption calculation must be stamped by a P.E. Refer to Appendix H for more information.

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- Meter hourly natural gas, electric, or propane consumption at the water heater for a minimum of 60 days and adjust for seasonal variability to obtain an annual average GPD and hourly usage profile. Water heater gas, electric, or propane meter consumption calculation must be stamped by a P.E. Refer to Appendix H for more information.
 - For new construction, where metering cannot be performed, estimated annual average GPD and hourly usage profile calculations may be submitted. Estimates must be stamped by a P.E. Refer to Appendix H for more information.

6.3.2.2 Collector and Solar Storage Tank Sizing Validations

- Fluid collector square footage cannot exceed 1.25 times the GPD.
- Systems with two or more tanks must have a minimum of one gallon of storage per square foot of collector. Systems using unglazed collectors must have a minimum of 0.33 gallons of storage per square foot of collector. Systems 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. Systems using unglazed collectors must have a minimum of 0.41 gallons of storage per square foot of collector. Systems using 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 must be stamped and signed by a State of California licensed Professional Engineer (P.E.) justifying the reduced storage and indicating how overheat/stagnation will be prevented.

6.4 Metering, Monitoring, and Communication Requirements

This section contains detailed information on the metering, monitoring, and communication requirements for participation in the CSI-Thermal Program. There are three purposes for metering: program measurement and evaluation (opt-in), customer performance monitoring, and 70/30 true-up payments.

6.4.1 Requirements for Opt-In Program Measurement and Evaluation (M&E)

The purpose of M&E metering is to help PAs and the CPUC evaluate program and technology performance over time. Data and information collected by the M&E process will not be used by the PAs to inform customers directly on the performance of their systems. The ability to opt-in allows project to have more accurate data and benefit of offset funding available from the program. The requirements for this option are described below.

6.4.1.1 Required Equipment

Complete Btu meters must be capable of recording Btu calculations only when there is established flow. For assembled Btu meters, the PPD must ensure that Btu calculations are only performed when there is flow.

- Systems with Two or More Tanks

For systems that have separate solar storage tank(s) and a back-up water heater, required equipment consists of a BTU meter, i.e., a flow meter on the cold water supply line, an appropriately located temperature sensor pair, and a calculator.

- One Tank Systems

For one-tank systems in which the storage tank is heated by both thermal solar and an auxiliary heat source, required equipment consists of a BTU meter, i.e., a flow meter on the cold water supply line, an appropriately placed temperature sensor pair, and a meter that measures the gas, electric, or propane contribution from the back-up water heater or boiler.

6.4.1.2 Equipment Accuracy Standard

- Heat (BTU) meters must satisfy the maximum permissible errors (accuracy tolerances) of International Origination of Legal Metrology (OIML) R75 Class 2 accuracy. Refer to Appendix G for OIML R75 accuracy class definitions and the metering equipment approval process.

6.4.1.3 Equipment Location

Metering equipment must be installed on the potable water side of the SWH system.

6.4.1.4 Communication Requirements.

Refer to Section 6.4.4, entitled M&E and True-Up Communication Requirements, for details.

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.

These are minimum requirements. However, systems with capacity over 250 kW_{th} that have 70/30 metering, or those opting-in to M&E metering, have more accurate metering. As a result, these systems may use their more robust metering system to provide CPM.

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 $\pm 2\%$ at full flow.
- Temperature sensors must have a maximum permissible error of $\pm 1^\circ\text{F}$ 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).

Refer to Appendix G for metering equipment approval process.

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.

6.4.3 Requirements for 70/30 True-Up Payment Customers ($> 250\text{ kW}_{\text{th}}$)

The purpose of 70/30 true-up payment metering is to enable the PA to calculate a true-up payment based on 12-months of actual solar energy delivered.

6.4.3.1 Required Equipment

Complete Btu meters must be capable of recording Btu calculations only when there is established flow. For assembled Btu meters, the PPD must ensure that Btu calculations are only performed when there is flow.

- Systems with Two or More Tanks

For systems that have separate solar storage tank(s) and a back-up water heater, required equipment consists of a BTU meter, i.e., a flow meter on the cold water supply line, an appropriately located temperature sensor pair, and a calculator.

- One Tank Systems

For one-tank systems in which the storage tank is heated by both thermal solar and an auxiliary heat source, required equipment consists of a BTU meter, i.e., a flow meter on the cold water supply line, an appropriately placed temperature sensor pair, and a meter that measures the gas, electric, or propane contribution from the back-up water heater or boiler.

6.4.3.2 Equipment Accuracy Standard

Heat (BTU) meters must satisfy the maximum permissible errors (accuracy tolerances) of OIML R75 Class 1 accuracy. Refer to Appendix G for OIML R75 accuracy class definitions and the metering equipment approval process.

6.4.3.4 Equipment Location

Metering equipment must be installed on the potable water side of the SWH system.

6.4.3.5 Communication Requirements

Refer to Section 6.4.4, for details.

6.4.4 Minimum Program Performance Data (PPD) Requirements for 70/30 True-Up and all Opt-in M&E Metering

For 70/30 true-up payment and opt-in M&E participants, a PPD provider is defined as a service provider that monitors and reports the energy delivery data from the SWH system to the PA. These data serve as the basis for 70/30 true-up incentive payments and M&E studies. The data flow between the SWH system and the PA's designee must meet the PPD requirements described in Appendix E.

All PPD providers must be approved by the PAs. The instructions for qualifying as a PPD provider can be found in Appendix E. Approved PPD providers can be found on the following website: www.gosolarcalifornia.org/solarwater.

6.4.4.1 Data Privacy

Protecting System Owner and Host Customer data privacy is of the highest importance. As such, data shall be collected, processed, and reported to the System Owner and the PA via secure channels. The PPD provider may provide data to third parties, including Solar Contractors and Host Customers (if different than the System Owners), provided the System Owner has consented in writing to the release of such performance data.

6.4.4.2 Remote Access

All monitoring systems must have remote communication capability whereby performance data can be collected, accessed remotely, and uploaded for processing by a PPD.

6.4.4.3 Solar Performance Data

The PPD provider must monitor, trend, archive, and report the fields listed in Table 10, in 15-minute intervals that will be available on a daily basis. The data must be in xml for data delivery, and must reference the PPD username, password, and application number. Sample data schema can be found at <https://www.csithermal.com/schema/metering.xsd>. For assembled Btu meters, the PPD must ensure that Btu calculations are only performed when there is flow.

Table 10
Program Performance Data Reporting Requirements

Data Field	1-Tank System	2-Tank System
Date	Required	Required
Time	Required	Required
Cumulative gallons of hot water consumed	If Available	If Available
Solar BTUs delivered (2-tank system)	N/A	Required
Total BTUs delivered (1-tank system)	Required	N/A
Back-up gas consumption (therms)	Required if gas	N/A
Back-up electric consumption (kWh)	Required if electric	N/A
Back-up propane consumption (therms)	Required if propane	N/A
Cold water supply temperature (°F)	If Available	If Available
Solar hot water delivery temp. (°F)	If Available	If Available
Collector temperature (°F)	If Available	If Available
Pump 1 run time (24 hours a day)	If Available	If Available
Pump 1 energy (kWh)	If Available	If Available
Pump 2 run time (24 hours a day)	If Available	If Available
Pump 2 energy (kWh)	If Available	If Available
Pump 3 run time (24 hours a day)	If Available	If Available
Pump 3 energy (kWh)	If Available	If Available
Log data		
• Alarms	If Available	If Available
• System messages	If Available	If Available
• System events	If Available	If Available
• Trends	If Available	If Available

6.4.4.4 Minimum Report Delivery Requirements

The PPD provider must electronically submit performance data reports for each project through www.csithermal.com. The data is utilized for 70/30 true-up incentive payments as well as M&E purposes. A minimum acceptable data submission must include 90% of the required data points for each quarterly submittal.

6.4.4.5 Time Granularity of Acquired Data

The PPD provider must record all required solar performance or output data points no less frequently than once every 15 minutes.

6.4.4.6 Frequency of Data Collection

The PPD providers must remotely acquire and process all data points no less frequently than once per day.

6.4.4.7 Frequency of Data Reporting

PPD providers are required to report performance data quarterly to the PAs for five years for systems participating in the M&E process. PPD providers are required to report performance data quarterly to the PAs for 12 consecutive months for systems participating in the 70/30 true-up process.

6.4.4.8 Data Retention Policy

PPD providers must retain performance data for five years from the M&E data collection end date.

6.4.4.9 Summary of performance metering and communication requirements

Table 11, below, provides a summary of the Performance Metering and Communication Requirements.

**Table 11
Summary of Performance Metering and Communication Requirements**

Incentive Structure	System Size	Metering Process	Min. BTU Meter Accuracy	Metering Equipment Location	CPM Required	PPD Required	Who Bears Cost
Single Lump-sum Rebate	≤ 30 kW _{th}	None	N/A	N/A	N/A	N/A	N/A
Single Lump-sum Rebate	30 kW _{th} < system ≤ 250 kW _{th}	Customer Performance Monitoring	Flow Meter: ± 2% At full flow Temperature sensors: ± 1° F	Collector loop or potable water side	Yes	No	Paid for by System Owner
70/30 True-Up	> 250kW _{th}	70/30 True-Up payment	OIML R75 Class 1	Potable water side	Yes	Yes	Paid for by System Owner

Single Lump-sum Rebate	$\leq 250 \text{ kW}_{\text{th}}$	Opt-in to M&E (not mandatory)	OIML R75 Class 2	Potable water side	Required for systems $>30 \text{ kW}_{\text{th}}$	Yes	Contract or less \$500 offset from PA
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APPENDICES

Appendix A Acronyms

AB: Assembly Bill

AFUE: Annual Fuel Utilization Efficiency rating

Btu: British Thermal Unit

CCSE: California Center for Sustainable Energy

CEC: California Energy Commission

CPM: Customer Performance Monitoring

CPUC: 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

MPE: Maximum Permissible Error

MW: Megawatt

NREL: National Renewable Energy Laboratory

OG: Operating Guidelines

PPM: Proof of Project Milestone

PA: Program Administrator

PDP: Performance Data Provider (applies to CSI General Market)

PMRS: Performance Monitoring and Reporting Service (applies to CSI General Market)

PPD: Program Performance Data

PG&E: Pacific Gas and Electric

RRF: Reservation Request Form

SB: Senate Bill

SCE: Southern California Edison

SCG: Southern California Gas Company

SDG&E: San Diego Gas and Electric

SOF: Surface Orientation Factor

SRCC: Solar Rating and Certification Corporation

SWH: Solar Water Heating

TRNSYS: The Transient Energy System Simulation Tool

Appendix B Definitions and Glossary

70/30 True-Up: The CSI-Thermal Program will pay multi-family/commercial projects with capacity over 250 kW_{th} in two parts. The first payment will be 70 percent of the incentive based on the energy savings estimate from the OG-100 calculator at the time the ICF is submitted. The second payment is paid based on subtracting the first payment from the final incentive amount determined from metered energy savings for the first year. PA will not pay more than 110 percent of the estimated incentive amount.

Applicant: The Applicant is the entity that completes and submits the CSI-Thermal Program application and serves as the main contact person for the CSI-Thermal Program PA throughout the application process. The eligible Solar Contractor or Self-Installer will be the Applicant for CSI-Thermal Program 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 CSI-Thermal Program, unless expressly stated otherwise, refer to true, not magnetic, azimuth.

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

Combination System: Any solar water heating system that includes domestic hot water loads in combination with other thermal loads.

Commercial: For the purposes of the CSI-Thermal Program, 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 CSI-Thermal Program, 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 CSI-Thermal Program 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 service¹ from, PG&E, SCE, SCG, or SDG&E. Municipal electric utility customers are not eligible to receive incentives from the designated PAs.

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 M² 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 includes 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

Megawatt (MW): Unit of electrical power equal to one million watts; also equals 1,000 kW.

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. SWH systems installed with propane or electric back-up water heaters on new construction projects are not eligible for an incentive through the CSI Thermal program.

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 CSI- Thermal Program incentive check is made payable.

Program Administrator (PA): For purposes of the CSI Thermal Program, PG&E, SCE, SCG, & CCSE (which administers the program on behalf of SDG&E) are the PAs.

Project: For purposes of the CSI-Thermal Program, the “Project” is the installation and operation of the SWH system, as described on the submitted application.

Program Performance Data: A service that monitors and reports the energy delivery data from the SWH system to the PA to serve as the basis for 70/30 true-up incentive payments and M&E studies.

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 PAs may, at their discretion, 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.

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 for purposes of CSI 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 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 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.

TRNSYS: An energy simulation tool, designed to simulate the transient performance of thermal energy systems. The multifamily and commercial OG-100 incentive calculator will use the TRNSYS software to estimate energy savings.

Two-Tank System: A system where there is a separate dedicated solar storage tank and separate auxiliary heater.

Appendix C Surface Orientation Factor (SOF) Chart¹⁰

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.

**Table C1
Surface Orientation Factor Chart**

		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°

¹⁰ 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 Multi-Family/Commercial Projects

**Table D1
Maximum Gallon Per Day Guideline Table¹¹**

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
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
Quick Service Restaurants	0.7 per meal served
Elementary schools	0.6 per student
Junior and senior high schools	1.8 per student
Coin-op Laundries	20 per 10 lbs per washing machine

¹¹ The GDP table is only a maximum justification and predates low-flow fixtures and appliances. Data should **not** be used for sizing requirements.

Appendix E

INSTRUCTIONS FOR QUALIFYING AS A PPD PROVIDER FOR THE CALIFORNIA SOLAR INITIATIVE THERMAL PROGRAM

The purpose of this section is to outline the required process and qualifications to be approved as a PPD provider for the CSI-Thermal Program. This section also details the data reporting requirements (format, delivery method) and schedule for 70/30 true-up payments and M&E purposes. The PPD provider may also provide CPM provider services. All PPD providers must meet the requirements established herein in addition to the requirements set forth in the CSI-Thermal Program Handbook.

BACKGROUND AND REQUIREMENTS

Customers participating in the CSI-Thermal Program 70/30 true-up payment process and/or M&E program are required to install performance meters to determine the energy delivered by their SWH system. This data must be read and communicated to the PA by a third-party PPD provider. This document provides information and instructions for providers wishing to qualify to provide PPD provider services.

The following are the PPD provider's primary responsibilities:

- Manage meter reading and data retrieval schedule
- Read and retrieve performance meter data
- Post data to www.csithermal.com on a consistent and reliable schedule, per PA requirements.
- Validate performance data prior to submitting
- Calculate quarterly energy delivered by the SWH system for true-up payment and M&E purposes
- Format data using the CSI-Thermal program approved protocol
- Troubleshoot and resolve communications issues
- Store data in accordance with program requirements
- Make historical performance data available to PAs as requested
- Provide technical support to PAs as well as customer support
- Communicate meter/device changes to the PA
- Provide disaster recovery and data backup services as requested by the PAs
- Ensure confidentiality of customer information and performance data
- Possess technical expertise and capability
- Comply with all State and Federal laws

PPD Provider Task Requirements

Data Format

Data must conform to the specific program requirements as outlined in Section 6.4.4. The 70/30 true-up and M&E data reports must include 15-minute interval (as defined in Section 6.4.4.5 Time Granularity of Acquired Data). All 70/30 true-up and M&E data reports must be formatted using XML unless otherwise specified. Required fields can be found in Section 6.4.4.3, Solar

Performance Data. The XML schema will be published at <https://www.csithermal.com/schema/metering.xsd>

Data Validation

The PPD provider must validate all data prior to posting it to the PAs secure FTP server. The following data validation rules shall apply:

- Time Check of Meter Reading Device/System (all)
- Meter Identification Check (all)
- Time Check of Meter (all)
- Pulse Overflow Check (if applicable to metering system)
- Test Mode Check (if applicable to metering system)
- Sum Check

Payment Validation, Audits, and Measurement and Evaluation

The PA may, at their discretion, perform validations on performance data prior to issuing payments to customers participating in this program. The validations will compare actual first year performance data with the expected performance as estimated based on documentation submitted on the Host Customer's approved incentive claim form. If payment falls outside expected ranges for the year, the incentive payment will be withheld until the PA determines to its satisfaction the reason for the discrepancy.

The PPD provider will work with the Host Customer to resolve any discrepancies identified by the PA which may include testing and/or recalibrating the meter/devices if deemed necessary. The PAs are not responsible for the costs associated with investigating and resolving any such discrepancies (i.e., testing, meter replacement hardware, installation labor).

The PA will also perform random audits of PPD provider data to ensure accuracy and compliance with the requirements outlined in this document, or as part of the CSI-Thermal Measurement and Evaluation Program in accordance with the CSI-Thermal Handbook. Any PPD provider found to be in violation of any of these requirements will be subject to the penalties outlined later in this document. The PA, via the local utility or its designated contractor may, at its discretion, inspect and test the performance meter or install separate metering in order to check meter accuracy, verify system performance, or confirm the veracity of monitoring and reporting services.

Any additional metering installed by or at the request of the PA will be paid for by the PA. However, in the event metering is installed during the course of an audit or investigation initiated by the PA where cheating or tampering is suspected and confirmed, the System Owner will be charged for these costs.

Data Retention

Raw and PPD provider validated interval and cumulative monthly data must be retained for a period of five years from the data collection end date. The M&E data collection time period is five (5) years and the 70/30 true-up data collection time period is one year (12 consecutive months). See Section 6.4.4.8 of the CSI-Thermal Handbook for more details. The PPD provider must be prepared to post historical interval data at the PAs request. The PA audit will include raw interval data which is to be maintained by the PPD provider for comparison with validated interval data

transmitted to the database. The PPD provider is also responsible for providing backup and disaster recovery services for 100 percent of the data.

Technical and Customer Support

The PPD provider must provide a technical support number to the PA for use during normal business hours (8:00 a.m. to 5:00 p.m. Pacific Standard time, Monday through Friday, except holidays) to help resolve any data availability, format or corruption issues, communication problems, server access problems, or other technical issues. Within those normal business hours, the PPD provider must respond to PA requests within two business days with a status report and plan for correcting the issues. The PPD provider must also provide a customer support number to respond to customer inquiries within two business days from the initial customer contact. PAs will have the discretion to set deadlines for the resolution of data transfer problems/issues.

PPD Provider Performance Exemptions

The PPD provider is responsible for meeting the above noted program requirements and for consistently posting performance data in accordance with the PAs scheduling and data posting requirements. At its discretion, the PA may grant reasonable allowances for occasional issues or technical problems, as well as for large catastrophic events such as earthquakes.

In the event of such catastrophic event resulting in an energy delivered interruption; OR in the event of metering or communications equipment failure where the data is irretrievable by the PPD provider at no fault of the customer AND it can be determined that the customer's SWH equipment was still operating, the PA may extend the 70/30 true-up incentive payment period beyond the established timeframes otherwise specified by the incentive program Handbook. The 70/30 true-up incentive payment extension period will be equivalent to the same period the system energy production data is unavailable. To submit a Data Report relative to missing data, the PPD provider will resubmit the respective Data Report, thereby replacing the previous incomplete report with a complete quarter of data.

PPD Provider Non-Performance

The PA will not issue incentive payments to customers based on estimated data from the PPD provider, nor will the PA estimate incentive payments under any circumstances. It is the PPD provider's responsibility to ensure timely (within 5 days after the end of the specified reporting period) and accurate posting of validated performance data so customer incentive payments can be made.

The following conditions may result in penalties, suspension of activity, or revocation of PPD provider approval from the PA:

- Data not posted by specified date (10 percent of accounts serviced by PPD provider over a one month period are late).
- No data received for incentive period (per customer: no data posted 2 times consecutively OR 2 times in 9 months; and/or per PPD provider: no data posted for 10 percent of accounts serviced by PPD provider). Submittal of corrected data or previously missing quarterly data must be received in cycle sequence.

-
- Data not validated in accordance with program requirements over the course of the CSI-Thermal Program. (1 time)
 - Estimated data posted instead of actual data. (1 time)
 - Meter change information not reported within 30 days of the meter change. (3 times within 6 months)
 - If an audit or investigation shows a discrepancy of more than 5 percent between the PPD provider reported data and PA check meter production data for one data report period. This discrepancy will trigger an audit schedule set by the PA for the PPD provider.

The PPD provider will be given reasonable opportunity to correct problems identified by the PA. The PA will work with the PPD provider to correct any such problems and avoid unnecessary delays in issuing incentive payments to customers, to the extent feasible. However, if the PPD provider fails to resolve any issues to the PAs satisfaction within 60 days which result in delays in incentive payments to customers, the following penalties may apply:

- If the problem is with a single or less than 20% of customer accounts served by the PPD provider, the PA will suspend PPD provider activity with just those affected customers. The affected customers will be notified that the PPD provider has been unable to resolve the specified issue within an acceptable timeframe and they will be given a 30 day grace period to select and engage with another PPD provider. The original PPD provider will be required to transfer all historical data to the newly selected PPD provider. An incentive payment will not be made until the customer provides a contract or similar document proving they are engaged with another PPD provider, but the customer's incentive payment period will be extended beyond the established period allowed under the applicable program rules to compensate for this interruption in data collection. If the customer fails to engage with and provide proof that they have contracted with a new PPD provider within the allowable grace period, the time between the grace period expiration date and the date the PA receive such proof will be deducted from the final payment amount.
- If the problem is of a more serious nature as determined by the PA and continues over 60 days, or it affects more than 20% of customers served by the PPD provider, the PPD provider's approval will be revoked and all customers will be notified that they must select another PPD provider. As above, an incentive payment will be made until the customer selects another PPD provider, but the customers' incentive payment period will be extended beyond the established payment period. The PPD provider will be eligible to reapply after six months upon demonstrating that they have successfully resolved all problems to the PAs satisfaction.

Unless the PPD provider's actions results in revocation, upon receipt of a notice from the PA with respect to the PPD provider's failure to provide the performance, the PPD provider must, as soon as reasonably practicable: (1) perform a root-cause analysis to identify the cause of such a failure; (2) provide the PA with a report detailing the cause of, and procedure for correcting such failure within 3 days of completion of such root-cause analysis; (3) implement such procedure after obtaining the respective PA approval of such procedure.

Criteria for a PPD Provider Appeals Process

Should the PPD provider disagree with a PA decision regarding a penalty, the PPD provider has the right to appeal to the CSI-Thermal Working Group for further consideration.

APPLICATION PROCESS

Application & Documentation

The PPD provider applicant completes the attached “Application to provide PPD Services” and provides all documentation in the attached checklist. Note that the PPD provider Applicant must submit an application to and successfully complete the data transfer test described later in this document to any of the four PAs.

The PAs will review the submitted documentation, determine if the PPD provider Applicant meets the program requirements and notify the PPD provider Applicant via email. The PA will review the application and respond to the PPD provider Applicant within 15 business days.

Data Transfer Test

Once the PA has reviewed and accepted the prospective PPD provider’s application, they will contact the PPD provider to schedule a data transfer test. Upon approval of the test, the PPD provider is eligible to submit quarterly performance data for CSI-Thermal customers.

PPD Provider Approval Initial Audit Period

Upon PA approval of the required PPD provider application documentation, and successful completion of the PPD provider data test procedures, the PPD provider will be qualified to provide performance data to the PA for incentive payment. However, the PAs will audit the raw production data from each PPD provider’s first data report for their first three customers for compliance with these PPD provider requirements. The PA will notify the PPD provider of noncompliance and will work to assist the PPD provider with resolving the issues.

Application to Provide PPD Provider Services

This application and the attached documents are to be used by Applicants for approval as a PPD provider. Please refer to the outline below to ensure your application includes all applicable documentation.

Company Name: _____ *

Primary Contact: _____

Address: _____ Address 2: _____ *

City: _____ * State: _____ * ZIP: _____ *

Phone: (____) ____ - _____ * Fax: (____) ____ - _____

Email: _____

Company Website: _____ *

*The above information is subject to public display upon approval of this application.

Technical Support Contact

Contact Name: _____

Phone: (____) ____ - _____ Email: _____

Hours of Operation (PST): _____ Days of Operation: _____

Customer Support Contact

Contact Name: _____

Phone: (____) ____ - _____ Email: _____

Hours of Operation (PST): _____ Days of Operation: _____

PPD Provider Application Outline

Section I: Application to Provide PPD Provider Services (above fields)

Section II: Company Background

- Company background (i.e. years in business, number of employees, general description, etc.)
- Meter data reading and reporting experience and capabilities, capacity, technology overview, IT capabilities, etc.

Section III: Data Format

Review the data format requirements in this section and initial beside each line item to indicate compliance.

-
- Provider can and will provide data in XML format _____
 - All applicable data fields will be submitted _____
 - Provider is able to meet data privacy and protection requirements _____
 - Provider is able to meet monitoring systems remote communication requirements _____
 - Provider is able to monitor, trend, archive, and report fields listed in Table 10 _____
 - Provider is able to electronically submit performance data reports for each project through www.csithermal.com _____
 - Provider is able to record all required solar performance or output data points at a minimum of every 15 minutes _____
 - Provider is able to report performance data quarterly to the PAs _____
 - Provider is able to meet data retention and performance requirements _____
 - Provider is able to calculate Btu values only when there is established flow _____

Section IV: Data Validation

- Data validation procedures
- Process for retrieving missed reads

Section V: Data Retention

- Data retention plan
- Backup and recovery plans

Section VI: Data Communication and Security

- Data communication (frequency, scalability, types, troubleshooting, etc.)
- Data posting (data translation, formatting, firewall access, etc.)
- Hardware and software scalability plans
- Data confidentiality and security procedures

By signing this document, the Applicant agrees to comply with all program requirements including those described in the CSI-Thermal Program Handbook (signature must be someone with legal authority at the PPD provider). Additionally, Applicant agrees to keep confidential all data received from the PA for testing. Information in this document will remain confidential.

Signature: _____ Date: _____

Printed Name: _____ Title: _____

Appendix F
Record Low Temperatures
in California Energy Commission's Climate Zones

Table F1
California Climate Zone Chart

CEC Climate Zone	Record Low Temperature (°F)
1	21
2	14
3	14
4	19
5	20
6	27
7	29
8	25
9	28
10	19
11	20
12	19
13	19
14	3
15	2
16	-7

Appendix G

Metering Equipment Approval Process

The purpose of this section is to outline the metering equipment application and approval process for Opt-in Measurement and Evaluation (M&E), Customer Performance Monitoring (CPM), and 70/30 True Up.

BACKGROUND AND REQUIREMENTS

The metering accuracy requirements are the following, as outlined in section 6.4:

Opt-in M&E (section 6.4.1.2)

Complete Btu meters must be capable of recording Btu calculations only when there is established flow. For assembled Btu meters, the PPD must ensure that Btu calculations are only performed when there is flow.

Heat (BTU) meters must satisfy the maximum permissible errors (accuracy tolerances) of OIML R75 Class 2 accuracy

70/30 True-Up Payment for projects > 250 kW_{th} (section 6.4.3.2)

Complete Btu meters must be capable of recording Btu calculations only when there is established flow. For assembled Btu meters, the PPD must ensure that Btu calculations are only performed when there is flow.

Heat (BTU) meters must satisfy the maximum permissible errors (accuracy tolerances) of OIML R75 Class 1 accuracy.

Heat Meter Accuracy Classes (OIML R75¹²) for Opt-in M&E and 70/30 True-up Metering

Definitions:

$\Delta\Theta$	= the temperature difference
$\Delta\Theta_{\min}$	= the lower limit of $\Delta\Theta$
q	= the flow rate of the heat conveying liquid
q_p	= the highest value of q that is permitted permanently for short periods of time for the heat meter to function correctly
E	= maximum permissible error applicable to a complete heat meter
E_f	= maximum permissible error applicable to the flow meter
E_t	= maximum permissible error applicable to the temperature sensor pair
E_c	= maximum permissible error applicable to the BTU calculator

Maximum Permissible Errors (MPEs) applicable to complete heat meters

- $E = E_f + E_t + E_c$

The relative MPE of the flow sensor, expressed in %, for the accuracy classes:

⁸ International Recommendation for Heat Meters (OIML R75-1 Edition 2002) <http://www.oiml.org/publications/R/R075-1-e02.pdf>

-
- **Class 1:** $E_f = (1 + 0.01 q_p / q)$, but not more than 3.5% **(70/30 True-up)**
 - **Class 2:** $E_f = (2 + 0.01 q_p / q)$, but not more than 5% **(Opt-in M&E)**

The relative MPE of the temperature sensor pair, expressed in %:

- $E_t = (0.5 + 3 \cdot \Delta\Theta_{\min} / \Delta\Theta)$

The relative MPE of the calculator, expressed in %:

- $E_c = (0.5 + \Delta\Theta_{\min} / \Delta\Theta)$

CPM for projects >30 kW_{th} (section 6.4.2.2)

- Flow meter must have a maximum permissible error $\pm 2\%$ at full flow.
- Temperature sensors must have a maximum permissible error of $\pm 1^\circ$ 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).

APPLICATION AND APPROVAL PROCESS

Applicant or metering equipment manufacturer must submit the following metering information to one of the CSI-Thermal Program Administrators (PA):

- Identify the specific metering options for which approval is being requested.
- **Complete BTU Meter:** make, model, and documentation (i.e. manufacturer equipment specification or third-party test report) that verifies the equipment meets the accuracy requirements for the metering option(s) outlined above
- Identify a metering name to appear on the approved list, for each metering option in which approval being requested.

Specifications can be sent via email or US Mail to:

California Center for Sustainable Energy (SDG&E territory):

CSI-Thermal Program
8690 Balboa Ave Suite 100
San Diego, CA 92123
Email: swh@energycenter.org

Pacific Gas and Electric:

PG&E Solar and Customer Generation: CSI-Thermal
PO Box 7433
San Francisco, CA 94120
Overnight Deliveries

PG&E Solar and Customer Generation
245 Market St., MC N7R
San Francisco, CA 94105-1797
Email: solar@pge.com

Southern California Gas Company:
CSI-Thermal Program
555 W. Fifth Street ML GT22H4
Los Angeles, CA 90013
Email: swh@socalgas.com

Southern California Edison:
Attn: CSI Thermal Program Administrator
P.O. Box 800
Rosemead, CA 91770-0800
Email: CSIGroup@sce.com

PAs will review the specifications to determine which metering accuracy standards the equipment achieves. If the metering equipment meets the accuracy standards for 70/30 true-up, this equipment will be added to the approved list of meters for 70/30 true-up, Opt-in M&E and CPM metering purposes. If the metering equipment meets the accuracy standards for Opt-in M&E, this equipment will be added to the approved list of meters for both Opt-in M&E and CPM metering purposes. If the metering equipment meets only the standards for CPM, this equipment will be added to the approved list of meters for CPM.

APPROVED METERING EQUIPMENT LIST

A list of all approved meters for each metering purpose will be publically available at www.gosolarcalifornia.org/solarwater. Additionally, a drop down menu containing all approved meters will be imbedded into the application to allow applicants to easily select the metering equipment to be installed at the project site.

Appendix H

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

Building types not listed in the Maximum GPD Guideline Table (Appendix D) must meter actual hot water consumption or natural gas or electric consumption used for water heating. Building types that are listed in the Maximum GPD Guideline Table must use the values in Appendix D to size multi-family and commercial projects. They may not opt to use the metering method described in this appendix. In order to meter actual consumption, applicants must do one of the following:

- Meter actual hot water consumption using a flow meter with accumulator for a minimum of 60 calendar days and adjust for seasonal variability. Hot water consumption calculation must be stamped by a P.E.
- Meter natural gas, electric, or propane consumption at the water heater for a minimum of 60 days and adjust for seasonal variability. Water heater gas or electric meter consumption calculation must be stamped by a P.E.

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

The 60 days of metered data collected must be quality checked and processed by a State of California Licensed Professional Engineer (P.E.). The P.E. is responsible for the following:

- 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 60 day 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 H1 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. The results of the data will create a custom load profile for their proposed system.

**Table H1
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 submitted in the “Customer Load Profile” documents section of the application database.

- The load profile data must be submitted to the PAs in tab delimited format document using the format provided in Table H1.
- The actual monitoring data.
- The assumptions used to extrapolate the 60 days of monitoring data to the 8760 hour usage profile and average GPD.