
Solar Water Heating

Specialty Commercial Solar Water Heating

California Statewide Utility Codes and Standards Program

August 17th , 2011

Specialty Commercial Solar Water Heating

Outline

- Proposed Code Change
- Methodology
- Results
- Proposed Code Change Language
- Questions & Comments

Specialty Commercial Solar Water Heating

Code Change Proposals – Base Code

- **Prescriptive:**
 - Add required solar fraction of 25% for restaurants 12,600 sq. feet or larger.
 - Introduce restaurant (full-service) hot water demand profile into F-chart or equivalent calculator.
 - Update Compliance Manual and Compliance Forms
- **Performance:**
 - Introduce hourly solar model and restaurant hot water demand profile, and integrate into the Non-Residential Alternative Calculation Method (ACM) Manual, while changing it from an optional capability to a minimal capability.

Specialty Commercial Solar Water Heating Methodology

- Energy Savings & Energy Cost Savings
 - Modeled Proposed Standards Case (TRNSYS)
 - Active Indirect Glycol w/ Natural Gas Storage Tank
 - 16 Climate Zones
 - Compared to Base Case (no solar system)
 - Assumptions & Formulas in CASE Report

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Methodology

- Calculation of Solar Fraction
 - Proposed Standards Case
 - Annual Solar Fraction (SRCC) = $1 - EF / SEF$
 - $SEF = Q_{del} / (Q_{aux} + Q_{par})$
 - Q_{del} = Energy delivered to the hot water load (TESS 2011)
 - Q_{aux} = Annual amount of energy used by the auxiliary water heater or backup element with a solar system operating (TESS 2011)
 - Q_{par} = Parasitic energy: Annual amounts of AC electrical energy used to power pumps, controllers, shutters, trackers, or any other item needed to operate the SDHW system (TESS 2011)
 - $EF = EF$ equivalent, i.e. operating efficiency

Single Family & Specialty Commercial Solar Water Heating

Cost and Savings Results

Key Numbers for Commercial Active Indirect Glycol w/ Natural Gas Storage Tank (BASE TDV)

Climate Zone	Annual Energy Savings (Therms)	Annual Energy Savings (kWh)	15 Year BASE TDV Energy Cost Savings (\$)	Incremental Measure Cost (installation and PV maintenance and replacement)	Life Cycle Cost Savings (\$)	Solar Fraction
1	1,444	(502)	\$19,493	\$20,950	(\$1,458)	0.18
2	1,649	(517)	\$22,235	\$20,950	\$1,284	0.25
3	1,605	(513)	\$21,677	\$20,950	\$726	0.24
4	1,668	(531)	\$22,535	\$20,950	\$1,585	0.25
5	1,688	(529)	\$23,080	\$20,950	\$2,130	0.25
6	1,610	(539)	\$22,105	\$20,950	\$1,154	0.25
7	1,624	(536)	\$22,584	\$20,950	\$1,634	0.26
8	1,626	(533)	\$22,311	\$20,950	\$1,361	0.26
9	1,646	(541)	\$22,536	\$20,950	\$1,585	0.26
10	1,666	(540)	\$22,843	\$20,950	\$1,893	0.27
11	1,678	(534)	\$22,572	\$20,950	\$1,621	0.26
12	1,640	(527)	\$21,977	\$20,950	\$1,026	0.25
13	1,591	(512)	\$21,298	\$20,950	\$347	0.26
14	1,806	(573)	\$24,813	\$20,950	\$3,863	0.28
15	1,662	(581)	\$22,732	\$20,950	\$1,781	0.31
16	1,776	(535)	\$24,293	\$20,950	\$3,343	0.24

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Proposed Code Language

- **Non-Residential Standard:**

- **Section 145:**

- **Add: a) Nonresidential Occupancies.** A service water heating system installed in a nonresidential building complies with this section if it complies with the following requirements:
 1. All service water heating systems shall comply with the applicable requirements of Sections 111, 113 and 123; and
 2. Service water heating systems providing hot water to restaurants (designated as “restaurant” or area category as “dining”) and having a conditioned floor space greater than 12,600 square feet shall have a passive or active solar system complying with the freeze and overheat protection SRCC guidelines and complying with either A or B below:

Specialty Commercial Solar Water Heating

Proposed Code Language

- **Section 145: (continued)....**

A. Solar system is sized to provide 25% of the energy for water heating. If the system uses a pump, the pump shall have an electronically commutated motor.

B. An active solar system having all of the following characteristics:

- The system shall have glazed flat plate collectors with an area of at least 1 sq. ft. of collector per 50 sq. ft. of conditioned floor space.
- Solar storage tanks shall have an internal volume of at least 1 gallon per 1 sq. ft. of collector and insulated according to Section 113(c)4.
- The collectors shall a. SRCC OG-100 rating with a Y intercept no less than 0.706 and a slope no less than -0.865 Btu/hr ft²·°F
- Collectors shall face within 35 degrees of due South, and shall have a tilt angle of at least 14 degrees (3:12) from horizontal. Over 95% of collector area shall be unshaded for at least 8 hours on the equinox.
- Pump shall have an electronically commutated motor.

- Exception: Climate Zone 1.

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Proposed Code Language

- **Non-Residential Compliance Manual:**
 - **Section 4.7**
 - **Modify:** All of the requirements for service hot water are mandatory measures, except for restaurants and dining facilities that must comply with §145(a), and high-rise residential, hotels and motels that must comply with the Residential Standards §151(f)8. These requirements are described in the Residential Compliance Manual.

Specialty Commercial Solar Water Heating

Proposed Code Language

- **Non-Residential Compliance Manual:**
 - **Section 4.7.1:**
 - **Add:** a) Nonresidential Occupancies. Service water heating systems providing hot water to restaurants (designated as “restaurant” or area category as “dining”) and having a conditioned floor space greater than 12,600 square feet shall have a passive or active solar system complying with the freeze and overheat protection guidelines of SRCC guidelines and complying with either A or B below:

Specialty Commercial Solar Water Heating

Proposed Code Language

- **Section 4.7.1: (continued)....**

A. Solar system is sized to provide 25% of the energy for water heating. If the system uses a pump, the pump shall have an electronically commutated motor.

B. An active solar system having all of the following characteristics:

- The system shall have glazed flat plate collectors with an area of at least 1 sq. ft. of collector per 50 sq. ft. of conditioned floor space.
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- Pump shall have an electronically commutated motor.

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Proposed Code Language

- **Non-Residential Compliance Manual:**
 - **Section 4.7.1:**
 - Solar Water Heating Calculations: Solar water heating can be used as a tradeoff under the performance approach. The building standards use solar fraction (SF) to determine the impact of the solar water heating systems. The SF is the percent of the total energy required by the water heating system that is provided by the solar system. Note that systems used for compliance must have received a rating by the Solar Rating and Certification Corporation (SRCC). When using the prescriptive approach, the designer has two options. The first option is to achieve a solar fraction by selecting the applicable type and number of collectors, storage volume, as well as the tilt and orientation of the collectors. To use this approach, go to the following website to download the calculator: XXXX. The second option is to follow the specifications in Section 145

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Proposed Code Language

- **Compliance Forms**
 - **MECH-2C**
 - Add: “Building Area (ft²)” and “Restaurant (Building Category) or Dining (Area Category) (see LTG-1C) and “Solar Fraction.”

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QUESTIONS & COMMENTS