Task 48 – Quality Assurance and Support Measures for Solar Cooling

Subtask C: Market Support Measures

C1: Review of Relevant International Standards, Rating and Incentive Systems

Country: United States of America

Milan, Italy – March 26, 2012

Khalid Nagidi

Energy Management Consulting Group
Agenda

- Introduction
- US Solar Thermal Market
- Current Trends
- Solar Thermal Industry Rating & Certification
- Rebates & Incentives

Estimated U.S. Energy Use in 2010: 98.0 Quads

Source: Lawrence Livermore National Laboratory
U.S. Census Regions and Divisions

Source: U.S. Energy Information Administration / Annual Energy Review 2010
Heating Degree-Days by Census Division

Source: U.S. Energy Information Administration / Annual Energy Review 2010

High: 4,958 (1978)

30-Year Normal: 4,524

Low: 3,951 (1998)
Cooling Degree-Days by Census Division

30-Year Normal: 1,242

High: 1,457 (2010)

Low: 1,029 (1976)

Source: U.S. Energy Information Administration / Annual Energy Review 2010
State-Level Energy Consumption Estimates and Estimated Consumption per Person in 2009

Source: U.S. Energy Information Administration / Annual Energy Review 2010
2010 U.S. Buildings Energy End-Use Splits

Space Heating: 20.7%  
Water Heating: 9.1%  
Space Cooling: 13.2%  
Total: 43% of US Buildings Energy Use

Source: 2010 Building Energy Data Book by U.S. DOE/EERE, Table 1.1.5
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Solar Collectors in Operation by Country at the end of 2007

Figure 4: Total capacity in operation of water collectors of the 10 leading countries at the end of 2007


- 84% of these installations are in the residential sector

US Solar Thermal Installations
Estimated in 2009

- California: 1,000
- Hawaii Islands: 8,750
- Arizona: 1,500
- Florida: 5,000
- Mid-Atlantic: 1,500
- Midwest and All Other US: 5,000+
- Northwest: 500
- New England + New York: 3,000
- Total ~26,250 Installations, each 64 sf. (1,680,000 sf)

Source: Hawaii Utility Administrators
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Current Trends

Solar Water Heating

- Evacuated Tube Collectors are getting increased popularity

Solar Swimming Pool Heating

- More and more systems are installed with an average of 350-400 ft²/system

Solar Space Heating

- Interest on combined heating and hot water systems (Combi-Systems) is growing

Solar Air Conditioning

- SAC is gaining interest especially in geographical regions with generous incentives, and high energy cost
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Solar Rating and Certification Corporation

- SRCC is a Non-profit organization established in 1980
- OG-100: Solar Collectors
- OG-300: Solar Water Heating Systems
- 110 SRCC Participants
SRCC Certified Solar Collectors as of Q1 2012

- 946 Glazed (OG-100)
- 43 Unglazed (OG-100)
- 4 Concentrating (OG-100)
- 20 Integral Collector Storage (ISC) and Non-Separable Thermosiphon Collector (OG-100)
- 2,115 Certified Systems (OG-300)
## Typical Solar Collector Certification and Rating

### Solar Collector Certification and Rating

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Viesmann Manufacturing Company (US) Inc.</th>
<th>Warwick, RI 02886 USA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>Sonolux 100-F, SV SHS1</td>
<td></td>
</tr>
<tr>
<td>Collector Type</td>
<td>Flat-Plate</td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>2007G42A</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>19-NOV-08</td>
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</table>

### Collector Thermal Performance Rating

<table>
<thead>
<tr>
<th>Category (T=18)</th>
<th>Clear Day (3.1 kWh/m²/day)</th>
<th>Milky Day (2.4 kWh/m²/day)</th>
<th>Cloudy Day (1.7 kWh/m²/day)</th>
<th>Milky Day (1500 kBtu/1000 ft²/day)</th>
<th>Cloudy Day (1000 kBtu/1000 ft²/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (0°C)</td>
<td>11.3</td>
<td>8.5</td>
<td>6.8</td>
<td>3.3</td>
<td>0.9</td>
</tr>
<tr>
<td>B (5°C)</td>
<td>10.3</td>
<td>7.5</td>
<td>6.0</td>
<td>3.3</td>
<td>0.9</td>
</tr>
<tr>
<td>C (20°C)</td>
<td>9.6</td>
<td>6.6</td>
<td>5.3</td>
<td>2.4</td>
<td>0.9</td>
</tr>
<tr>
<td>D (60°C)</td>
<td>8.6</td>
<td>5.3</td>
<td>4.0</td>
<td>1.2</td>
<td>0.9</td>
</tr>
<tr>
<td>E (80°C)</td>
<td>7.6</td>
<td>4.0</td>
<td>3.0</td>
<td>1.0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

### Collector Specifications

- **Gross Area**: 2.494 m² (26.84 ft²)
- **Net Aperture Area**: 2.34 m² (25.13 ft²)
- **Gross Weight**: 42.2 kg (93 lb)
- **Test Pressure**: 110.3 kPa (160 psig)

### Collector Materials

**Cover (Outer)**: Aluminum
**Cover (Inner)**: None
**Absorber Coating**: Black Chrome
**Insulation Side**: None
**Insulation Back**: Black Glass Fiber

### Technical Information

<table>
<thead>
<tr>
<th>Efficiency Equation (NOTE: Based on gross area and (P'=T)-Ta)</th>
<th>Y Intercept</th>
<th>Slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si Units: (n=0.769)</td>
<td>-0.0358</td>
<td>0.575</td>
</tr>
<tr>
<td>IP Units: (n=0.769)</td>
<td>-0.0338</td>
<td>0.575</td>
</tr>
<tr>
<td>Incident Angle Modifier (β=[30°], 60°)</td>
<td>-0.1590</td>
<td>0.575</td>
</tr>
</tbody>
</table>

### Collector Test Details

- **Test Fluid**: Water
- **Test Flow Rate**: 20.0 ml/h, 0.0025 gpm

### Remarks

Certification must be renewed annually. For current status contact:
SOLAR RATINGS & CERTIFICATION CORPORATION
400 High Point Drive, Suite 400 • Cocoa, Florida 32926 • (321) 213-6077 • Fax (321) 281-0910

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<tr>
<td>Model</td>
<td>Tube</td>
<td></td>
</tr>
<tr>
<td>Collector Type</td>
<td>Tubular</td>
<td></td>
</tr>
<tr>
<td>Certification</td>
<td>2009G20B</td>
<td></td>
</tr>
<tr>
<td>Date</td>
<td>0AUG-09</td>
<td></td>
</tr>
</tbody>
</table>

### Collector Thermal Performance Rating

<table>
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<tr>
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</thead>
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<tr>
<td>A (0°C)</td>
<td>12.7</td>
<td>9.5</td>
<td>7.1</td>
<td>3.9</td>
<td>1.3</td>
</tr>
<tr>
<td>B (5°C)</td>
<td>11.2</td>
<td>8.8</td>
<td>6.6</td>
<td>3.2</td>
<td>1.2</td>
</tr>
<tr>
<td>C (20°C)</td>
<td>10.1</td>
<td>8.0</td>
<td>6.0</td>
<td>2.9</td>
<td>1.1</td>
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<tr>
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<td>4.5</td>
<td>2.0</td>
<td>0.9</td>
</tr>
</tbody>
</table>

### Collector Specifications

- **Gross Area**: 2.257 m² (24.65 ft²)
- **Net Aperture Area**: 2.257 m² (24.65 ft²)
- **Gross Weight**: 30.0 lb
- **Fluid Capacity**: 1.89 ltr 0.5 gal
- **Test Pressure**: 130 kPa (19 psig)

### Collector Materials

**Frame**: Aluminum
**Cover (Outer)**: Glass Vacuum Tube
**Cover (Inner)**: None
**Absorber Coating**: Sputtered metal
**Insulation Side**: Vacuum
**Insulation Back**: Vacuum

### Technical Information

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<td>-0.0000010</td>
<td>0.575</td>
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<td>-0.0000010</td>
<td>0.575</td>
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<td>-0.1590</td>
<td>0.575</td>
</tr>
</tbody>
</table>

### Collector Test Details

- **Test Fluid**: Propylene Glycol & Water
- **Test Flow Rate**: 20.5 ml/h, 0.0302 gpm

### Remarks

Certification must be renewed annually. For current status contact:
SOLAR RATINGS & CERTIFICATION CORPORATION
400 High Point Drive, Suite 400 • Cocoa, Florida 32926 • (321) 213-6077 • Fax (321) 281-0910
Laboratories Offering SRCC Accredited Testing Programs in US as of Q1 2012

1. Atlas Weathering Services Group  
   45601 N. 47th Avenue  
   Phoenix, Arizona 85087  
   Accreditation Date: May 14, 2010  
   **SRCC Test Program Accredited to Perform:**  
   - Qualification Tests (Standard 100)  
   - Glazed Liquid-heating Collector Efficiency (Standard 100)

2. Florida Solar Energy Center  
   1679 Clearlake Road  
   Cocoa, FL 32922-5703  
   Accreditation Date: October 1980  
   **SRCC Test Program Accredited to Perform:**  
   - Qualification Tests (Standard 100)  
   - Glazed Liquid-heating Collector Efficiency (Standard 100)  
   - Unglazed Liquid-heating Collector Efficiency (Standard 100)  
   - ICS and Non-separable Thermosiphon Systems (SRCC TM-1)
3. **Pacific Energy Testing, LLC**  
3517 Edison Way, Suite A  
Menlo Park, CA 94025  
Accreditation Date: January 31, 2010  
**SRCC Test Program Accredited to Perform:**  
- Qualification Tests (Standard 100)  
- Glazed Liquid-heating Collector Efficiency (Standard 100)  
- Unglazed Liquid-heating Collector Efficiency (Standard 100)  
- Glazed Air-heating Collector Efficiency (ASHRAE 93)  
- ICS and Non-separable Thermosiphon Systems (SRCC TM-1)  

4. **TUV Rheinland PTL, LLC**  
2210 South Roosevelt Street  
Tempe, AZ 85282  
Accreditation Date: March 1, 2010  
**SRCC Test Program Accredited to Perform:**  
- Qualification Tests (Standard 100)  
- Glazed Liquid-heating Collector Efficiency (Standard 100)  
- Unglazed Liquid-heating Collector Efficiency (Standard 100)
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Database for State Incentives for Renewables & Efficiency (DSIRE)

Source: http://www.dsireusa.org/
California Solar Initiative – Solar Water Heating Rebate Program

- Solar equipment must be SRCC certified
- $12.82 per estimated therm displaced of natural gas
- $0.37 per estimated kWh displaced of electricity

Maximum Incentives:

- Single-family residential systems that displace natural gas: $1,875
- Single-family residential systems that displace electricity: $1,250
- Commercial and multifamily residential systems that displace natural gas: $500,000
- Commercial and multifamily residential systems that displace electricity: $250,000
New York - LIPA Residential Solar Water Heating Rebate Program

- Systems must be new; collectors must be SRCC OG-100 certified
- $20 per kBTU (based on SRCC collector rating)

Maximum Incentives:
- $1,500 or 50% of installed cost

Installation Requirements:
- Customer must have an existing electric water heater; system orientation must be south, southeast, or southwest; system must be owned by the customer (i.e., leased systems are not eligible)
Hawaii Energy - Solar Water Heater Rebate Program

- Equipment must be SRCC OG-100 certified.
- Residential: $750.
- Commercial: $50 per 5,000 Btu/hr derated capacity.
Oregon Energy Trust - Solar Water Heating Buy-Down Program

- Systems must be new. Expansions to existing solar systems are not eligible. System must be listed as eligible by Energy Trust and must be SRCC-certified.

- Systems must be installed by a qualified Energy Trust solar contractor.

- $1,500 for residential systems; 35% of system cost for commercial.
Florida Beaches Energy Services - Solar Water Heating Rebate Program

• Solar Water Heater Rebate: $500

Equipment Requirement:

• Must be Florida Solar Energy Center (FSEC) certified
• All system components must be new
• Systems must be guaranteed against freeze damage
• Solar pool heating systems ineligible

Installation Requirements:

• Newly constructed homes are not eligible for rebate
• Systems must be installed by a licensed Florida contractor according to manufacturer specifications
• System must be at least 80% shade free
• Systems must be installed prior to the issuance of a rebate
Thank you!

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