



Solar Thermal Trends, Performance-Based Incentives, and RPS

CESA Members and
State-Federal RPS Collaborative Webinar

Hosted by Clean Energy States Alliance
March 30, 2012



State-Federal RPS Collaborative

- With funding from the Energy Foundation and the US Department of Energy, the Clean Energy States Alliance facilitates the **Collaborative**.
- Includes **state RPS administrators and regulators, federal agency representatives**, and other stakeholders.
- Advances dialogue and learning about RPS programs by **examining the challenges and potential solutions** for successful implementation of state RPS programs, including **identification of best practices**.
- To get the **monthly newsletter** and announcements of **upcoming events**, sign up for the listserv at:
www.cleanenergystates.org/projects/state-federal-rps-collaborative

Solar Thermal Trends, PBIs, and RPS

IEA Report Link: http://www.iea-shc.org/publications/downloads/Solar_Heat_Worldwide-2011.pdf

On page 13, Figure 9: Total capacity of glazed flat-plate and evacuated tube collectors in operation by economic region and in kWth per 1,000 inhabitants by the end of 2009

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Joint CESA/State-Federal RPS Collaborative Solar Thermal Trends

Les Nelson

International Association of Plumbing & Mechanical Officials



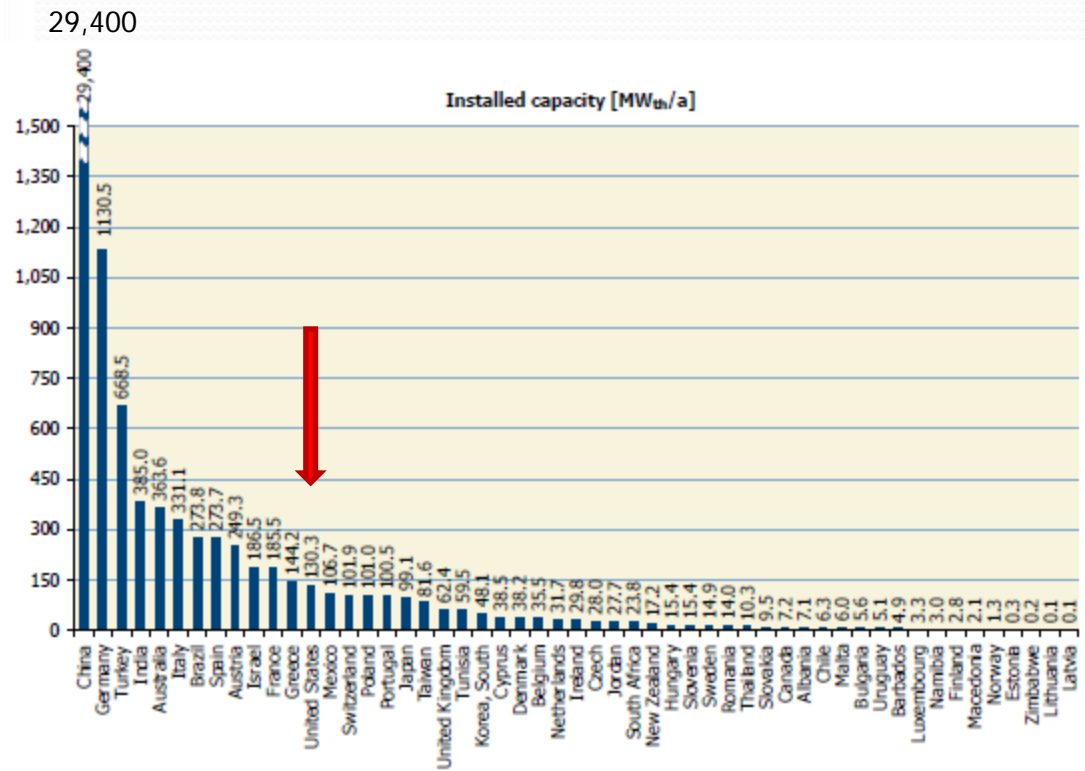
Solar Heating – Solar Thermal



How Are We Doing?

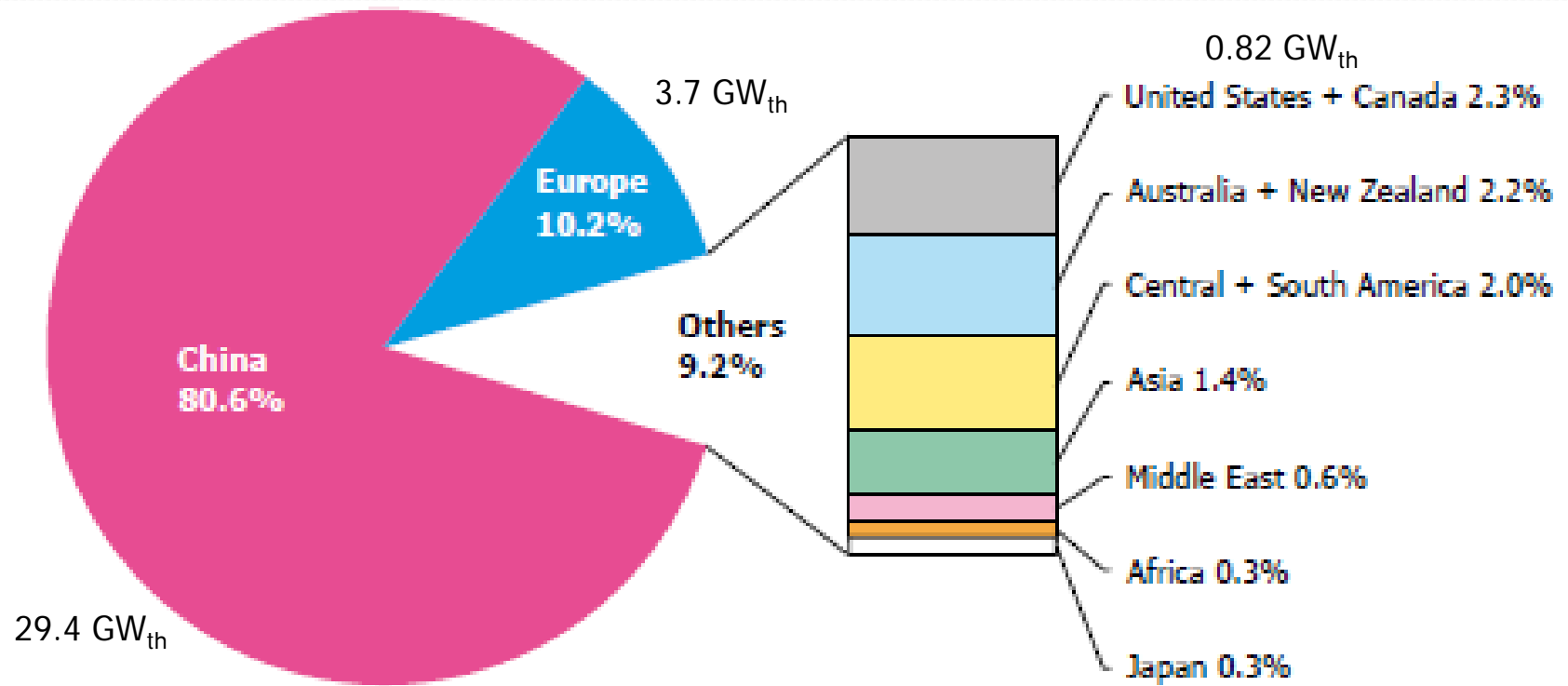


Newly Installed Capacity in 2009

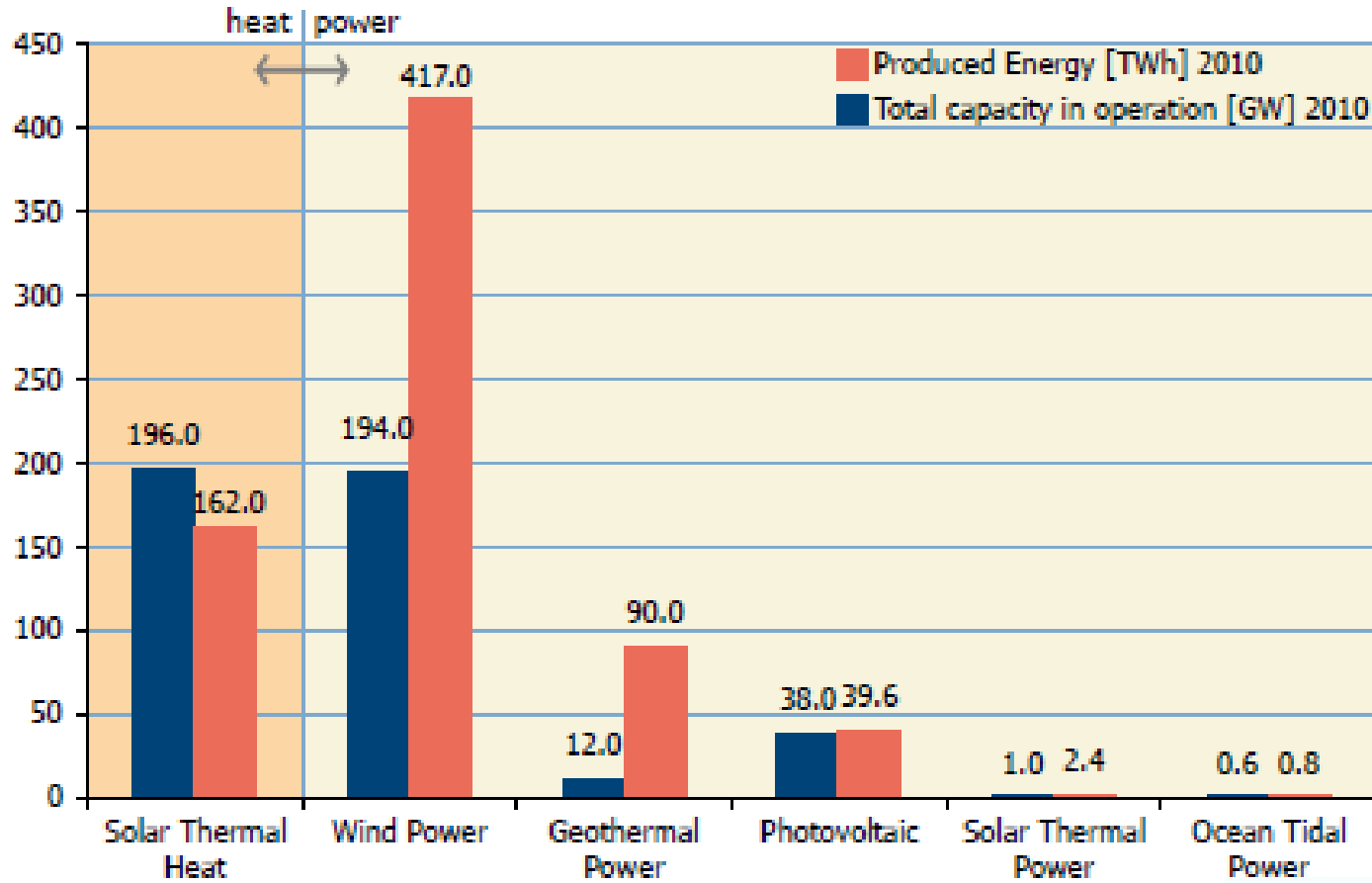


Solar Heating Capacity Installed in 2009

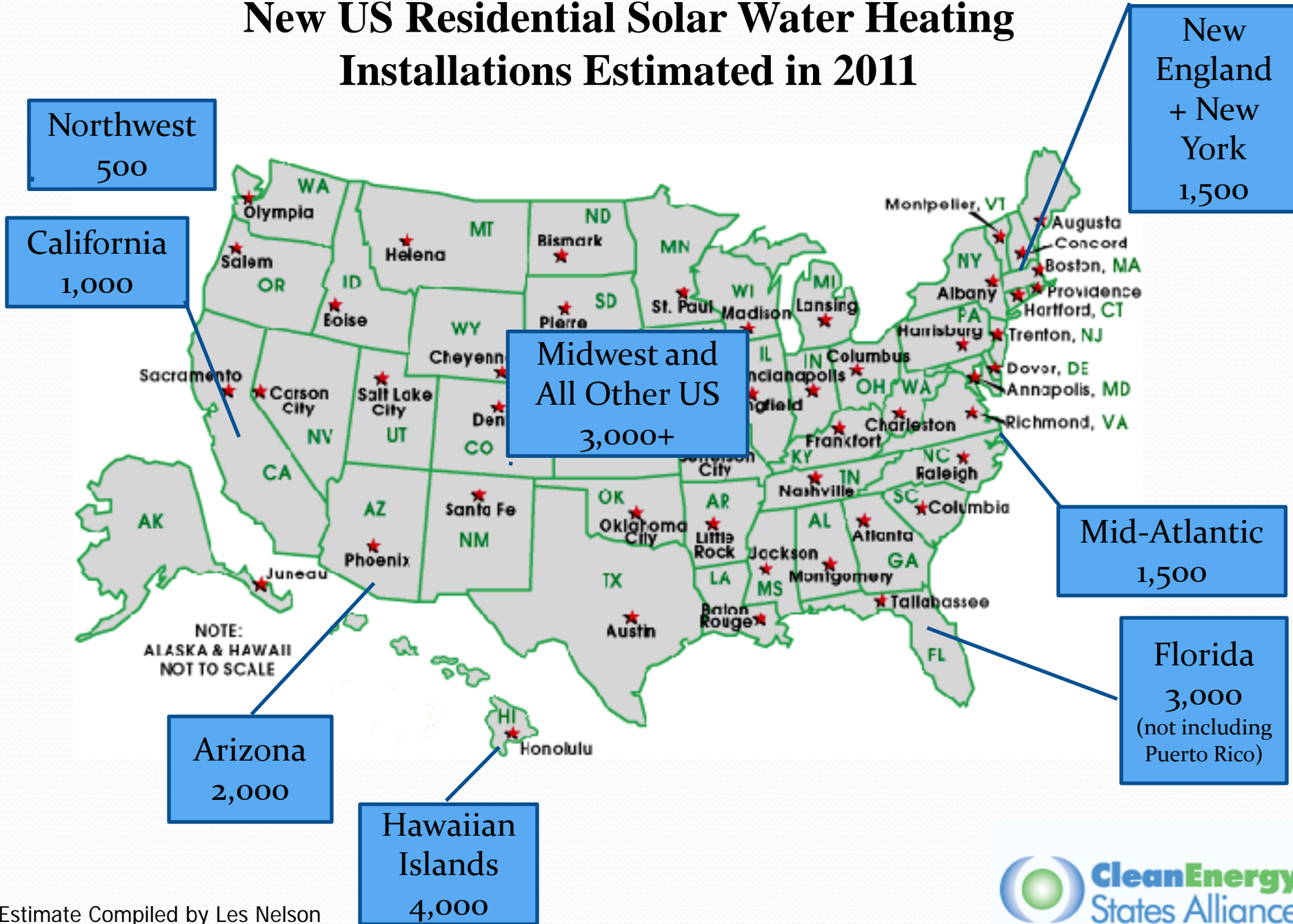
36.5 GW_{thermal}



Worldwide Capacity in Operation – Blue Total Energy Generated - Orange



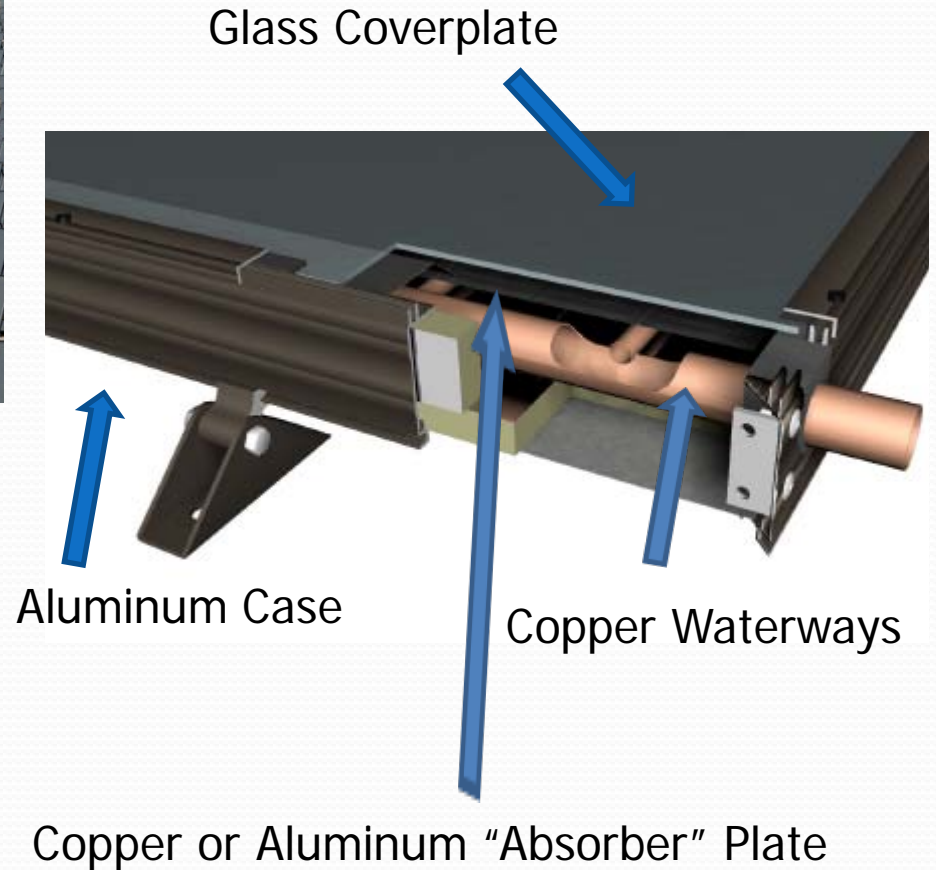
New US Residential Solar Water Heating Installations Estimated in 2011



Estimate Compiled by Les Nelson

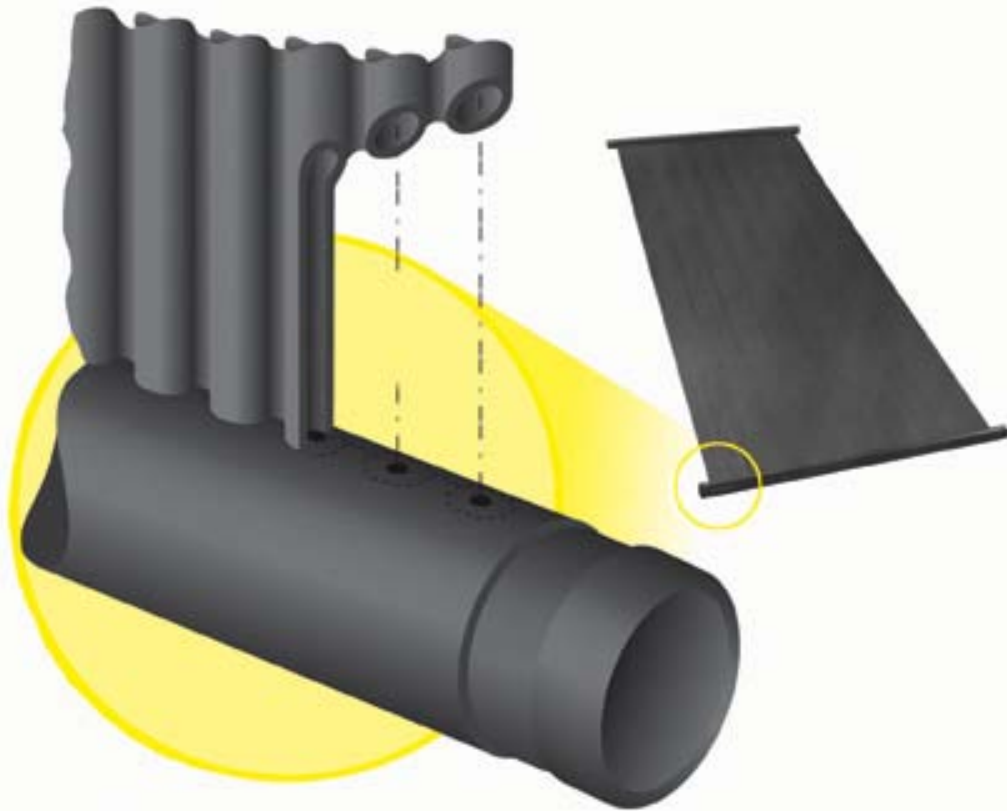


Flat Plate Collector



Courtesy: FLS Energy/Alternate Energy Technologies

Unglazed Polymer Flat Plate

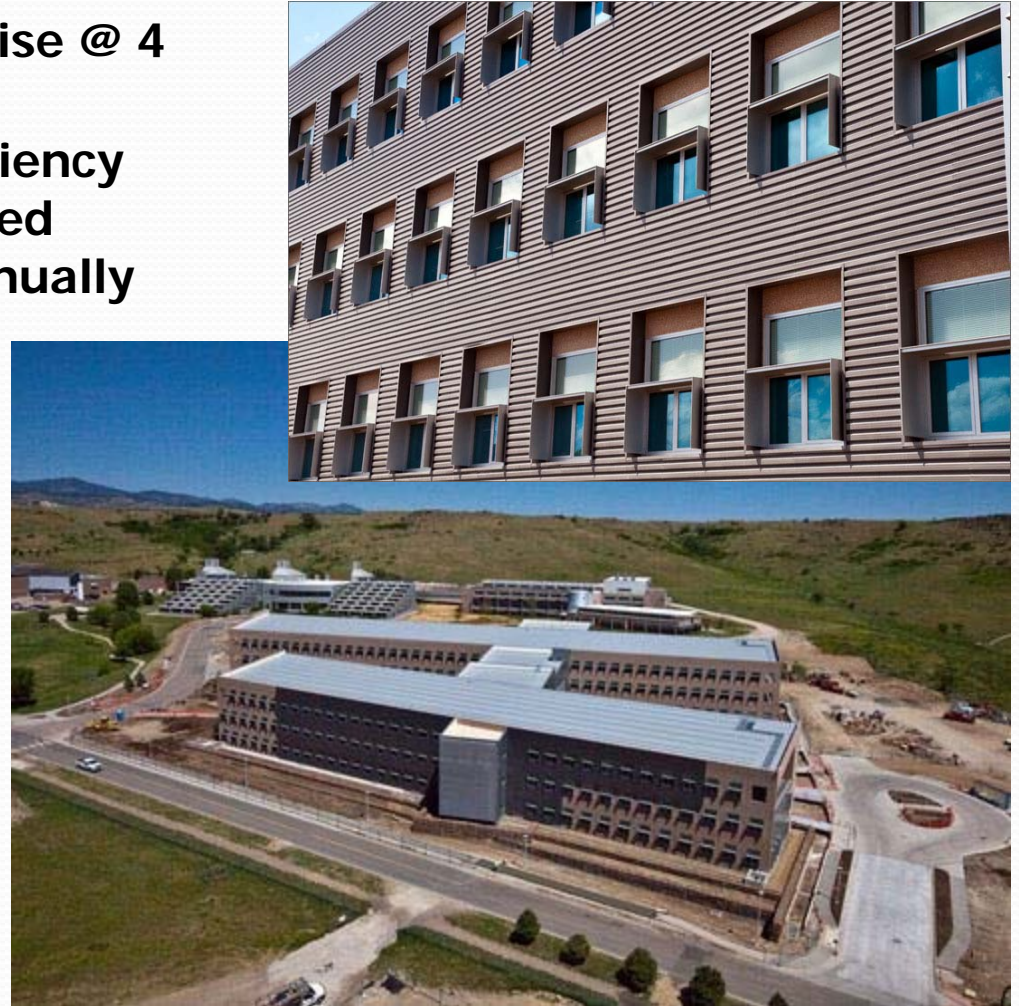
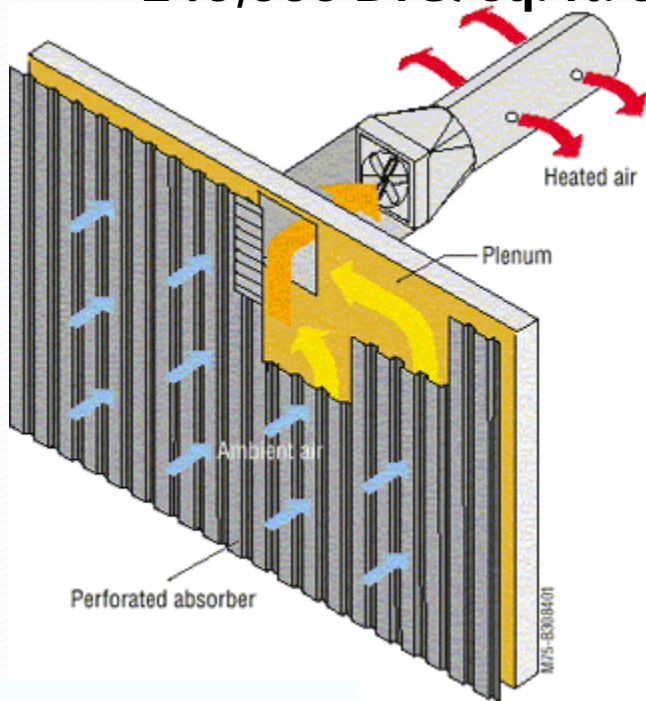


**Nestle Chocolate Factory
Paseo Tollocan, Mexico
904 panels; 36,160 square feet**

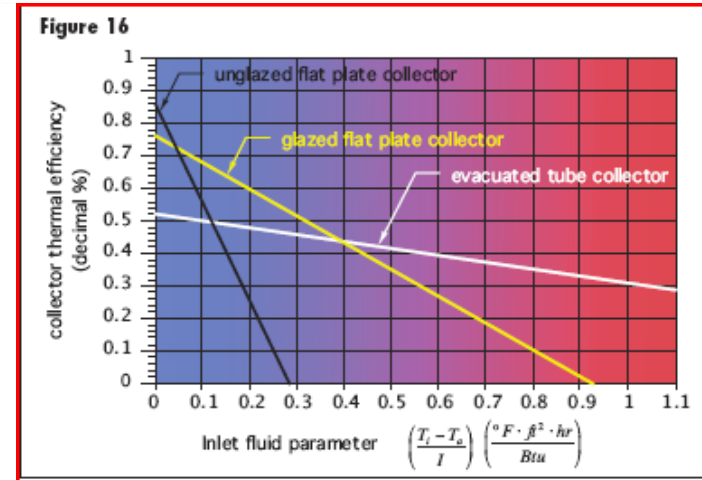
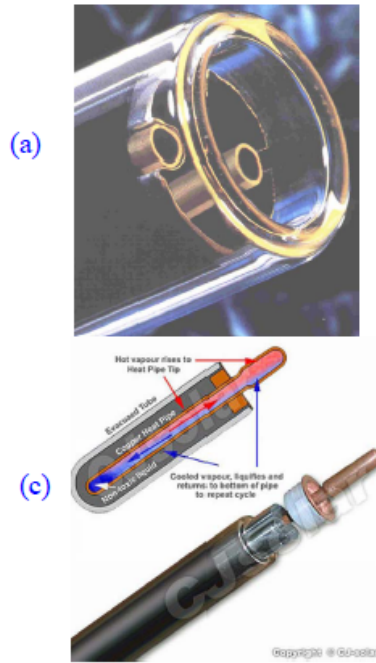
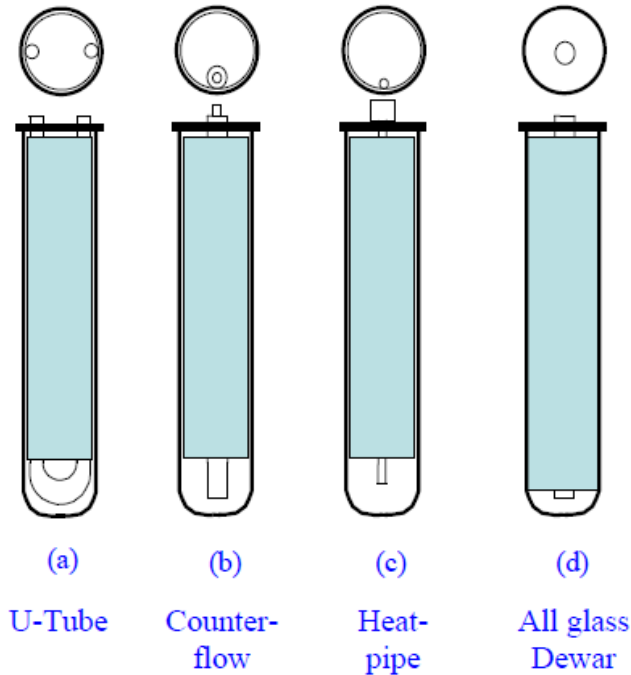
Courtesy: Aquatherm Industries, Inc.

Transpired Air Solar Pre-Heating

- Up to 40°F temperature rise @ 4 CFM
- 60% to 65% annual efficiency
- ~ \$30/square foot installed
- ~ 240,000 BTU/sq. ft. annually



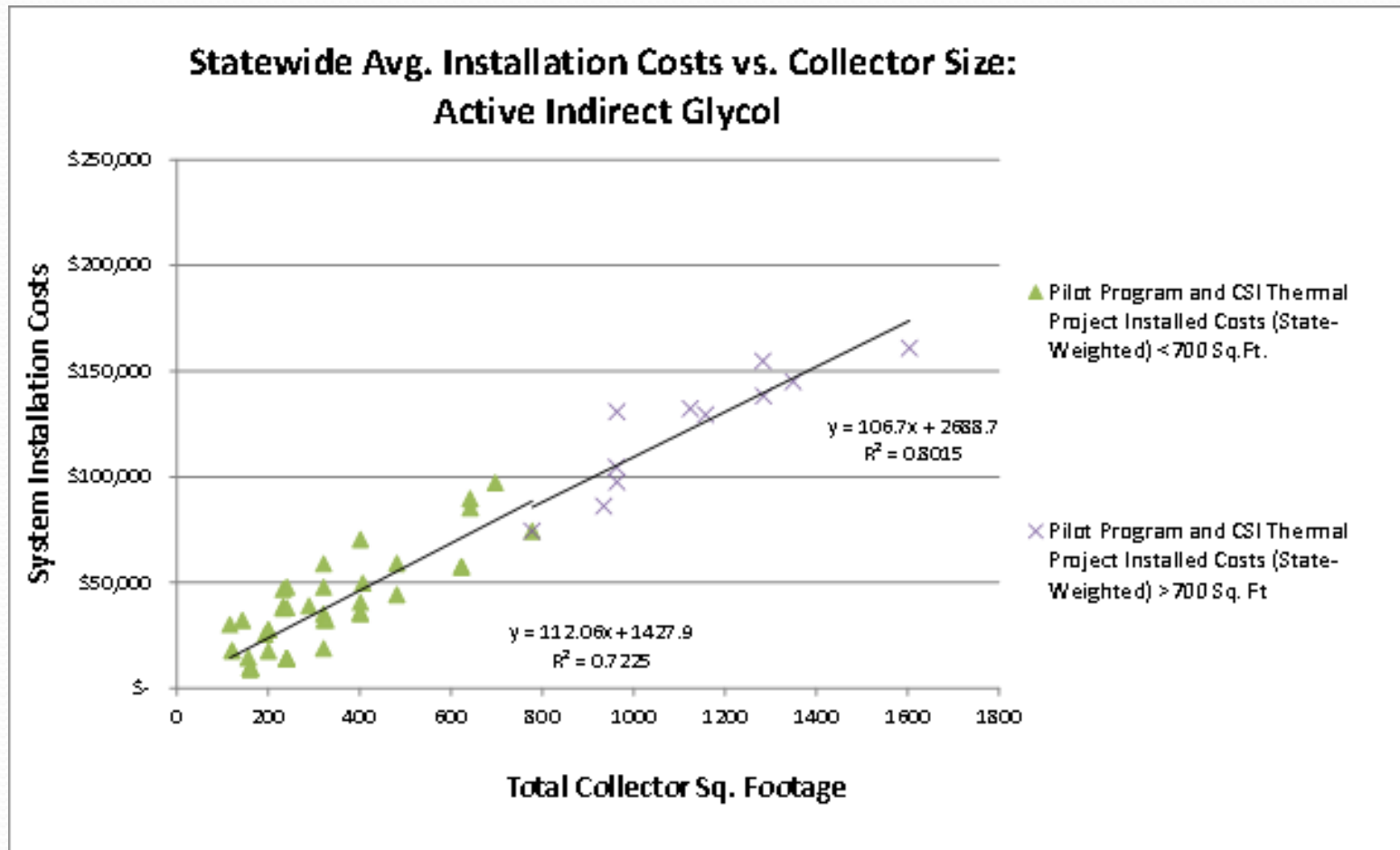
Evacuated Tube Collector



Apricus North America

Courtesy: Gerardo Diaz, School of Engineering, University of California Merced

Installed Commercial Systems in California (Glazed Collectors – 2011 Data)



In Process: California Solar Initiative – Thermal Proposed Program Changes

Commercial Swimming Pools



Commercial Process Heating

Courtesy: Heliocol & Fafco

What Does IAPMO Do?



Solar-related:

- Certifies solar collectors and systems
- Developed and maintains the Uniform Solar Energy Code
- Develops and maintains solar and plumbing-related standards
- Certifies products for Energy Star



**Solar Water Heating in the US 100 years ago
Pomona, California Area Homes
Circa 1910**

Thank You!

Les Nelson

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The Development of a U.S. Heat Meter Standard




James Critchfield

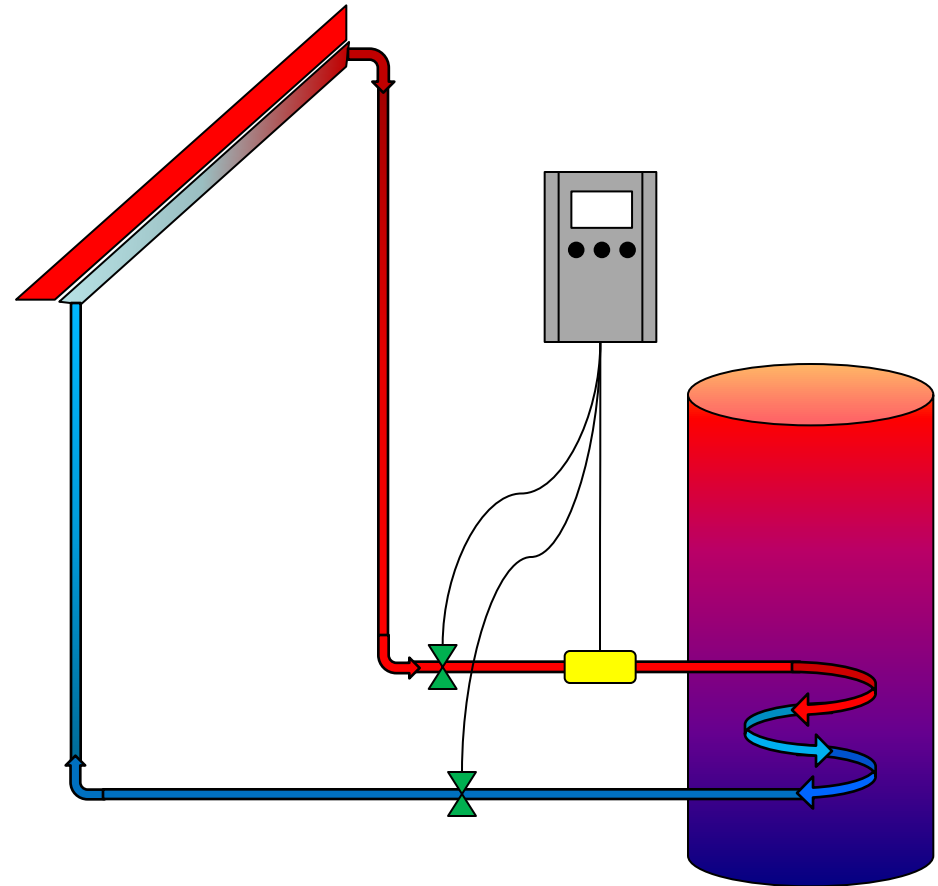
U.S. Environmental Protection Agency

Agenda

- What is a heat meter?
- Standards overview
- EPA's Heat Meter Standard Initiative
- Getting involved

What is a Heat Meter?

- A complete heat meter instrument has three principal subcomponents:
 -  Pair of temperature sensors
 -  Fluid flow meter
 -  Calculator
- Heat meters measure the heat absorbed or given up by a heat conveying liquid across a heat-exchange circuit
- Sensor placement determines what you measure (total system output vs. useful output)
- Meters are used to assess system performance and arbitrate system benefits between parties



Standards Overview

A standard is a document that provides, for common and repeated use, rules, guidelines or characteristics for products or related process and production methods, with which compliance is not mandatory

(World Trade Organization)

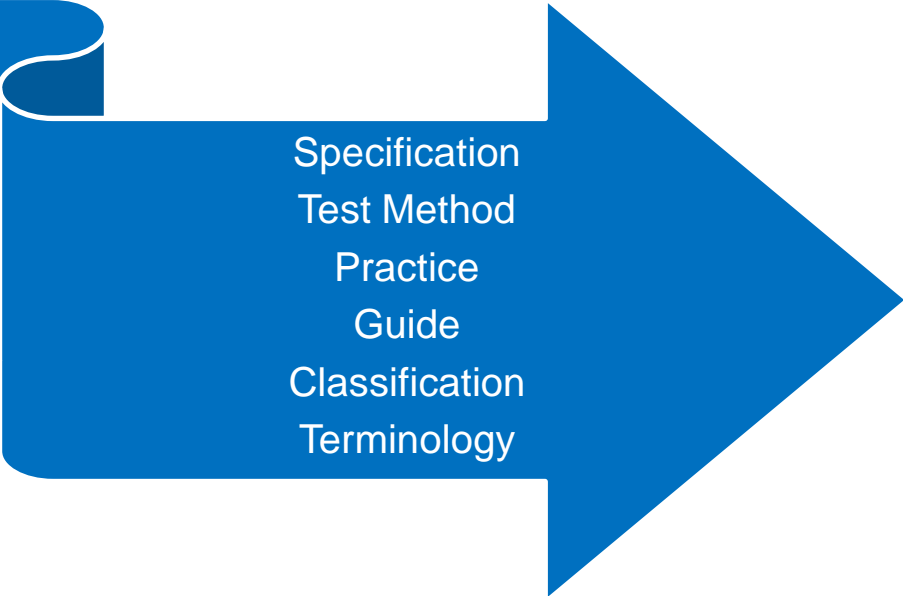
Federal agencies and departments shall use technical standards that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments

(The National Technology Transfer Act of 1995)

Categories of Standards



Voluntary Consensus Standard
Government Standard
Industry Standard
Consortium Standard
Company Standard



Specification
Test Method
Practice
Guide
Classification
Terminology

Existing Heat Meter Standards



Canadian CSA C900.1

Coming Soon!



European EN1434



OIML R75 – International Recommendation

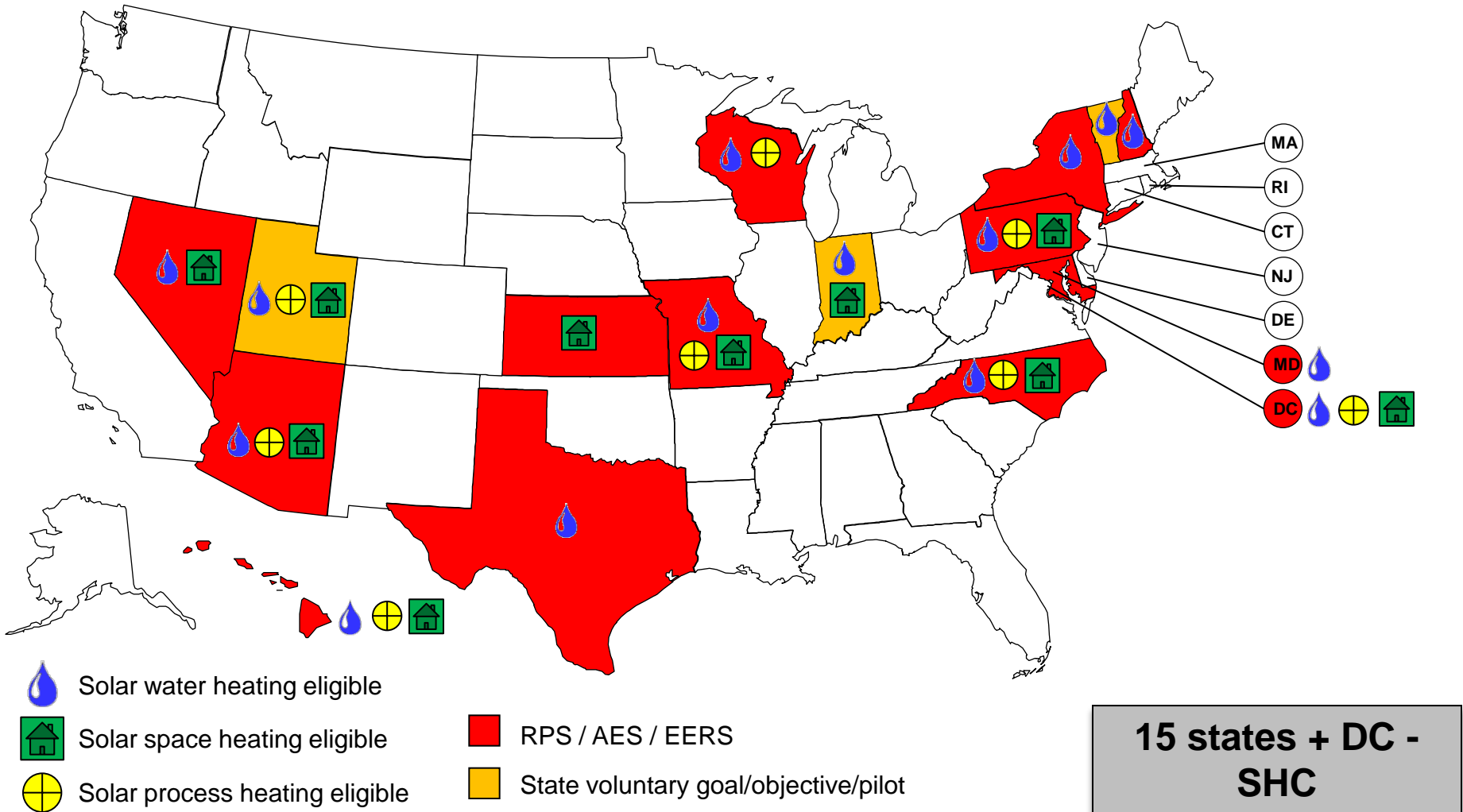
EPA's Heat Meter Standard Initiative

- In late 2010, the U.S. EPA undertook an effort to facilitate the market's development of a U.S. Heat Meter Standard
 - Throughout 2011, EPA convened several meetings to support the development of a stakeholder proposal that outlined the need and justification for a U.S. standard
 - In January 2012, a final proposal was submitted to two ANSI-accredited standards development organizations for their consideration
 - ASTM International
 - International Association of Plumbing and Mechanical Officials (IAPMO)
- Stakeholder Coverage**
- 160 individuals
 - 115 organizations
 - Academia
 - Consultants
 - Government
 - Trade & Industry Groups
 - Technology Integrators
 - Manufacturers
 - Non-profits
 - Standard Development Orgs.
 - Testing Laboratories
 - Utilities
 - Regulators
 - Perspectives from the Solar, Biomass, CHP, District Heating industries

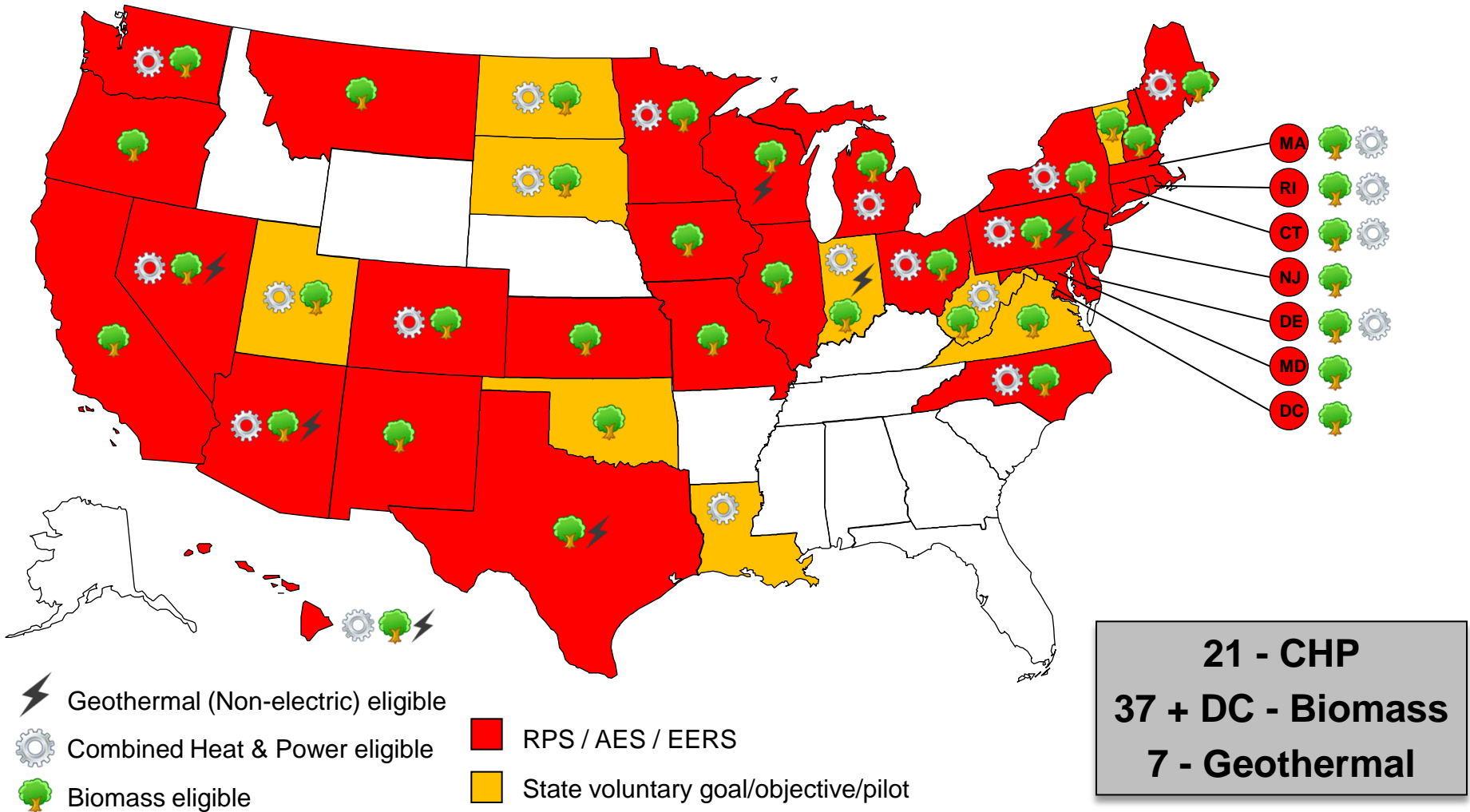
Stakeholder Proposal

- The proposal identified several key issues and trends, which underpinned the need and justification for a U.S. standard:
 - State recognition of thermal energy sources in state RPS and EERS standards
 - A trend toward incenting renewable energy projects through performance based incentives (output-based) as opposed to upfront rebate programs (capacity-based)
 - Emerging thermal energy project deployment models including third-party ownership and Energy Purchase Contracts / Energy Purchase Agreements
 - Increasing focus on the thermal energy component of buildings (e.g. national green building standards)
- The development of individual state definitions for heat meter instrumentation was identified as a risk

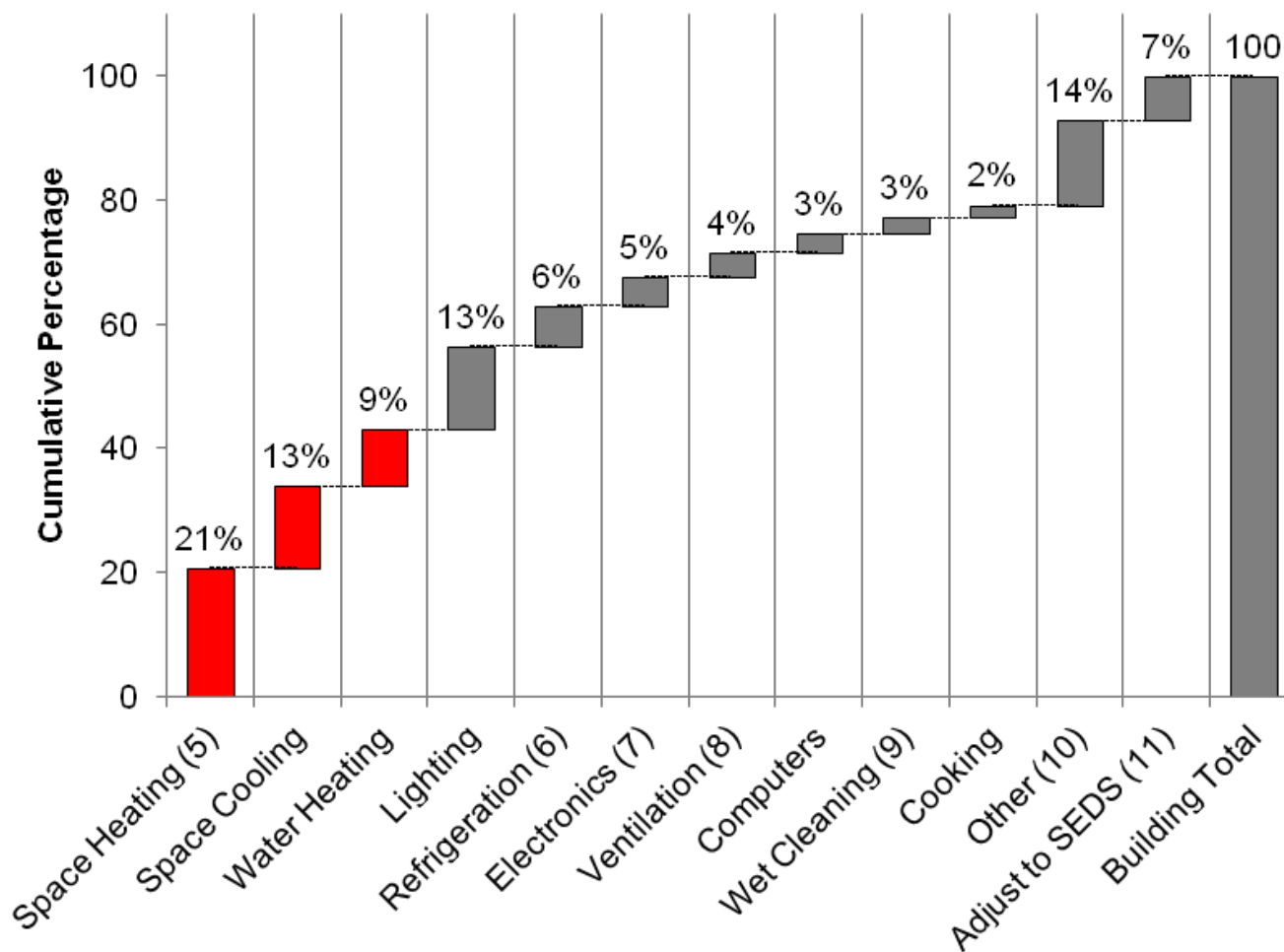
State Policy Eligibility for Solar Heating & Cooling



State Policy Eligibility for CHP, Biomass & Geothermal



2010 U.S. Buildings Primary Energy End-Use (% total BTU)



Why Standardize Heat Meters?

- To support the comparable and accurate attribution of the energy, financial and environmental benefits generated from thermal energy sources and renewable heating and cooling technologies
- To promote a quality market for heat meter products
 - Manufacturers can meet a single standard's stated accuracy level and compete on cost and features
 - Customers can choose the meter that best meets their needs
- To assist government administrators with the regulation and oversight of compliance policies and ratepayer sponsored initiatives
- To ensure fairness and confidence in the exchange of payments for energy delivery between customers, project developers, utilities and investors

EPA's Heat Meter Standard Initiative

- In late January 2012, ASTM and IAPMO announced their intent to jointly develop a U.S. Heat Meter Standard through ASTM's E44 committee on Solar, Geothermal and other Alternative Energy Sources
- An ANSI voluntary consensus based process ensures that standards are developed under the principals of consensus, impartiality, relevance, openness, transparency, and due process

ASTM E44 Committee

- Organized 1978
- Current Roster: 205 Individuals & Organizations
- 14 Countries (35 members)
- 49 Approved Standards
- 55 Work Items Under Development
- 9 Subcommittees
 - E44.01 Terminology and Editorial
 - E44.05 Solar Heating and Cooling Systems and Materials
 - E44.09 Photovoltaic Electric Power Conversion
 - E44.15 Geothermal Field Development, Utilization and Materials
 - E44.20 Glass for Solar Applications
 - **E44.25 Heat Metering**
 - E44.44 Photovoltaic System Fire Safety
 - E44.90 Executive
 - E44.93 Government and Industry Liaison

Key Considerations for a U.S. Standard?

- ✓ Accuracy and operational characteristics
- Constructional requirements
- Communication platforms, data exchange and interfaces
- Security and data storage
- Redundant features, e.g. controls or proprietary elements
- Pattern approval tests
- Initial verification tests
- Commissioning, calibration and maintenance
- Harmonization with other standards
- Working fluid definitions
- Installation, temperature sensor and flow meter placement

Getting Involved

- ASTM International Committee E44 on Solar Geothermal and other Alternative Energy Sources
 - New Heat Metering Subcommittee (E44.25) was formed
- Committee Participation:
<http://www.astm.org/MEMBERSHIP/MemTypes.htm>
 - \$75 Participating Members
 - \$400 Organizational Members
- Standards development process involves a public comment mechanism



- The first in person Sub Committee meeting will be held Wednesday, July 11-12th at the San Francisco Marriott Marquis Hotel in conjunction with SEMICON West & Intersolar North America conferences
- Additional Information
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Thank you

Questions?

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Solar Thermal Energy Facilities and the North Carolina Renewable Energy and Energy Efficiency Portfolio Standard (REPS)

Sam Watson

North Carolina Utilities Commission

North Carolina Utilities Commission



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Outline



- Overview of North Carolina REPS, requirements and set-asides
- Solar thermal energy facility eligibility as a renewable energy facility
- Unique solar thermal energy issues

Renewable Energy Concepts



- “Renewable energy” is electricity generated from renewable resources, such as the sun, wind, water, geothermal, and biomass
- A “renewable portfolio standard” (RPS) is a policy tool that requires retail sellers of electricity to obtain a portion of their electricity portfolio from renewable resources
- A “renewable energy certificate” (REC) is a tradable instrument equal to one unit of energy derived from a renewable energy resource

Renewable Energy and Energy Efficiency Portfolio Standard (REPS)



- In 2007, North Carolina became the first State in the Southeast to adopt a renewable portfolio standard – Session Law 2007-397 (Senate Bill 3)
- REPS requirement may be met through combination of renewable energy generation and, to a limited extent, energy efficiency savings
- REPS requirement applies to investor-owned electric utilities (electric public utilities), electric membership corporations (EMCs), and municipally-owned electric suppliers

REPS Compliance Requirement



- General REPS requirement increases from 3% in 2012 to 10% by 2018, then to 12.5% by 2021 (for electric public utilities)
- Specific set-asides established for energy derived from the sun (beginning in 2010) and from poultry and swine waste
- REPS compliance costs are recovered through a rate rider
- Cap imposed on incremental cost of compliance

Solar Set-Aside



- Requires that a certain percentage of the total electric power in kilowatt hours sold to retail electric customers in the State, or an equivalent amount of energy, be supplied by a combination of **new solar electric facilities and new metered solar thermal energy facilities** that use one or more of the following applications: solar hot water, solar absorption cooling, solar dehumidification, solar thermally driven refrigeration, and solar industrial process heat
- Percentage increases from 0.02% in 2010 to 0.2% in 2018
- RECs for solar thermal energy assume kilowatt-hour equivalent
 - One REC earned for every 3,412,000 British thermal units (Btu) of useful thermal energy produced

Means of REPS Compliance



- REPS compliance may generally be met through the use of renewable energy resources by:
 - Generating power at a new renewable energy facility
 - Co-firing with a renewable energy resource at an existing utility generating facility
 - Purchasing power from a renewable energy facility
 - Purchasing unbundled RECs from a renewable energy facility
- A portion of the REPS requirement may be met by reducing energy consumption through the implementation of energy efficiency measures

Renewable Energy Facility



- Defined as a facility that either:
 - Generates electric power by the use of a renewable energy resource, including a combined heat and power facility; or
 - **Is a solar thermal energy facility**
- Excludes large-scale (>10 MW) hydro
- Electric public utilities limited to purchases from “new” renewable energy facilities
 - Placed into service on or after January 1, 2007 (with a limited number of grandfathered facilities)

Registration of Renewable Energy Facility



- Ensure in advance that each renewable energy facility from which electric power or RECs are used for REPS compliance meets the particular requirements of Senate Bill 3
- Facility owner must file registration statement pursuant to Commission Rule R8-66
- Applies to both in-state and out-of-state facilities
- Registration form posted on Commission web site
- Initial review by Public Staff

Registration of Solar Thermal Energy Facilities



- More than 85 solar thermal energy facilities have filed registration statements with the Commission
- 64 solar thermal energy facilities have registered with the North Carolina Renewable Energy Tracking System (NC-RETS) to earn RECs
- Metered solar thermal energy facilities registered with NC-RETS have a nameplate capacity equivalent of nearly 4.7 MW, with over 3 MW developed by a single entity, FLS Energy
 - Compared to 142 solar electric facilities with a total nameplate capacity of more than 52 MW

Solar Thermal Energy In The News



- N.C. company building gigantic solar water heating system at turkey plant (Raleigh, NC, News & Observer, March 24, 2012)
 - <http://www.newsobserver.com/2012/03/24/1955756/nc-company-building-gigantic-solar.html>
- Company installs, maintains water-heating systems (N&O, May 23, 2011)
 - <http://www.newsobserver.com/2011/05/23/1217421/solar-showers.html>
- Marines going solar? Oo-rah! (N&O, May 21, 2010)
 - <http://www.newsobserver.com/2010/05/21/492733/marines-going-solar-booyah.html>

Unique Solar Thermal Energy Issues



- Public utility status
- Eligible thermal energy
 - Double counting
 - Capacity
 - Estimating
- Meter placement
 - Sampling

Public Utility Status



- May a third party solar thermal energy developer own the facility and sell hot water to a consumer?
 - Consumer is providing its own water, third party is effectively selling the heat, or thermal energy
- Public utility is defined as one who is “producing, generating, transmitting, delivering or furnishing electricity, piped gas, steam or any other like agency for the production of light, **heat** or power to or for the public for compensation” (N.C.G.S. 62-3(23))
- Commission declined to regulate sale under North Carolina law for on-site domestic hot water use (NCUC Docket No. RET-4, Sub 0, April 22, 2009)

Eligible Solar Thermal Energy



- Cannot earn RECs for solar thermal energy used as input to electric generation separate from RECs earned for the electricity
 - Denied registration of concentrated solar power facility using solar thermal energy to pre-heat feed water for biomass-fueled generating facility (NCUC Docket No. RET-28, Sub 0, December 22, 2011)
- RECs earned for actual solar thermal energy used, not capacity of solar thermal energy system
 - Denied RECs for full capacity of aquatic center solar thermal energy panels based on engineering estimates of thermal load (NCUC Docket No. RET-10, Sub 0, July 21, 2010)
 - Commission denied the use of the RETScreen model to estimate RECs earned for unmetered facilities (NCUC Docket No. RET-11, Sub 0, October 21, 2011)

Meter Placement



- Meter is not required to earn RECs, only to earn RECs eligible to meet the REPS solar set-aside
- Metering devices, when used, shall be located so as to measure the actual thermal energy consumed by the load served by the facility
 - E.g., meter should be placed on load side of heat exchanger
- Commission has approved statistical sampling for large installations of single-panel solar thermal energy systems on Marine base housing units (NCUC Docket No. RET-4, Sub 5, August 15, 2011)

Conclusions



- Solar thermal energy facilities may be used to meet REPS compliance
 - Lower cost than solar electric
- Solar thermal energy facilities present unique, but not insurmountable, issues distinct from those of solar electric facilities
- North Carolina REPS has spurred tremendous growth in installation of both solar thermal energy facilities and solar electric facilities

Contact Information

The background of the top banner features the Great Seal of the State of North Carolina on the left, which includes the date 'MAY 20, 1775' and the words 'GREAT SEAL OF THE STATE OF NORTH CAROLINA'. To the right of the seal is a stylized map of North Carolina with a power transmission tower superimposed on it, set against a blue and orange gradient background.

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