Solar Water Heating CDM Methodology – Questions for public comments

Specific subjects for input would include:

1. Does the methodology represent appropriate emissions calculation and monitoring approaches for small scale-scale methodologies including compliance with CDM modalities and procedures and requirements for determining the amount of real, additional, measurable and verifiable reductions in greenhouse gas emissions associated with solar water heating systems.

2. Are the project definition and applicability conditions appropriate? Is it appropriate for the methodology to be applicable to be both single and multifamily residential as well as commercial facilities?

3. Will the methodology be applicable to and support the development of both projects and POAs?

4. What changes are suggested to the methodology to make it more accurate and/or more usable?

5. Should there be a limit to the number of years allowed for crediting?

6. For new construction facilities (*e.g.,* homes) are there suggestions for more detailed language on determining baseline systems for domestic water heating?

7. Are all four methods described for calculating CERs appropriate? Should the method to be selected be prescriptive based on specific project conditions or discretionary to be selected by the PP and/or DOE?

8. For all four methods described, how often (every year, every three years, etc.) should the savings determination be updated with field verification of system operation and/or analyses of savings? Are there different criteria, then what is specified, appropriate for field verification?

9. For the calibrated simulation model method: (a) what specific criteria should be established for any specific computer simulation model to be considered "approved" and who should provide this approval? (b) What specific criteria should be established for a model to be considered calibrated? (c) What parameters should be required as project specific inputs to the model? (d) For large numbers of project SDHW systems, does each individual system have to be modeled?

10. For metering approach method and other field data collection requirements: (a) what parameters should be metered? (b) what time period and time interval metering requirements should be established? (c) what metering accuracy and calibration requirements should be established?

11. For the control group method: what criteria should be used for defining an appropriate control group?

12. For the deemed savings approach: (a) What should be the basis for the deemed savings values and what solar system and/or applicability criteria should be defined in order for a deemed savings value to be allowed to be used? (b) How and what sources can be used to determine the deemed savings values? (c) How extensive a list of deemed savings values should be determined and what geographic areas, system types, end user demographics, etc. should they cover?

13. Are there other suggestions and comments associated with the draft methodology?

Background Information

Factors to define applicability and complexity:

- New construction and/or retrofit
- Displaced electric and/or fossil fuel back up
- Back-up water heating capability operational (or not) in parallel with solar heating
- Residential and/or commercial applications
- Passive or active solar water heating systems

Methodological issues:

- Baseline definition
- Suppressed demand (baseline versus project hot water use)
- Metering costs for metering options
- Water consumption assumptions for default and metering options
- Generally it is not cost effective or aesthetic to optimize collector orientation so a stipulated value per square meter may not be appropriate.
- A system installed for a family of four and used by a couple will save less than its "capacity to save."

Basic approaches:

- Use of computer simulation calibrated with key system parameters such as square meters of orientation/tilt of panels, annual average source water temperature and use temperature, and number of occupants (for residential)
- Metering – census or sample
  - Solar system output and useful hot water production less back up fuel use
  - Useful hot water production less back up fuel use (ignore storage losses)
- Use of comparison group of similar facilities (homes) without solar water heating systems
- Default values
  - Based on metering of a sample of systems
  - Based on minimum design criteria

International Performance Measurement and Verification Protocol Applied to Renewable Energy Systems[1]

The International Performance Measurement and Verification Protocol (IPMVP) provides guidance on implementing performance measurement programs [1]. A Renewable Energy Subcommittee has prepared a draft chapter for the IPMVP addressing the special uses and requirements of Measurement and Verification (M&V) programs for renewable energy systems. The protocol describes four options.

[1] Summary from Time-of-use Monitoring of United States Coast Guard Residential Water Heaters With and Without Solar Water Heating in Honolulu, Hawaii, Andy Walker, Ph.D., PE and Craig Christensen, National Renewable Energy Laboratory, and Glen Yanag.

1. Option A, "Measured Capacity, Stipulated Performance" uses engineering estimates based on system specifications to stipulate savings. The system is initially inspected to ensure that the equipment is installed according to those specifications. The system is then inspected periodically to ensure that it continues to operate properly.

2. Option B "Measured Production/Consumption" uses long-term measurement of energy delivery over the term of a performance contract directly by metering the plant's output or indirectly by determining savings based on analysis of end-use meters.

3. Option C, "Utility Bill Analysis," infers savings by the statistical analysis of whole-facility energy consumption without end-use metering of the renewable energy system.

4. Option D, "Calibrated Models," predicts the long-term performance of a system by calibrating (renormalizing) a computer model based on data from a short-term test.

Option B, Measured Consumption describes how to determine energy savings indirectly by calculating the difference between the baseline load and the metered auxiliary (in this case electric) energy usage. There are four ways to calculate savings relative to a baseline when only the auxiliary energy is measured [2]. "Control Group" compares the metered energy use with similar loads that do not have renewable energy systems. "Before and After" measures the energy use before the renewable energy system is installed and compares that with the use after the system is installed. "On and Off" turns the renewable energy system off for a short time by by-passing it and compares this to energy use when the system was on. Finally, "Calculated Reference" determines baseline energy use by engineering calculations and subtracting metered energy usage to estimate renewable energy delivery.

Suggested approaches in draft methodology:

Limit to residential applications for new construction or retrofit. Ignore suppressed demand. Require annual (or bi-annual) inspection of systems (or sample) to confirm operation. Allow four methods to determine savings:

1. Use standard solar water heating computer model with data collection on system characteristics and to determine hot water consumption and source water temperature applicable to the conditions found.

2. Metering of hot water production (flow rate and temperature) of project systems and determine savings by calculating energy use that would have been required to produce same amount of energy (delta T times flow) with the baseline system less any measured energy input to auxiliary systems. Allow sample per occupancy and demographics. Ignores energy use for storage.

3. Control group and project group metering of water hating energy use. Include metering of solar system auxiliaries. Compare energy use for control group and project group. Use sampling per occupancy and demographics.

4. Deemed savings values. Allow use of deemed savings values (e.g., kWH/year saved per system) for systems that meet certain criteria and are confirmed to be operating.

Solar System Analysis Programs:

F-Chart - http://www.fchart.com/fchart/fchart.shtml

- Computer program useful for the analysis and design of active and passive solar heating systems
- Developed at the University of Wisconsin Solar Energy Laboratory to estimate the long-term average performance of:
- Systems covered:

  Domestic Water Heating (DWH) Systems § Pebble Bed Storage Space and DWH Systems § Water Storage Space and DWH Systems § Active Collection with Building Storage Space;

  Heating Systems § Direct-Gain Passive Systems § Collector-Storage Wall Passive Systems § Pool Heating Systems § General Solar Heating Systems (e.g., process heating systems) § Integral Collector-Storage DWH Systems;
- Weather data for hundreds of North American locations, the 16 California climate zones and numerous other locations are included with the program. User can add new weather data.

RETScreen - http://www.retscreen.net/

- Energy project analysis software that can be used world-wide to evaluate - for various types of energy efficient and renewable energy technologies;
- Indicates energy production and greenhouse gas emission reductions;
- Each energy model (Solar water heating project, etc.) is developed within an individual Microsoft® Excel spreadsheet "Workbook" file;
- The Workbook file is in-turn composed of a series of worksheets. Worksheets have a common look and follow a standard approach for all RETScreen models;
- In addition to the software, the tool includes: product, weather and cost databases; an online manual; a Website; an engineering textbook; project case studies; and a training course;
- It is inexpensive with free trial.

References

[1] Walker, A., and Thompson, A. (editors), 2000, International Performance Measurement and Verification Protocol- Renewable Energy Section. In press, U.S. Department of Energy Report Number DOE/EE-0157, to be published as NREL Special Report, and also published on the Internet at **www.ipmvp.org**.

[2] Christensen, C.; **Burch**, J. (1994). Monitoring Approaches for Utility Solar Water Heating Projects. Burley, S. M. et al., eds. Solar '94: Proceedings of the 1994 American Solar Energy Society Annual Conference, 25-30 June 1994, San Jose, California. Boulder, CO: American Solar Energy Society; pp. 261-266. Acc No. 15585.