NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Solar Water Heater Roadmap Leads Path to Market Expansion

Highlights in Research & Development

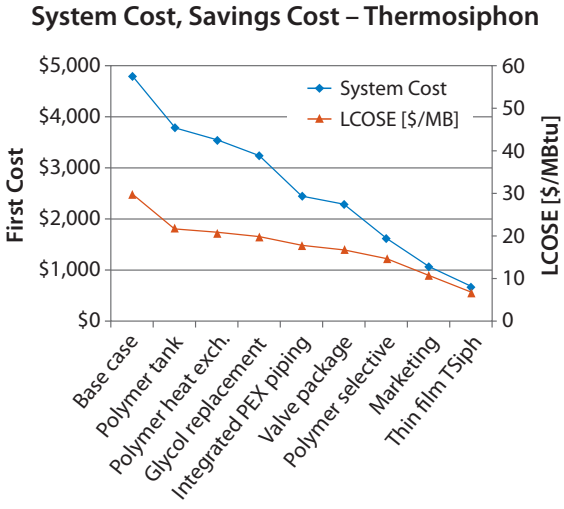
Innovative strategy to reduce installed cost of solar water heater systems can rival conventional natural gas water heaters in the marketplace.

Researchers in the Residential Buildings group at the National Renewable Energy Laboratory (NREL) have developed an R&D roadmap outlining a path for innovative, cost-effective solar water heating solutions for the U.S. market. Solar water heaters (SWHs) currently make up less than 1% of the U.S. residential water heating market, leaving a significant opportunity for market growth.

Based on analysis and industry feedback, NREL researchers pinpointed the natural gas water heater market as the best opportunity for low-cost SWH systems. In this predominantly cold climate market, SWHs could achieve significant energy savings relative to other advanced water heating technologies, including heat pump water heaters (HPWHs). Solar water heaters will also perform well in warm climates; however, they will be in direct competition with HPWHs, and therefore are less likely to make a significant market impact.

A major barrier of SWHs is the installed cost ($5,000–$10,000), and the R&D roadmap identifies cost, performance, and reliability targets that are essential for SWHs to be competitive in the water heating market. The roadmap defines an R&D path that could lead to installed SWH systems with costs between $1,000 and $3,000, while maintaining source energy savings of at least 35% over conventional natural gas water heaters and offering a lifetime of over 15 years.

Achieving these targets will require innovative technologies and radical design changes. Two technology pathway options are outlined in the roadmap: 1) polymer component substitution and 2) cold climate thermosiphon systems. Substituting polymer components into existing SWH designs can reduce costs incrementally, but cannot achieve the cost targets in the roadmap. A more promising pathway is the cold climate thermosiphon. As shown in the graph, component substitutions (including polymer substitutions) and marketing cost reductions (marketing cost assumed to be 20% of system cost) can reduce the installed cost of a thermosiphon system to about $1,000 for new construction. Additional cost reduction is possible by incorporating polymer thin-film technology into the design, as shown by the rightmost option on the graph.



Component substitution path for a thermosiphon system in a new construction scenario. Note: The levelized cost of saved energy (LCOSE) is the net cost to install a SWH divided by its expected life-time energy output. Illustration by Stacy Buchanan

Key Research Results

Achievement

NREL's Residential Buildings Research group used analysis and industry-based feedback to complete an R&D roadmap for low-cost SWHs.

Key Result

This R&D roadmap demonstrates the need for radical design changes and outlines low-cost pathway options intended to increase the marketability of SWHs.

Potential Impact

If the cost, performance, and reliability targets in the roadmap are met, the market for SWHs will expand and significant energy savings (relative to other water heating technologies) can be achieved.

Technical Contact: Kate Hudon, *kate.hudon@nrel.gov*

Reference: Hudon, K.; Merrigan, T.; Burch, J.; Maguire, J. (2012). *Low-Cost Solar Water Heating Research and Development Roadmap*. NREL Report No. TP-5500-54793. *www.nrel.gov/docs/fy12osti/54793.pdf.*

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15013 Denver West Parkway
Golden, CO 80401
303-275-3000 | www.nrel.gov

NREL/FS-5500-54847
September 2012

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