

Solar hot water douses rising energy costs at Madison's fire stations



BIOMASS



SOLAR



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When Madison set out in 2004 to become what Mayor David Cieslewicz called a "green capital city," not one municipal property had yet taken advantage of solar hot water. Four years later, each of Madison's 11 firehouses is equipped with a solar hot water system, serving anywhere from 45 percent to 60 percent of the buildings' collective hot water loads and offsetting 205 tons of carbon dioxide (CO₂) emissions each year. It's fair to say that no other city in the country has been as aggressive or as successful as Madison in incorporating solar water heating into its municipal buildings.

"The City of Madison's goal is to be a model for solar technology in the Midwest," says Jeanne Hoffman, the city's facilities and sustainability manager. "Through demonstration projects like solar thermal installations at fire stations throughout Madison, we hope to show Madison businesses and residents that solar thermal is a cost-effective option that should be considered."

Madison's success with solar water heating began with a mayoral commitment to cut carbon dioxide emissions from City of Madison sources by 25 percent from 2007 levels. To achieve these ambitious targets, Madison adopted The Natural Step, a planning framework that integrates sustainability and systems thinking in all purchasing and capital budgeting decisions. Out of this planning effort emerged a desire to promote the use of solar energy systems, with city government leading by example.

But Madison's commitment to solar energy went beyond simply searching for rooftop space where panels could be located. With the full cooperation of the local electricity and gas providers, city engineers gathered energy-use data from all of the city's operations, searching for opportunities to offset energy costs with on-site renewable energy. And they found an excellent match: fire stations and solar water heating. Because they are always fully staffed, fire stations have a constant hot water load, much like apartment buildings. They are equipped with showers, kitchens, and laundry facilities. In



PHOTO COURTESY ED BLUME

Madison Firestation #6

addition, firefighting vehicles require regular washings with hot water.

The case for solar hot water gained strength when Kay (rhymes with "sky") Schindel, an engineer with the Department of Public Works and a certified Midwest Renewable Energy Association solar site assessor, determined that all of Madison's fire stations had the requisite structural integrity and sufficient solar exposure to accommodate panels on the roofs or walls. With Focus on Energy incentive dollars offsetting a portion of the up-front costs, the city took the plunge in 2006, installing the first four solar hot water systems to appear on Wisconsin fire stations.

Late in 2007, the city tackled the seven remaining fire stations through a single public works bid, under which all installations would be awarded to one contractor who is certified by the North American Board of Certified Energy Practitioners (NABCEP). Although a daunting assignment for any city engineer, Schindel's expertise in solar energy and his attention to detail enabled him to produce a set of bid specifications that ensured highly reliable, long-lasting installations in accordance with The Natural Step planning principles.

"Kay certainly did his homework," said Shawn Young, the lead hot water system installer for H&H Solar Energy Services, the firm Madison selected to



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Shawn Young, installer for H&H Solar Energy Services inspects the back of the panels atop fire station #1.

complete the remaining installations. "He met his obligations for due diligence."

The city's solicitation contained diagrams and measurements of the installations along with precise specifications of the equipment the city wanted. For example, the public works bid required 24 inches of clearance between the roof and the bottom edge of the panels to enable snow to slide completely off the panels. That specification became especially compelling after the record-setting volume of snow that fell on Madison during the winter of 2007–2008.

The installation atop Station 1 in downtown Madison may not be visible from the street, yet it's the largest system of all. The heating fluid circulating inside the copper tubing of the six south-facing panels reaches 160 degrees in summer. Even in winter, the six panels will provide a large portion of the station's hot water demand.

Of the seven fire stations covered under the bid, No. 6 demanded the most creativity and flexibility. Confronting a rooftop that sloped east and west, Schindel decided that the panels should be mounted instead as an awning above a row of windows on the south side of the building. The result: a less expensive installation that provides welcome shade during the summer months.

Says Young: "Anytime we needed a change, Kay made the necessary changes. The installations went smoothly because of his detailed knowledge of solar technology."

The city's strategy of leading by example has inspired other local governments and communities in the area, but none more so than Dane County, which shares office space with the City of Madison in the City-County Building. Dane County's 2009 budget includes funds to install a solar hot water system large enough to provide 75 percent of the hot water used by local government employees and those visiting the four-story City-County Building.

Just like the City of Madison, more and more communities across Wisconsin are beginning to plan energy efficiency and renewable energy projects to reduce operational costs in publicly owned buildings. What strategies might your community employ to reduce energy costs?

Full Service Installer & Lead Contractor

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Types of system installations

Solar thermal, solar electric, small-scale wind

Service Territory:

Upper Midwest

At-A-Glance – Solar Hot Water System

Collector surface area: 240 square feet

Collector manufacturer: Heliodyne, Inc.

240 gallons of pre-heated water capacity

Annual energy savings: 593 therms annually

Avoided CO2 emissions: 3.1 tons annually

Solar contribution to hot water load: 60 percent

Incoming water temperature: 35 degrees to 55 degrees Fahrenheit

Installation Cost: \$33,480

Focus on Energy incentives: \$7,718.75

System payback: 19 years; 8-percent rate of return

Fire Station Details:

Occupancy Time: 24/7

Occupants: 12 firefighters

