

TRANSPIRED SOLAR COLLECTOR WALLS:

Use Solar, Save Green

BY CHARLENE RIEGGER

As green building practices become more important — not only for environmental reasons, but also for cost savings and tax credits — new products supporting this philosophy are popping up everywhere. This wealth of product information and “greenwash” can be tedious for the building professional to sort through. The transpired solar collector, however, is one that deserves the attention of the savvy building envelope consultant. The U.S. Department of Energy (DOE) has called transpired collectors “the most reliable, best-performing, and lowest-cost solar heating for commercial and industrial buildings available on the market today.” (DOE/GO-10098-558, 1998.) The concept has received numerous honors and awards from DOE; the American Society of Heating, Refrigeration, & Air Conditioning Engineers, Inc. (ASHRAE); *R&D Magazine*; and many others worldwide.

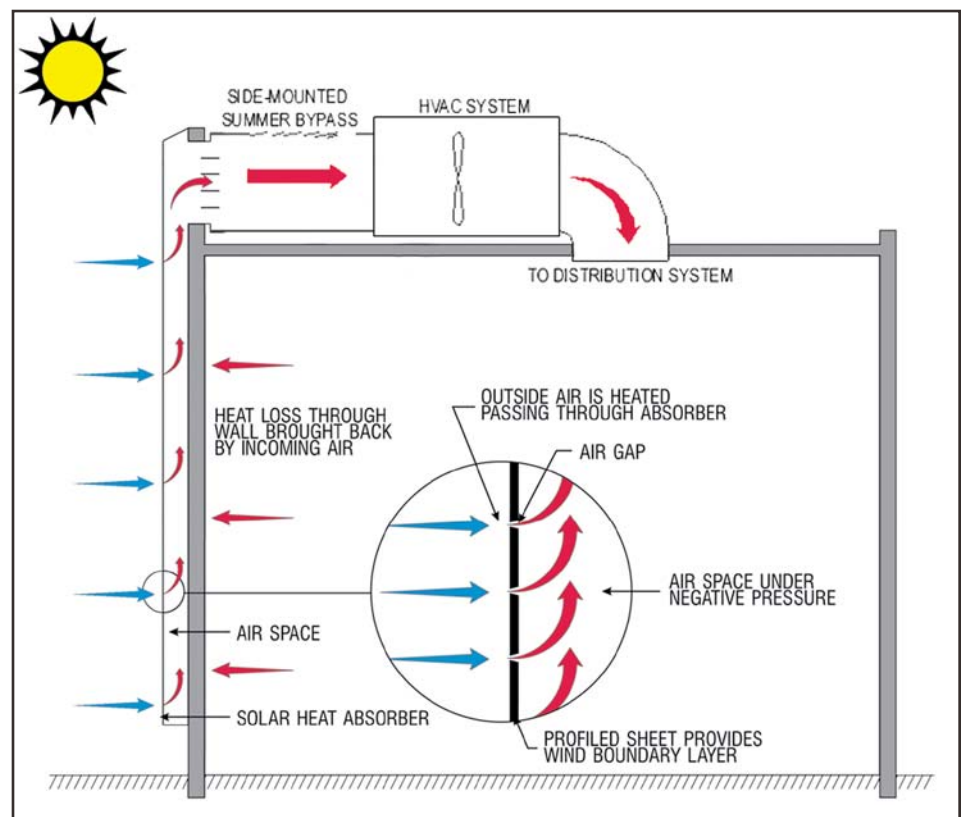
The Concept

The concept is simple: Perforated metal wall cladding is attached approximately 4 to 8 inches from a south-facing wall to a support grid of vertical and horizontal channels. The system may be applied vertically or horizontally over any noncombustible wall substrate, over or around existing wall openings. The grid system’s vertical channels are attached to the building wall, the horizontal channels are attached to the ver-

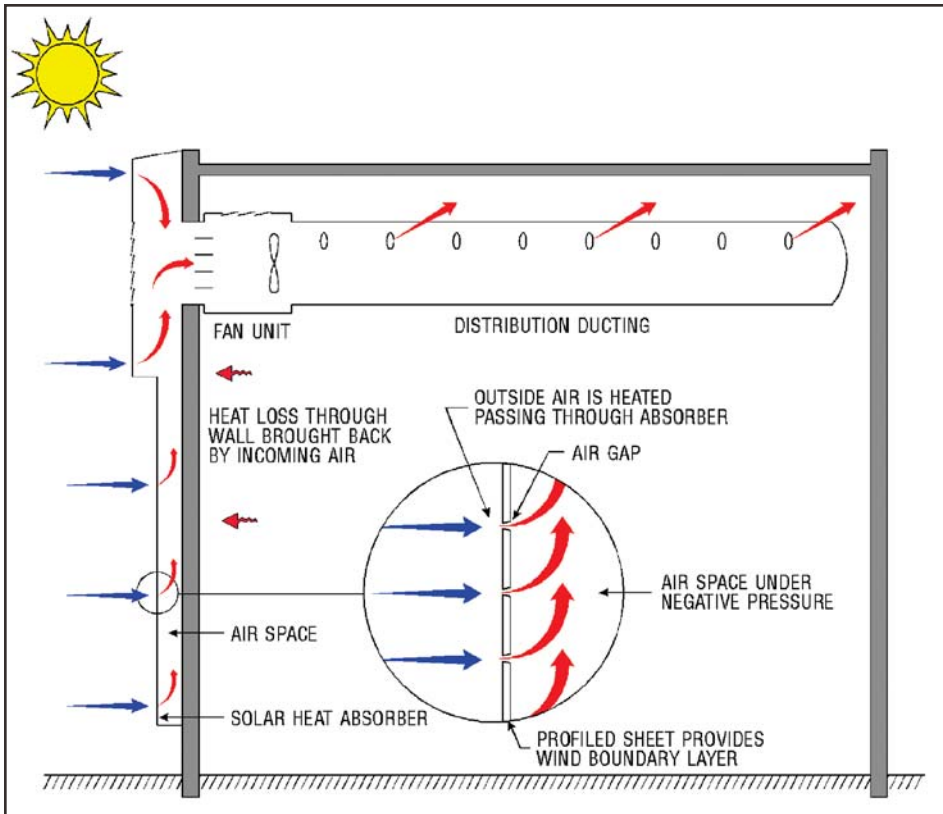
tical channels, and the perforated metal sheets are through-fastened to the horizontal channels.

The transpired solar collector may be mounted to the wall in several different ways, depending on the volume of air required. In some cases, only a portion of

the south wall is needed, or a penthouse wall may even be suitable. The sun heats the metal panel, and the heated air is drawn through tiny holes into the cavity between the panel and the wall by fans mounted at the top of the wall. The fans then distribute the heated air into the building through



Transpired solar collector schematic: Solar-heated air distributed through HVAC unit.



Transpired solar collector schematic: Solar-heated air distributed by dedicated fan.

flexible ducts mounted from the ceiling or through standard ducts connected to the heating and ventilating system. In the winter, the heated air removes a substantial load from the building's conventional heating system, thus saving considerable energy and money. In the summer, the panel is shading the inner wall, thus reducing the cooling demands of the building. When heating is not required, a controlled damper can be opened to allow air to bypass the

solar collector, providing a continuous supply of fresh air into the building. The transpired solar collector wall is also effective on cloudy days, though at a reduced level.

Additional Benefits

In addition, the use of this preheated fresh air system eliminates stratification of the air inside industrial buildings, where hot air rises to the ceiling and is lost through the roof or drawn out with exhaust



Transpired solar collector panel sample.

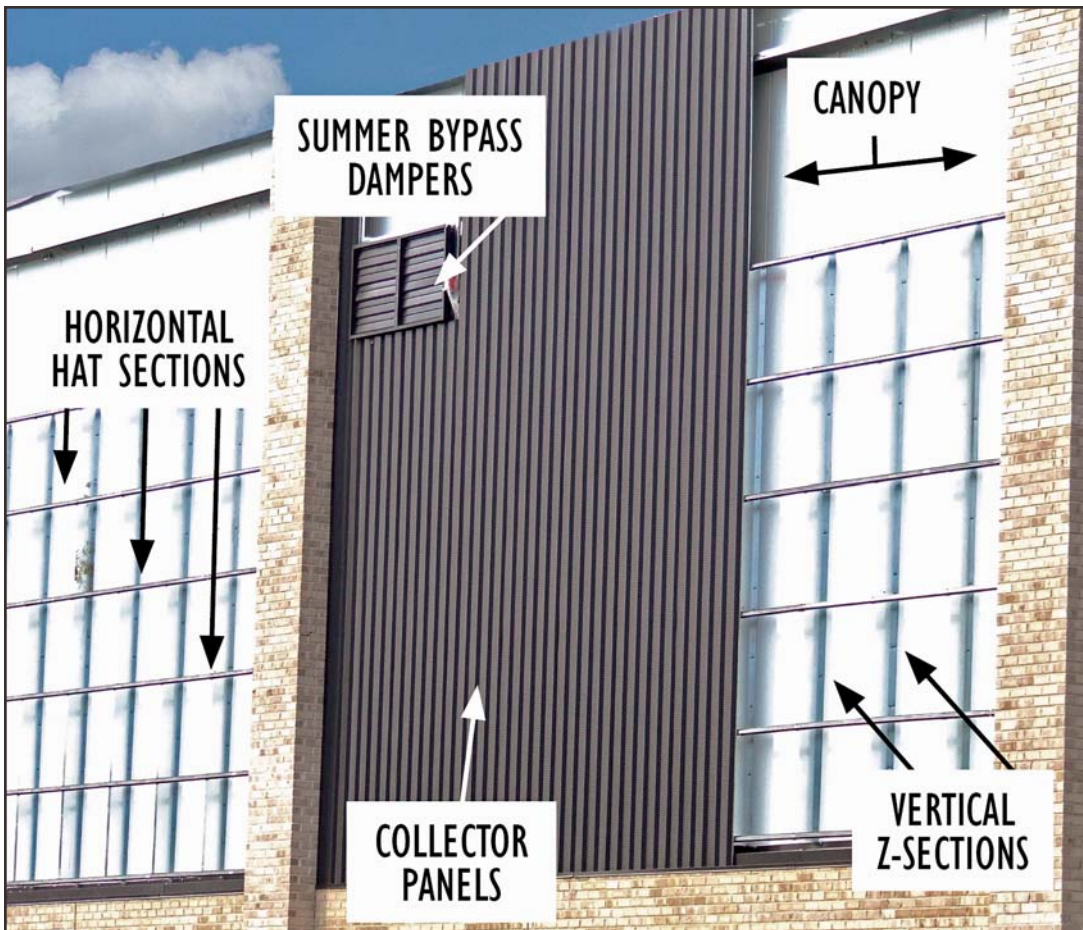
fans. Since the air is constantly being replaced, the system is ideal for vehicle repair shops, machine shops, chemical storage plants, and industrial applications where fumes are present. The system also provides positive pressure for the building. When a door or window is opened, the heat from indoors exits, but the cold outside air does not rush in.

New codes specify minimum ventilation rates and indoor air quality, depending on the type of building and the number of occupants. Inadequate fresh air may lead to "Sick Building Syndrome," which results in headaches; eye, nose, and throat irritations; and fatigue and/or difficulty in concentration for its inhabitants. This system replaces the air constantly and is also ideal for manufacturing plants, hazardous-waste storage buildings, gymnasiums, airplane hangars, schools, office buildings, apartment buildings, and warehouses requiring ventilation. The system also provides process heat for agricultural or industrial purposes.

Environmentally, the transpired solar collector wall is using natural energy that is clean, thus lowering the need for fossil fuel heat and reducing production of greenhouse gases. Payback of the system is relatively short, and state and federal grants, as well as tax credits, are given as incentives for solar energy use. The installation may qualify for Leadership in Energy and Environmental Design (LEED®) points and credits. The cost of conventional energy can vary greatly, depending on the geographical location and the season of the year. With soaring energy prices, the use of free solar heat will reduce the need for conventional energy sources.

Any existing noncombustible south-facing exterior wall in need of repair could be covered with the energy-saving transpired solar collector wall panel. For a uniform appearance, the other exterior walls can be covered with a similar panel system in the same color. For variety and aesthetics, coordinating or contrasting colors may be used. Use of the perforated panels on a vertical, southern-exposure wall is recommended to collect the most solar energy. A vertical surface will give more reflected radiation with no snow buildup and low wind loads.

Research has proven that each square foot of panel will supply 150 to 200 BTUs per hour. Intake air



Grant Way Industrial building in Allentown, PA, during installation process; labeled details.

is preheated by up to 65°F (36°C) above ambient air temperature, reducing annual heating costs by \$1 to \$5 per square foot of collector wall, depending on the type of fuel displaced. U.S., Canadian, and German governments have independently monitored installations of this type. The International Energy Agency's (IEA) Solar Heating and Cooling Program is reporting efficiencies of over 70%, according to its report, SHC.T14.Air.1 9/99.

The National Renewable Energy Laboratory, a division of the Department of Energy (DOE), is currently monitoring some projects and is continually researching the transpired solar collector system.

Specifications

Transpired solar collectors are typically manufactured from aluminum and, to a lesser extent, zinc in two-wide, ribbed configurations. Thicknesses vary from .032-in aluminum to .028-in zinc. Panels are

approximately 40 in wide and are available in many colors and with a polyvinylidene fluoride (PVDF) finish. Darker colors with high solar absorption rates are recommended for maximum effectiveness. The systems are virtually maintenance-free, since there are no liquids or moving parts other than the fan system or optional filters. The paint finish is warranted for 30 years.

CASE STUDIES

Transpired air collector systems are successfully being used by both private and governmental sectors. Installations in automotive, manufacturing, aviation, education, and distribution facilities have shown substantial energy savings. Transpired solar collector systems have been installed on many buildings throughout the United States.

Pennsylvania Manufacturing Facility

One installation, on a new 60,000-sq-ft manufacturing facility in Allentown, PA, was completed in 2006. Its design objectives were to provide reduced heating costs, year-round comfortable air ventilation, and positive air pressure.

A 3,600-sq-ft collector (solar absorptivi-



Completed installation of Grant Way Industrial building in Allentown, PA.




Greenwood Elementary School with completed transpired solar collector installation.

Greenwood Elementary School

The Greenwood Elementary School in Millerstown, PA, was recently renovated to include 730 sq ft of black-colored collector wall. The annual greenhouse gas reduction is 19,000 lbs. The annual heating cost savings are \$2,553, with a simple payback of five years (based on 2008 natural-gas costs). Expected savings over the 30-year project life are \$115,000. Schools are not eligible for tax credits. However, when using on-site renewable energy, there is a possibility of additional grants from state governments.

Manufacturers

The transpired solar collector wall is available from two companies. ATAS International, Inc. manufactures the product under the trade name InSpire™ Wall in the U.S. Conserval Engineering, Inc., offers the product under the trade name SolarWall™ in Canada. 

ty 0.91) faces 16 degrees west of due south. The total airflow rate is 18,000 cubic feet per minute (cfm), which is delivered by two 30-in diameter fans. For each square foot of collector wall, the flow rate is 5 cfm. The annual renewal energy delivered is 650 million BTUs. The average air temperature rise is 13°F at 5 cfm/sq ft during daylight hours for the nine-month use season. The rise of the temperature over ambient air on a sunny afternoon is typically 55°F. The annual greenhouse gas reduction for this installation was 98,000 lbs. The annual projected energy savings for this project were \$16,500, with an actual savings of

\$22,086, translating to a savings of \$4.60 per square foot of collector wall. The total projected energy savings for this installation over a 30-year project life are approximately \$700,000. The simple payback period, with accelerated MACRS depreciation, is less than 3½ years.

Charlene Riegger

Charlene Riegger is the marketing coordinator for ATAS International, Inc., headquartered in Allentown, PA. The company manufactures metal roofing, wall panels, ceilings, and accessories



English Churches Fight Theft of Metal Roofs

Ecclesiastical, the insurers of over 95% of Great Britain's Anglican churches, has paid claims costing more than £9 million for metal theft in 2008 to date (mid-October) and £10 million for 2,300 claims in 2007. Church insurance manager John Coates said, "Churches continue to be plagued by metal theft. We have been fighting for over 18 months to give churches every means to protect themselves. Many churches are listening, but many are still dangerously vulnerable. In some circumstances, the only solution is to take temptation away and replace it with an alternative material. It's a difficult balance to strike: We want to preserve and protect our historic churches for the future, but we also want to ensure that metal theft doesn't force them to close."

Lead sheet has been the main target, but a significant proportion of the insurance company's cost has been making good the damage caused by the thieves and the subsequent ingress of water. Dramatic increases in theft have come about because of spiraling prices caused by worldwide demand for lead-acid batteries, both for vehicles and for uninterrupted power supplies (UPS), and more recently because of the speculator activity this rising market price has attracted. Significant amounts of lead have been stockpiled and kept from the market to encourage prices to rise. Prices started to fall by the start of 2008 as new sources of supply opened up.

Insurance companies were advising their clients to mark metal so that it can be identified when recovered, to install alarms in their buildings, and to do all they can to restrict access to roofs. For more information, see www.english-heritage.org.uk/upload/pdf/Advice_Note_on_Theft_of_Metal_Roof_Coverings_5_JS_.pdf.