SOLAR BUILDINGS

Transpired Air Collectors
Ventilation Preheating

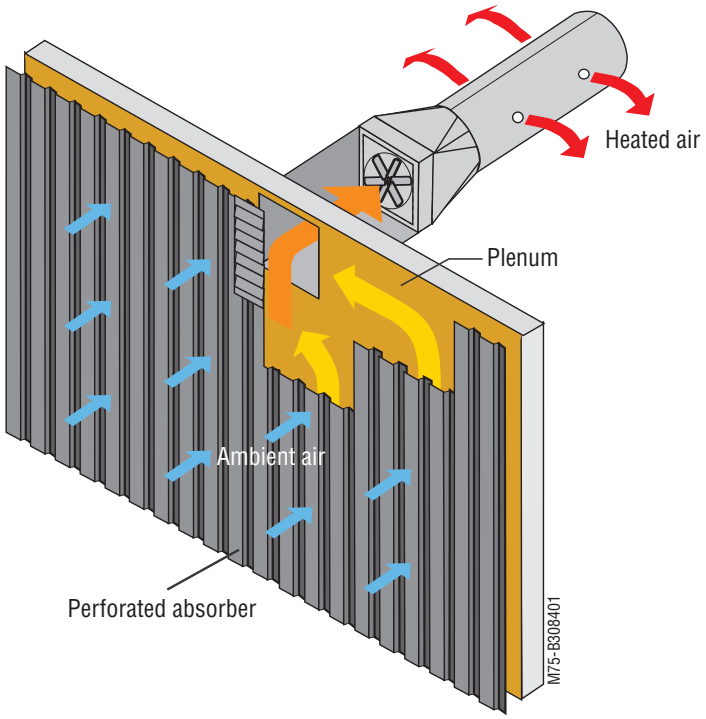
THIS ELEGANTLY SIMPLE TECHNOLOGY CAN BE HIGHLY COST EFFECTIVE FOR COMMERCIAL AND INDUSTRIAL BUILDINGS.

Many commercial and industrial buildings have high ventilation rates. Although all that fresh air is great for indoor air quality, heating it can be very expensive. But an elegantly simple technology is available to use solar energy to preheat ventilation air and dramatically reduce utility bills.

Transpired air collector systems essentially consist of a dark-colored, perforated façade installed on a building's south-facing wall. An added fan or the building's existing ventilation system draws ventilation air into the building through the perforated absorber plate on the façade and up the plenum (the air space between the absorber and the south wall). Solar energy absorbed by the dark absorber and transferred to the air flowing through it can preheat the intake air by as much as 40°F (22°C). Reduced heating costs will pay for the systems in 3–12 years.

This R&D 100 Award-winning technology is the product of the practical initiative of Conserval—a private solar heating and energy conservation company that markets the technology as SOLARWALL©—and the scientific expertise of the U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL). Unlike previous technologies for space heating, the transpired collector requires no expensive glazing with associated energy loss to reflection. Design refinements, identified by NREL's research and computer modeling, boosted the amount of available solar energy (diffuse as well as direct sunlight) that the transpired collector can capture to a record-breaking 80%. Using transpired collectors provides numerous other advantages:

- The collectors are virtually maintenance free, with no liquids and no moving parts other than the ventilation system fans.
- At night the collector assists heating because heat lost through the main building wall behind the collector system absorber is recaptured.
- Transpired collectors help meet demands for improved indoor air quality, because better ventilation is an integral part of the system.
- Collectors can be added on to or designed as part of a building's façade; commercially available SOLARWALLs© use attractive metal sheeting and are available in many colors. The systems will pay for themselves even faster in new construction than when added to existing buildings because of money saved on the building's façade.



Transpired air collectors preheat building ventilation air by using the building's ventilation fan to draw fresh air through the system. The intake air is heated as it passes through the perforated absorber plate and up the plenum between the absorber and the south wall of the building.

THE TRANSPIRED AIR COLLECTOR IS MORE EFFICIENT, LESS EXPENSIVE, AND BETTER FOR INDOOR AIR QUALITY THAN PREVIOUS SOLAR AIR COLLECTORS.

Many Uses

Transpired collectors are ideal for industrial and commercial buildings with large ventilation requirements. More than 40 systems have been installed, including several at major manufacturing plants. Other common applications include vehicle maintenance facilities, hazardous waste storage buildings, gymnasiums, airplane hangars, schools, and warehouses requiring ventilation.

Favorable factors for a cost-effective transpired collector installation include:

- Appropriate south-, southeast-, or southwest-facing wall
- Long heating season
- High utility rates for heating
- Relatively large ventilation requirement.

Transpired collectors generally are applicable wherever outside air must be heated. Collectors can also preheat combustion air for central-heating plants or industrial furnaces. However, transpired air collector systems may be inappropriate for some multistory buildings due to fire code problems as well as for buildings with existing heat-recovery systems.

Transpired air collector systems are being used in both the federal and private sectors. The Fort Carson Army Post in Colorado was the first federal facility to install a "solar wall." The transpired collector heats a new high-bay aviation maintenance facility by prewarming air and supplying the heated air to the building's central heating system. High-profile, private-sector industrial users include Ford Motor Company, McDonnell Douglas, General Motors Corporation (GM), and Federal Express. At a GM battery plant in Canada, Conserval installed a transpired collector to correct the ventilation problems of a steam-operated fan coil system for space heating. And a Federal Express Distribution Facility in Colorado uses a 5,000-square-foot transpired collector that is expected to save about one million Btus of natural gas annually.

Simple Concept

The transpired air collector is easier to use, lower in cost, and more efficient than previous flat-plate solar air collectors made with glazing. Transpired collectors use common-wall construction with building material as the solar heat absorber. This makes installation simple and substantially reduces material costs, including reducing costs for insulation. In addition, because they do not use glazing, which reduces the amount of sunlight absorbed by conventional flat-plate collectors, transpired air collectors are more efficient.

Keith Gawlik/PIX 04118

Transpired air collector ventilation preheating technology is ideal for sunny locations with long heating seasons, such as for this Federal Express facility in Colorado.

Major Potential

Space heating is a universal need in cold climates, as well as a major user of energy—some 13% of U.S. energy is used for heating residential and commercial buildings alone. By reducing this energy use, transpired air collectors can also reduce building operation costs, reliance on imported fossil fuels, pollution, and greenhouse gas generation. In addition to being maintenance free, transpired collectors help eliminate temperature stratification where that is a problem.

Transpired air collector systems can be used to preheat air for standard commercial and industrial building ventilation systems. They pay for themselves quickly and produce substantial environmental and economic benefits with no negative side effects. They provide a highly effective means for substituting renewable energy for fossil fuel consumption.

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