

# COMBUSTION

## Success Story



## A FRESH WAY TO CUT COMBUSTION, CROP, AND AIR HEATING COSTS AVOIDS MILLION BTU PURCHASES

### BENEFITS

- Captures as much as 80 percent of available solar energy, avoiding some of the resource depletion, pollution, and greenhouse gas emissions associated with conventional heating
- Solarwall<sup>®</sup> preheating can save enough energy to reduce combustion or air heating costs by \$10 to \$50 per square meter (\$1 to \$5 per square foot) of wall installed, depending on the type of fuel used
- Can be added to existing buildings or designed into a new facade
- Ventilation installations will generally pay for themselves in less than 3 years for new construction and within 5 to 7 years for retrofits; payback for systems supporting combustion equipment could be less
- Virtually maintenance free system uses no liquids and has no moving parts other than the system fans
- Increased ventilation improves indoor air quality and worker comfort, increasing productivity

“I had what I thought was a great—but largely intuitively developed—energy-saving invention. National Renewable Energy Laboratory scientists had the theoretical and computer analysis expertise to make it even better. The I&I grant allowed us to take full advantage of that expertise and increase the effective solar energy capture of the Solarwall<sup>®</sup> to a phenomenal 80 percent.”

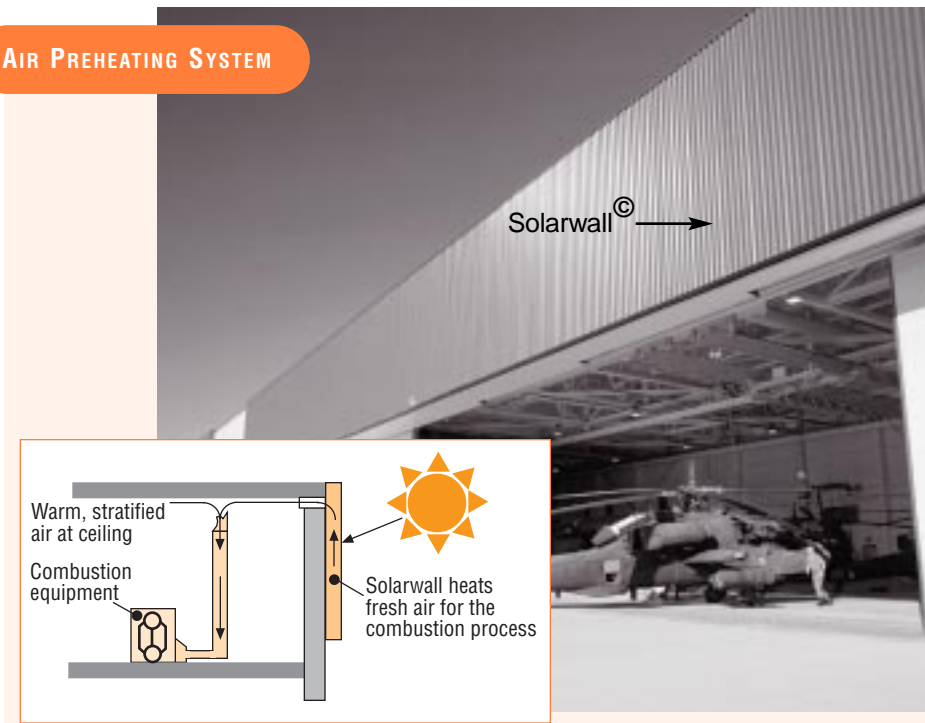
— John Hollick, Solarwall<sup>®</sup> inventor and President, Conserval Systems, Inc.

### ELEGANTLY SIMPLE SYSTEM USES SOLAR ENERGY TO PREHEAT COMBUSTION, CROP, AND VENTILATION AIR

Space heating of residential and commercial buildings is one of the largest uses of energy, accounting for approximately 9 percent of energy use in the United States, and industrial processes account for an additional 10 percent. At the same time, concern for improving indoor air quality and avoiding temperature stratification and sick-building syndrome calls for an increased intake of fresh, outside air. Industrial building operators face a quandary regarding how to maintain combustion heating requirements with rising fuel prices. Cold outside air for combustion also generally means high energy use for central heating plants and industrial furnaces.

Moving from industrial operations to agricultural operations in warm and humid climates presents a different heating/ventilation challenge. In agricultural operations, domestic crops are often sun dried. Sun drying avoids costly energy bills, but insects, mold, and rain can destroy much of the crop. Is there some way to continue to take advantage of solar energy without product loss?

### AIR PREHEATING SYSTEM



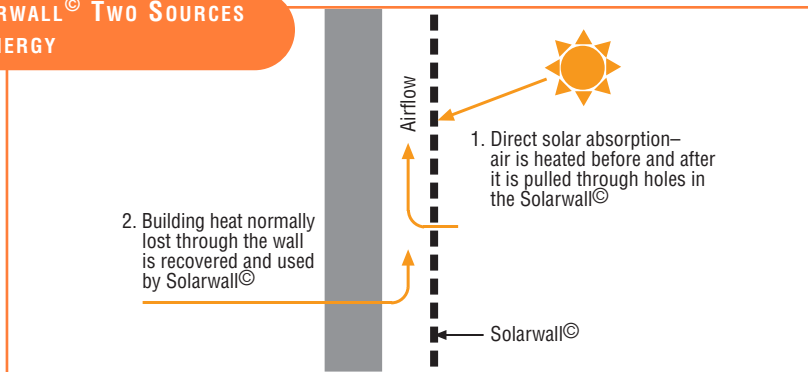
**Improving indoor air quality with more ventilation, or increasing combustion firing rate, does not have to mean increased heating costs. With Solarwall<sup>®</sup>, the sun and the building wall preheat the air, dramatically reducing energy consumption.**



## Solution

Conserval's Solarwall<sup>®</sup> systems capture solar energy to preheat air, greatly reducing fuel demand by combustion systems and saving energy and money while maintaining or increasing ventilation, preheating industrial combustion air, or fully heating air for crop drying. The secret is in—or more precisely through—the holes.

### SOLARWALL<sup>®</sup> TWO SOURCES OF ENERGY



The dark-colored and perforated facade is installed on the south-facing wall of the building. Sunlight heats the facade. The combustion system draws outside air into the building, through the holes in the facade and the space between the facade and the building, heating that air in the process. At the same time the facade captures heat loss through the building wall and shields the building from solar gain when heating is not needed. Solarwalls<sup>®</sup> can capture as much as 80 percent of available solar energy, reduce annual heating costs by \$10 to \$50 per square meter of wall installed, and pay for themselves quickly.

An 18-month, \$80,000 Inventions and Innovation grant, along with additional funding provided by the Department of Energy's Office of Power Technologies and the Office of Building Technology State and Community Programs, allowed Conserval to improve the efficiency of Solarwall<sup>®</sup> systems substantially, to develop design tools to predict and optimize energy savings, and to verify that the system could be installed on roofs for space heating and crop drying. Efficiency gains were made with a header duct, optimizing hole size/spacing, air flow rates, and coatings. This system can also be used with thermal storage. For example, as glass plants convert to oxy-fuel, the regenerators are normally removed. This system could store thermal energy for nighttime use in air combustion forehearths to reduce the outside air temperature variation, which impacts productivity.

## Results

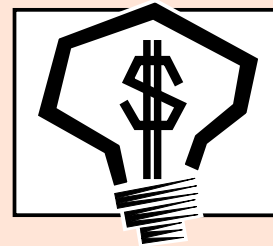
Conserval—a 22 year old company with a \$1 million annual budget—has installed more than 100 systems since project completion. Conserval and NREL were awarded an R&D 100 award in 1994 for the Solarwall<sup>®</sup>. Conserval recently opened its own production plant in Buffalo, New York.

Conserval's Solarwall<sup>®</sup> preheating can cost-effectively save energy wherever large amounts of outside air must be heated. It is ideal for manufacturing plants and other commercial and institutional buildings with large air heating or combustion requirements. Ventilation preheating installations have included schools, apartment buildings, and manufacturing plants. Combustion air preheating uses include central-heating plants and industrial furnaces. Solarwall<sup>®</sup> crop drying installations thus far include coffee, cocoa beans, chilies, and others. See the Internet page for details regarding residential applications.

## COMBUSTION

*The Combustion Program works closely with the industrial combustion community in pursuing research and development (R&D) that can achieve the goals and performance targets set forth by the industry in two landmark documents: **The Industrial Combustion Vision** and **The Industrial Combustion Technology Roadmap**. The program promotes the research and development of advanced, highly efficient combustion systems that will help U.S. industry to remain competitive in the future.*

OIT Combustion Program Leader: Bob Gemmer (202) 586-5885.



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

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DOE/GO-102001-0874  
Order# I-OT-563  
January 2001