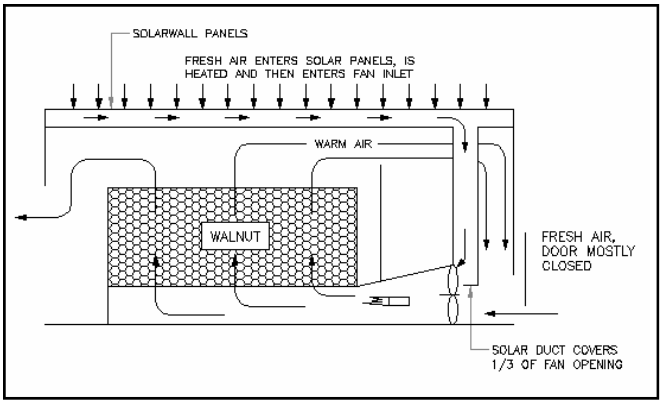
Carriere & Sons, California Walnut Drying

Walnuts being dried by solar heat.



Dryer operation: a portion of the warm air rising from the walnuts is recirculated back to the blower and mixed with the solar heated air.

Background

Carriere & Sons owns and operates hundreds of acres of walnut trees and a modern walnut drying facility. They are also in partnership with Borges of California, which is owned by Borges of Spain. Borges is the world's leading walnut operator and has forty-eight companies in its group devoted to the production and marketing of oils, dried fruits and nuts.

Walnuts are dried at a relatively low temperature with a maximum temperature of 110°F (43°C) leaving the dryer. This low temperature requirement is ideally suited for the use of the SOLARWALL® technology. A normal drying season consists of two months of drying from September 1st to October 31st. The walnuts are dried from 35% moisture content to 10% moisture content.

Project Summary

The Solarwall panels were mounted on the roof of a new drying building and cover the entire roof area of 40' by 80' with 3,200 ft^2 (300 m^2) of collectors. A duct comes from the roof to one side of the air intakes of the dryer fan. The solar collector heats approximately 25,000 cfm of outside air supplied to the 70,000 cfm blower.

The energy savings for two months of operations from September 1st to October 31st, is over 3,800 therms. (111,300 kWh) The actual dollar savings are based on the cost of gas, which fluctuates between $0.45 and $0.93 a therm. The energy savings are a combination of solar heat, and heat recovery from the uninsulated metal roof.

Duct from roof connects Solarwall panels to one of two inlets for blower.

The California Air Resources Board's Innovative Clean Air Technologies (ICAT) program provided financial support to demonstrate solar walnut drying.

The SOLARWALL panels were mounted on the roof of the dryer building.

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Keyawa Orchards, Inc.

Walnut Drying

Above: Rooftop mounted SOLARWALL® panels funnel solar heated air into the walnut drying system (shown left)

Background

Ron Keyawa is the operator of a large walnut production and processing facility in Ordbend, California. He had previously seen another SOLARWALL® system operating at Carriere, a neighboring walnut producer, and with the success of that installation, Keyawa decided to incorporate his own solar system into his processing facility during an expansion.

Solution

9300 ft^2 (864 m^2) of black SOLARWALL® cladding were mounted on the roof of the new drying building, and the solar heated air is ducted to the air intake of the walnut dryer.

The drying season is three months, from September to November. Walnut drying is a perfect application of the SOLARWALL® technology. Walnuts require large volumes of air heated to only 110°F (43°C). Roof mounted panels collect heat from two directions; from the solar energy reaching the top metal absorber, as well as recovering heat rising from the dryers below the existing metal roof.

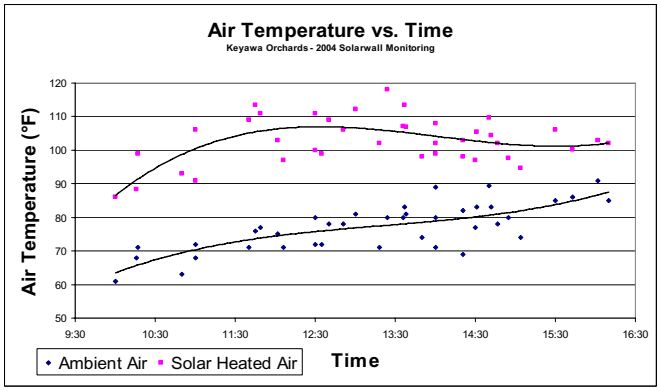
The system provides 65,000 cfm of solar heated air. If the dryer is running at full capacity and more airflow is required, the bypass dampers can be used to supply additional air. Conversely, if the air from the panels is too hot, the bypass dampers will open automatically to cool the air to the desired temperature.

The California Air Resources Board's Innovative Clean Air Technologies (ICAT) program provided a grant for this demonstration project to encourage solar drying in the state, with the goal being lower emissions and improved air quality.

Results

The heat output is equivalent to a 500 kW heater. Using the software program SWIFT, developed by Natural Resources Canada, the following savings were calculated:

- 1431 MMBTU fuel savings per year
- $13,832 cost savings per year



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Korina Farms Pecan Drying

Left: Duct from roof delivers solar heat down to dryers. Right: Roof-mounted SOLARWALL panels collect solar heat, which rises to a roof plenum at the north end of the building.

Background

The owners of Korina Farms contacted Conserval Engineering about the possibility of installing a solar drying system on their new pecan drying facility after hearing that the solar technology was performing extremely well with other crop drying applications in California.

Pecans are a heat-sensitive crop that are dried between October and December, at a maximum temperature of 80°F (27°C).

Solution

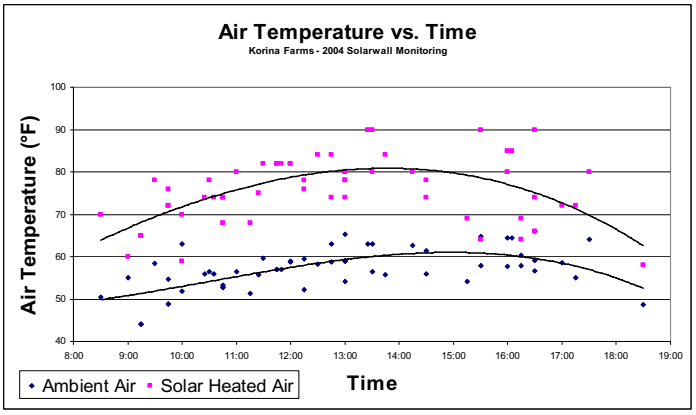
A 5,200 ft^2 (483 m^2) solar panel drying system was integrated into the roof of the new drying facility. The SOLARWALL® panels and ductwork connect to two drying fans, which are both rated at 37,000 cfm.

Financial support was provided by the California Air Resources Board's Innovative Clean Air Technologies (ICAT) program.

Results

This is the first dedicated pecan drying application in California and the first to use solar heating. Monitoring during the 2004 drying season showed excellent results.

The energy savings were projected to be 354 million BTUs/year, which translates into a dollar savings of about $3,500 each and every year (using propane costs of $1/therm).



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Sonoma County Herb Exchange

Herb Drying

Solar heat from roof mounted panels is ducted down into the drying chamber and is used to dry delicate herbs year round.

Background

Sonoma County Herb Exchange is a clearinghouse specializing in the harvesting of top quality organic and ecologically friendly herbs. Originally they sold only fresh herbs, but after making the decision to venture into a new area of drying herbs, it was a logical choice to use a SOLARWALL® heater as the drying mechanism. Not only does the solar technology provide uniform drying to the delicate crops, but it is also very cost-effective since the fuel is free.

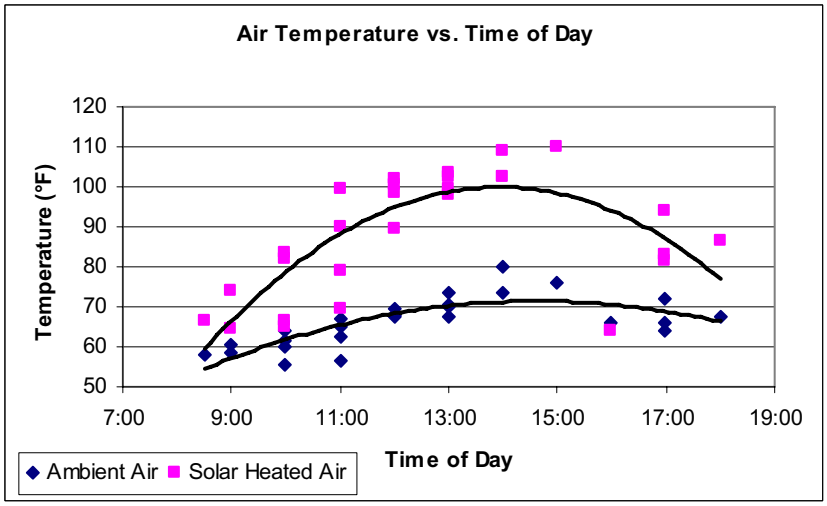
The California Air Resources Board's Innovative Clean Air Technologies (ICAT) program provided funds to demonstrate the simplicity of the installation, and the potential for small scale solar drying applications suitable for the smaller farming operations.

Solution

An eight panel residential kit, with 105 ft^2 (10 m^2) of solar collectors, was installed on the roof of the building housing the new dryer. The air, from a variable speed fan, is ducted from the solar panels through the bottom plenum of the dryer, up to the herbs being dried, and then it is exhausted out the top. The average temperature rise is over 22°F (12°C) on a sunny day inside the dryer, with peak temperatures of 40°F. The low temperature rise is ideal for many of the delicate herbs.

Speaking on the system's performance, Leslie Gardner, Director of Sonoma County Herb Exchange, wrote: "We have really benefited from it, and the Herb Exchange is forever grateful".

The temperature chart (right) shows the temperature rise that is achieved when drying the various herbs (above) at the Sonoma County Herb Exchange



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Sunsweet Dryers Fruit Drying, California

Dryer air inlet

Background

Sunsweet Growers is a cooperative of prune growers, which operates 481 drying tunnels. Sunsweet Dryers is the largest company in the USA drying prunes.

Prunes are dried at a relatively high temperature with a maximum temperature of 185°F leaving the burner. Each of the 481 tunnels has two chambers. The drying season is 4 to 5 weeks per year, 24 hours a day, usually from mid July to mid August. Each fan handles approximately 50,000 cfm of air with approximately 20% of fresh air and 80% re-circulated air. The burners are rated at 3.2 million BTU's per hour and are modulating. The roofs of the dryers are not insulated.

Solution

110 square meters (1,200 square feet) of Solarwall panels were mounted on the roof of three adjacent dryers and connected to one fan intake. The solar system pre-heats the ambient air 20 to 30°F before it enters the drying chamber. The energy produced by Solarwall panels comes from two sources: The first is the solar energy collected, and the second is the heat recovery from the roof. The air flow rate through the solar collector was designed for 10 cfm per square foot of collector.

Roof mounted panels

Monitoring of the gas consumption for the 2004 drying season showed a total fuel savings of 29 therms of gas per day from Solarwall when operated 24 hours a day. This represents a savings of 8.7% of the gas usage.

The California Air Resources Board's Innovative Clean Air Technologies (ICAT) program provided financial support to demonstrate solar drying in California.

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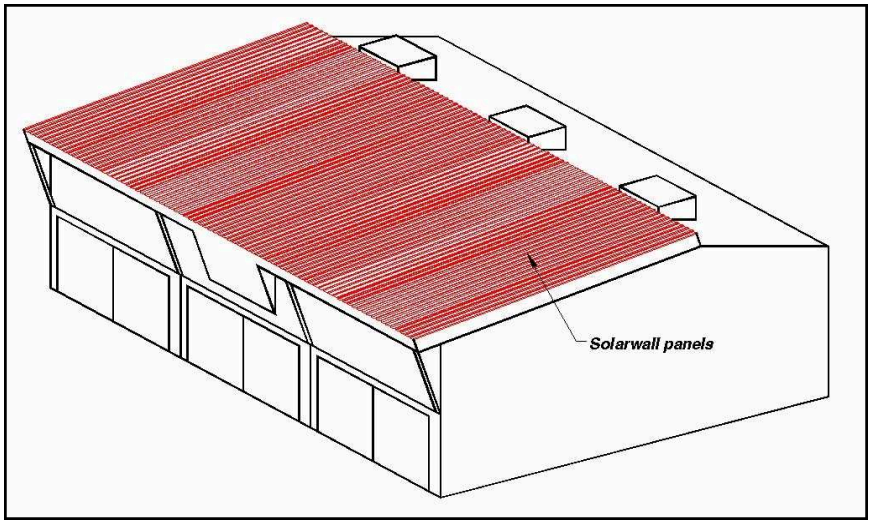
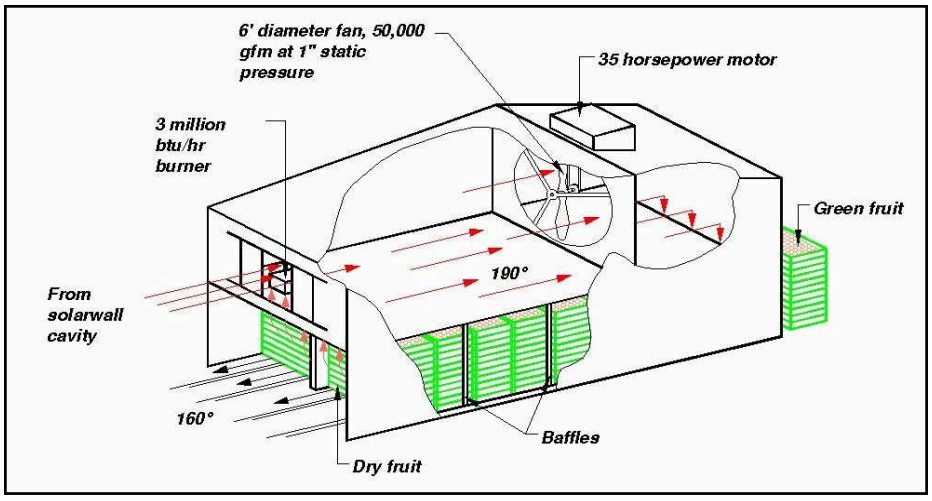
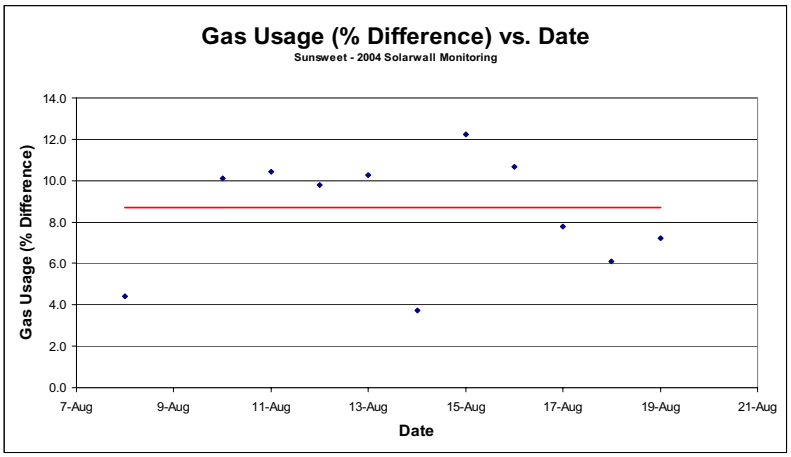
SOLARWALL®



Prune Dryer with Solar Preheated Air



Typical Prune Dryer



Average SOLARWALL gas savings is 8.7%