



structures

# Learning to Conserve

Creating an energy-efficient greenhouse structure can be challenging, with rising energy costs and resources becoming scarce in parts of the country. But Pleasant View Gardens has managed to do so and even see a payback. Read on for some hot ideas.

By Jasmina Radjevic



*Top:* Adding a second curtain to your greenhouse can help reduce heat loss.

*Middle:* Pleasant View Gardens' London, N.H., facility was built in 1972 and covers 7 acres.

*Above:* By installing flood floors, Pleasant View is able to conserve water and maximize the square footage of the greenhouse.

Energy efficiency is nothing new to greenhouse growers, but with the struggling economy and fuel prices continuing to rise, you may be looking for additional ways to save on energy costs. Pleasant View Gardens, with two locations in New Hampshire — Loudon and Pembroke — has been practicing energy conservation for the past several years and has seen much success.

From building open-roof greenhouses to adding shade curtains and installing flood floors, Pleasant View has continued to implement various energy-saving systems at its two operations. They will be the first to tell you that it involves tons of input costs, but the savings are remarkable. On average, most of the new systems have shown a payback within three years.

## Starting With Your Structure

One of the first steps in creating a more energy-efficient greenhouse structure is opening up the roof. Open-roof greenhouses have been around for many years now, and most greenhouse manufacturers offer a menu of various types of open-roof houses. These structures eliminate the need for cooling fans, which in turn reduce energy costs: Running exhaust fans can become quite expensive, especially during the summer.

About three years ago, Henry Huntington, president of Pleasant View Gardens, began pursuing open-roof structures for two reasons: to be more energy efficient and to mimic the outside environment for healthier crops.

One of the main benefits of an open roof, according to Jeff Warschauer, Nexus vice president of sales, is that it is easier to harden off the crops. "The crop inside the greenhouse feels like it's out-

side," he says. "It's getting full sun, getting a lot of wind and getting a lot of air." In a completely enclosed greenhouse, crops may be overnurtured. So when growers sell the crop and a consumer puts it outside, the crop has been "babied" so much that it may not perform as well in the more vigorous outdoors. The open-roof greenhouse facilitates the hardening without the risk of crop damage in an actual outside environment.

## Perfecting the Greenhouse

Building the open-roof greenhouses at Pleasant View was only the first phase of the grower's new construction. During the second phase, Huntington was sure he wanted to add on more 100 percent open-roof greenhouses, until Warschauer introduced him to the dual-atrium greenhouse, which is only half open. Other than the roof, "there's nothing different," says Warschauer. "The gutter heights are the same. The coverings are the same. The location is side by side. The crops are the same."

The biggest difference between the two houses is that the dual-atrium has half the gutters of the open-roof structure and fewer moving parts. According to Warschauer, whenever you have a gutter or a vent, there is the potential for a condensation leak. "So the more we can eliminate that, the drier and the better the environment for the crop," he says.

After comparing the two styles of open-roof greenhouses, there was little apparent difference in temperatures. So Huntington made the decision to add dual-atrium houses this time around, and when he looked at the environment, it was remarkably close to the other open-roof greenhouses. "Pleasant View found that with the



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last build, the dual-atrium, they were getting the performance they got in their 100 percent roof," says Warschauer. "And at the same time, they save the investment cost on both the material and installation because we're installing fewer moving parts."

The new dual-atrium greenhouses have half the gutters and half the vent mechanisms. According to Warschauer, a greenhouse with more gutters is more likely to have heat loss. "Gutters are thin pieces of metal, and they don't hold energy very well," he says. "You can leak heat out through the gutter even if you have a curtain system. If we can reduce the number of gutters, we certainly have a lot less heat loss."

### Adding Dual Curtains

After putting up glass greenhouses, Huntington realized how much energy they were

so that provided a challenge. "But just like anything the first time you do it, you find your way," Warschauer says.

To create a greenhouse that could hold two curtains, Nexus had to make changes to the structure. "We engineered the truss so we have more clearance that makes it easier for two curtains to be installed. That's a big difference when we modified [the greenhouse]," explains Warschauer. It gave them more room to be able to install the two curtains.

So how exactly does the second curtain work? On a cool, overcast day, they will pull the curtain to hold heat in the greenhouse, where normally the curtain would be open, according to Russ Elkins, facilities manager at Pleasant View.

On a sunny day, because of solar gain, the sun heats up the greenhouse immediately. But as soon as the sun goes down, heat is able

— less watering, less handling of the material and also maximizing the square footage of the greenhouse by using the floor," says Elkins.

They also put in retention ponds so the greenhouse runoff water could be recycled and used on outdoor crops in the future. "We knew we needed to start conserving water and controlling our runoff," Huntington says.

Although Pleasant View isn't in a region with major water issues, they still don't have a municipal water supply. "We pull it all out of the ground, so there's a limit to how much water we can get out of the ground here without putting in 10 more wells," Huntington explains.

Pleasant View is also working on setting up more systems this summer to start experimenting with water recirculation, Elkins says. "We want to retain some of the outside water—the water that hits the greenhouse—and put it into ponds to eventually use that water as well."



Dual-atrium greenhouses have half the gutters of open-roof structures and fewer working parts.

pumping through the roof. He especially found that on a cloudy winter day when there is no solar gain, he had to heat up the greenhouse quite a bit and it would go through the roof. "We can have a zero-degree day here, and if it's sunny, we'll be venting because we've got too much heat in the greenhouse," Huntington says. "But on a cloudy day that's maybe 25° F, we're burning all kinds of fuel just to keep things warm."

So Huntington asked himself, "How do we keep some of that heat in the greenhouse?" There had been some talk about some greenhouse growers putting in additional curtains, so he began researching the use of multiple curtains. His goal was to "come up with as transparent a curtain as possible so I wasn't going to reduce my light level but it would help hold heat in the greenhouse."

Huntington then approached Nexus with the idea of building a house with a dual-curtain system. At this point, Nexus had not designed a house that was able to handle two curtains,

to escape right out of the greenhouse. "So by pulling this blanket, which is more or less a clear blanket, it's actually helping retain some of the heat in the greenhouse," Elkins says.

Since putting in the dual-curtain system, Pleasant View has seen huge savings on energy costs. The entire system cost about \$100,000 (\$1.15 per square foot), but "we saved probably around \$30,000 to \$40,000 the first year." They expect to see full payback within three years.

"Because not everybody wants to do it right away," Warschauer says, the company has been engineering greenhouses that can accommodate a second curtain at a future date.

### Working With Water

Energy efficiency in the greenhouse is not all about the structure itself. There are other practices and systems growers can implement to save energy. For example, Pleasant View installed ebb-and-flood floors. "We did that for conserving water, which is a main resource for growing plants, and labor efficiencies as well

### Finding a Fuel Alternative

A new trend in greenhouses is using biomass heating systems. These systems burn wood chips instead of oil. As fuel prices continue to rise, Huntington and Elkins have been exploring alternatives.

"We've been researching it for probably about three years," says Elkins. He and Huntington have traveled through Pennsylvania, Ohio, the Northeast and Canada to research different biomass systems. And, according to Huntington, they didn't visit one operation that wasn't pleased with the change to biomass.

Although a biomass heating system involves huge capital input, it can mean significant savings in the future. "It's a substantial capital cost, so obviously you have to bring some scale into that," says Huntington. "We're burning enough between our two facilities that we should be able to pay for this in three years or less." Plus, after doing some research, Huntington found that wood fuel would cost about a third of what oil is costing him now per BTU.

One concern with the biomass system is the availability of wood chips, but even this problem has a fairly simple solution. To keep costs down, Elkins says they'll "set the system up so that we can burn possibly a mixture, which would be wood chips and maybe horse manure, or some other mixed products." As wood chip prices escalate, they will have options of burning other types of items. Some greenhouses with existing biomass systems are burning construction debris, whole tree chips, sawdust and even ground-up tire bits.

Huntington anticipates having the biomass system in place at the Pembroke location by the next heating season. At Loudon, an older, more spread-out facility, they will need to combine heating into one plant before putting the system in, he says. [GPN](#)

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