



# Feeling the heat

Greater efficiency in greenhouses can reap big rewards

BY JON BELL

**J**AY CUSHMAN HAS been in the nursery and horticulture industry for a long time. Not only did he graduate from **Oregon State University** with a degree in ornamental horticulture and spend more than 15 years with companies such as **Sun Gro Horticulture** and **McConkey Company**, but he's spent the last nearly 12 years in greenhouse sales for **OBC Northwest**.

In his experience in the industry, especially in his greenhouse work for OBC Northwest, Cushman has learned that there's one thing that growers and nursery owners want to talk about more than anything else. It's not energy efficiency, it's not structure and equipment design, and it's not better ways to heat a greenhouse.

"People would much rather talk about plants in this business," Cushman said. "If it's something that makes the plants better or it's the newest plant, they're ready to have a chat and talk about it."

While that's understandable, there might be other topics

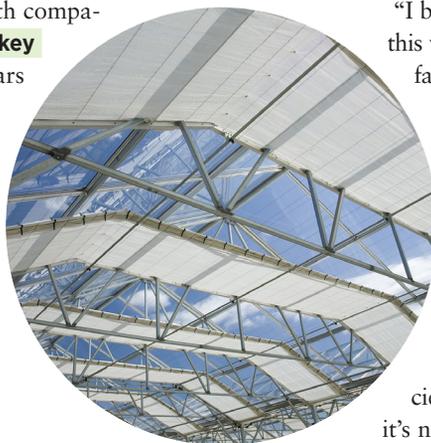
that growers and nursery owners, particularly in the greenhouse space, should be talking about — like energy efficiency, structure and equipment design and better ways to heat a greenhouse.

"I believe greater consideration needs to be given to this whole scope," Cushman said. "As growers and family businesses expand, this is going to become a much more important component."

Heating and energy usage in greenhouses have long been key to how efficiently plants inside them grow — and how efficiently owners and growers can run their operations.

As more attention has been turned toward carbon, from both a regulation and planetary angle, finding ways to be more efficient has become more important than ever. But it's not always easy for growers to commit to significant upgrades, which come with hefty price tags.

Thankfully, there are options and innovations available that, when paired with sizable financial incentives from the likes 



## Feeling the heat

Previous page, top: Heating a greenhouse is one of the highest expenses a grower can take on.

PHOTOS COURTESY OF DEREK SMITH **Bottom:** An energy curtain installed in a greenhouse can reduce heat loss. PHOTOS COURTESY OF WADWORTH COMPANY



**Left:** A renovation in eastern Washington paid for itself in less than two years by taking in solar heating during the day. Replacing the twin-wall with triple wall cut heat loss, as well. PHOTOS COURTESY OF CHRIS GUNTERMANN

of the **Energy Trust of Oregon (ETO)**, can make the shift to more efficient heating approachable and fruitful for greenhouse owners and growers.

“Energy is just an employee that comes into work through a pipe or a wire,” said Chris Guntermann, a longtime consultant who has worked with growers and nursery owners for more than 40 years, “and just as you manage your employees, you’ve got to manage your energy usage to get the most out of it.”

### Warming it up

Heat plays a major role in how greenhouses function properly and create the ideal environment for the crops grown in them, whether that be annuals or hardy plant materials for propagation. Plants grown in greenhouses need relatively uniform heat, and they need to be kept free of condensation, which can lead to disease.

But that heat also comes at a high cost. According to the ETO about 75% of the energy used in a typical green-

house goes to heating. (An additional 12% goes to electricity and 13% is for transportation.)

These days, most greenhouses employ a range of heating systems to deliver heat and maintain optimal conditions for their plants. Depending on the greenhouse and crop, heat may come from different types of equipment, including unit heaters for heating a specific space, boilers and high-efficiency condensing boilers, under bench heating, which warms the roots of plants and radiant floor heating. Direct vent heaters, which bring in fresh air from the outside, warm it and blow it into the greenhouse, are another option.

“When customers are entertaining how to approach the design of their greenhouse, we go through a number of steps to look at specific processes and products for heating based on what they’re look-

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**Left:** Condensing boilers have a smaller footprint than cast iron boilers, and digital controls turn the boiler on when heat is truly needed. **Right:** The benchtop warm water tube heat focuses heat on seedlings and trays, saving energy on heating the entire space. PHOTOS COURTESY OF CHRIS GUNTERMANN



ing for and what they’re going to grow,” Cushman said. “Within a design, we can calculate how much heat is needed and when it is needed.”

When it comes to greenhouse heating, other measures come into play as well. Thermal curtains can help reduce heat

loss, as can an improved greenhouse shell that uses an infrared cover. Additionally, advanced digital control systems can improve efficiency by streamlining when heaters and venting systems are running.

**Calculating payback**

Though many greenhouse owners have updated their heating systems, there may still be those out there who are using older technology that’s less efficient but

who are also hesitant to invest in a newer system. Others may have already upgraded but could improve their efficiency — and savings — even more by investing in other heating-related measures.

To help greenhouse growers make needed investments in efficiency, the ETO offers a robust incentive program comprising rebates and calculated incentives. Rebates are available for high-efficiency boilers, thermal curtains, under bench **»»**

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## Feeling the heat

An example of warm water floor heating installed on a layer of insulating board. The heater is at 120 degrees. These systems can be sabotaged by poorly controlled or applied cold water irrigation that washes the heat out of the pots, past the tubes, and into the cold ground. It can take 24 hours to bring pot temperatures back up after a cold water irrigation. PHOTOS COURTESY OF CHRIS GUNTERMANN

heating, intelligent greenhouse controllers, unit headers and infrared covers.

Calculated incentives involve a more complex assessment of a project and the before-and-after energy usage to calculate a custom incentive amount. They are available for greenhouse reglazing and condensing boilers. The incentives only apply to natural gas heating.

ETO's incentives can help offset a significant portion of an investment in upgraded heating measures — if not cover the entire cost — in just a few years.

“I get the impression that a lot of growers look at the up-front cost and not much beyond that,” said Steve Ziemak, a senior program analyst with ETO. “What we do as part of our analysis is we take the energy savings and the value of that savings and we let the nursery grower know what the simple payback would be

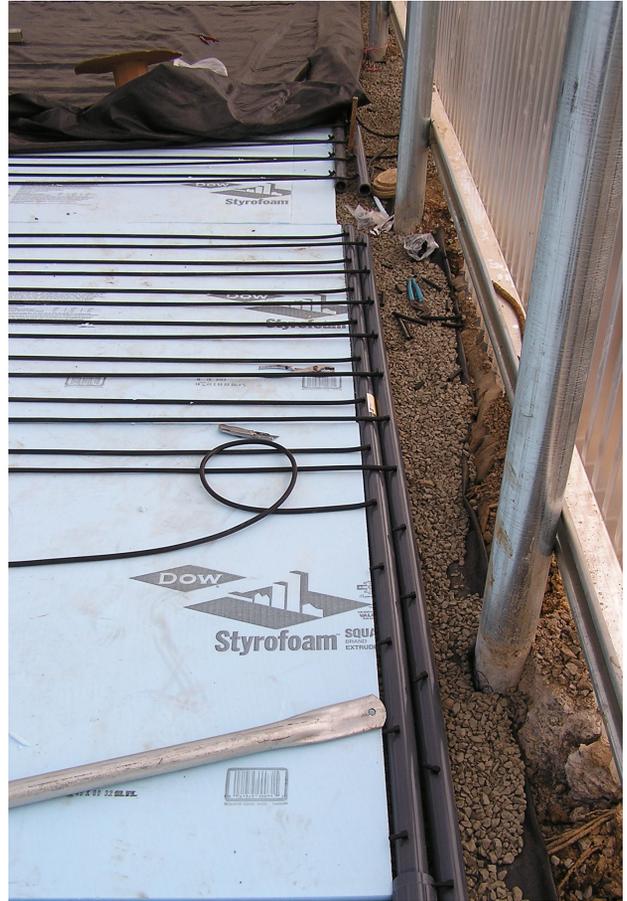
based on energy savings.”

He added that calculated incentives have to have a payback period of less than eight years.

“That being said, we see a lot of projects that have a much better payback, sometimes between one and three years,” Ziemak said.

### Steps to take

Nursery growers and greenhouse owners have an array of options to consider when looking into improving the efficiency and effectiveness of their heating systems. Some are the type of upgrade that



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This condensing natural gas unit heater which shows the benefit of in-and-out venting using plain pvc pipe rather than stainless steel. It brings in outside air, burns it, then vents it back outside. The condensate line is shown, along with an acid neutralizer. PHOTOS COURTESY OF CHRIS GUNTERMANN

would make more sense with the assistance of an ETO incentive or rebate. Others are simple steps that can make a noticeable difference with minimal effort.

**Take a look** — Guntermann said a simple quarterly walkthrough can help identify areas where heat might be escap-

ing or where other improvements could be made. He also suggests conducting that walkthrough late at night to get a sense of what's going on when no one's around. "Do it at 2 in the morning in your bunny slippers and you'll feel exactly where the cold air is coming in," he said.

**Condense it** — If you have yet to upgrade to condensing boilers, look into it. Annual savings can top 30%, and pay-back range is usually between three and eight years. ETO can help with a rebate for new boilers, too.

**Plug the gaps** — It seems obvious, but be sure to seal any gaps where heat might be escaping. Also, insulate all pipes, and consider upgrading your greenhouse shell to help conserve energy.

**Higher heat** — Consider specific heating systems depending on the type of crops and plant material. More efficient options could include radiant floor heating, under bench units or direct-vent heaters.

**Seize the controls** — Analog control systems don't do a good job of maximizing efficiency. Digital systems automate everything to ensure the heat is being delivered only when it should be and



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that venting is done properly. Some systems come with data loggers to help growers become even more efficient over time.

**Get online** — There are valuable tools online to help growers improve their greenhouse heating an efficiency. Among them: The USDA's Virtual Grower ([tinyurl.com/np8st4d2](http://tinyurl.com/np8st4d2))

tool, which allows greenhouse owners to determine heating costs and do simulations to determine where improvements can be made, and ETO's "Greenhouses Energy Savings Guide," ([tinyurl.com/s6wkxras](http://tinyurl.com/s6wkxras)) which offers tips and suggestions on potential upgrades.

### **Making comparisons without an audit**

The USDA Virtual Grower tool, which is downloadable software available for free, is particularly helpful for growers who want to evaluate possible greenhouse improvements and even make comparisons, said Michelle Moore, CEO of Adapt8 in Brooks, Oregon, which makes Solexx greenhouses and greenhouse coverings.

It allows the grower to input all the parameters of their current greenhouse — height, width, length, covering, heat source, temperature requirements and when those requirements apply — and then create virtual greenhouses to compare it to, with different parameters. The costs of the fuels used for heating are taken into account in the cost projections.

"The primary benefit is that you can do an analysis to determine the best investment for your money that has the highest return," Moore said. "You can quickly compare multiple scenarios. You can look at the type of heater, the type of fuel, the type of covering, the greenhouse design, and also the lighting."

Growers can look at their cost savings very quickly to determine the payback period or return on investment for various upgrades.

"They can use the data to apply for various incentives, while saving the expensive energy audit that they normally would have to do to qualify for an energy rebate," Moore said.

Adapt8 used the tool recently when it created its own test greenhouse at the corporate headquarters. By using the Virtual Grower tool, Adapt8 had hard data that enabled them to apply for an ETO rebate on the improvements they made. "We didn't have to hire anybody to do an energy audit because it was straight out of the USDA database," Moore said. ☺

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*Jon Bell is a freelance journalist based in Oregon who writes about everything from craft beer and real estate to the great outdoors. He can be reached at [jontbell@comcast.net](mailto:jontbell@comcast.net).*

## Soliculture brings power and light together as one

California company's solar panels turn greenhouses into power plants

It almost sounds more science fiction than horticulture.

Scientists from the University of California/Santa Cruz and NASA teamed up with greenhouse growers and Silicon Valley to create solar panels that not only enhance light for growing crops in greenhouses but generates electricity, too.

Today, a California company called Soliculture specializes in these panels, called greenhouse integrated photovoltaic panels, and helps growers maximize crop production while generating clean energy.

Glenn Alers, president and CEO of Soliculture, was one of the original researchers in the physics department at UCSC looking into ways to incorporate building integrated photovoltaics — essentially power-producing solar panels installed on building facades and roofs — into greenhouses. Their particular panels convert green light to red light, which has been shown to be better for both crop and power production.

"We were all physicists and didn't know how to grow anything," Alers said, "so we partnered with growers to really figure it out."

Soliculture completed its first commercial installation in 2015. Since then, the company has been installing panels in greenhouses in places like California, New York and Ontario, Canada.

Alers said renewable energy incentives can help cover the cost of installation, but even without any incentives, payback is usually between five and nine years. A federal solar incentive on a new greenhouse, which comes in the form of a 26% tax credit and applies to the entire structure of the greenhouse, would likely cover the entire cost of the panels.

Much of the interest in Soliculture's panels has been coming from California and some sunnier spots in the Midwest. Alers said the technology is most applicable in those kinds of locales, especially where power is expensive. In places like Oregon, where there is less sunlight and plenty of cheap power, the panels don't make as much sense. However, Alers noted that places like southern and eastern Oregon, where cannabis has become a popular crop, would be a good fit for Soliculture's systems.

He said greenhouse growers are often skeptical of promises to improve crop yields, but there's no denying the power-generating benefits of Soliculture panels.

"It can be hard to quantify the crop yields," Alers said, "but they definitely understand the electricity side of it."

For more information, visit [www.soliculture.com](http://www.soliculture.com)