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FEATURES

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The Heating Game

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Aside from labor, energy costs have become one of the biggest factors in profitability for controlled environment agriculture (CEA) growing. I reached out to a couple of experts to get their thoughts on the situation and how growers can reduce costs, not just now, but in the future with new builds and existing operations.

Burkhard Metzger, general manager for produce at Prospiant, gave me the rundown on natural gas prices and what the industry is looking at after enjoying a decade of low prices.

“In 2020, natural gas prices averaged $2.03 per million British thermal units (MMBtu); natural gas futures surged to $5.72 per MMBtu in November. That’s the highest they’ve been since 2009,” he says. “It’s also a warning signal that the potential price at the burner tip will be pushed well past the $6 per MMBtu threshold commercial greenhouse operators typically set.

Pictured: Proper site selection is one of the first factors to consider when looking at reducing energy costs in a new construction project.

“Where natural gas prices go in 2022 and beyond is anyone’s guess. I do not expect them to drop back down to the stable, low levels experienced in recent years. Production and investment in new gas wells have been constricted during the COVID-19 pandemic and will take time to recover. At the same time, demand for residential heating is growing rapidly, with significant amounts of the available natural gas inventory being liquified and exported.”

So what can a grower do? Turns out plenty. Here are some of their tips.

New builds

One of the more promising options for reducing energy costs in new construction is cogeneration, but there are caveats on when and where this situation works best.

“Cogeneration is underutilized in the U.S., but probably only makes sense when natural gas is available and the local power company can accommodate a grid connection,” notes Dr. A.J. Both, researcher, professor and extension specialist in the Department of Environmental Sciences at Rutgers University.

Other options growers should investigate include a heat pump system with energy storage, exclusive use of LED lights, installation of a separate curtain system optimized for energy retention and adequate humidity control, A.J. says.

Burkhard says proper site selection is essential for energy cost reduction.

“Consider whether a location in a region with a warmer climate and less wind is a viable option. Also, consider how close the site is to existing natural gas infrastructure,” he says. “Many areas lack pipelines within two to three miles of potential greenhouse sites, which makes the cost of building a pipeline to supply natural gas to your project expensive.”

Burkhard also recommends CEA growers explore biomass boilers as an option due to the volatility of natural gas prices.

“The feedstock—wood and waste from agricultural and organic materials—is widely available, prices per ton are stable and biomass is carbon neutral; burning it to heat greenhouse crops releases as much carbon as the trees or biomass—trees and agricultural plants—consumed during their growing cycles,” he says. “As a result, greenhouse businesses can achieve their sustainability goals while better managing energy costs.”

Existing facilities

OK, now on to what most of you are looking for: how to tweak and retrofit existing greenhouses, and what to consider for the future. A.J. says to focus on all your conservation strategies first, including your maintenance, searching for and reducing or eliminating air leaks and improving insulation. Then you can move on to looking at replacing the heating system with a higher-efficiency unit, investigating whether or not it makes sense to switch to a different fuel source entirely and looking at whether you can install a dedicated energy curtain.

Patricia Dean, CEO of Wadsworth Control Systems, seconds the dedicated energy curtain, and provided some tips to make sure it’s in proper shape:

• Check that the curtain is sealing well with no gaps. “You can adjust the drive unit to ensure a tighter seal,” she notes.

• Make sure the fabric hasn’t deteriorated, as curtains can lose their energy-saving capabilities over time if the fabric has worn.

• Adjust climate control settings. “I usually recommend starting the night period a bit before sunset since the winter light levels are quite low—it helps retain heat as the temperatures drop,” she says. “Then uncover the curtain a bit after sunrise so the cold air above the curtain has a chance to be warmed by the solar gain.”

More changes to consider

A.J.’s list continues with planting wind breaks (he said they should be far enough away from the greenhouse so they don’t obstruct sunlight and they don’t create snowbanks near the greenhouse), as well as investigating whether a lower nighttime temperature set point is feasible.

Of course, add to the to-do list considering switching out HPS to LED lights, depending on the cost factor there. And both A.J. and Burkhard recommend installing variable frequency drives on pumps and motors.

“Replacing single-speed pumps with two-speed or variable frequency drive (VFD) pumps enhances efficiency and can reduce energy costs,” Burkhard says. I looked into this more and these pumps are designed to operate near the pump’s best efficiency point. Because they operate at reduced pressures, they may require less maintenance over time.

Future options for reducing energy costs

I asked both AJ. And Burkhard what options may be coming for CEA growers that could help reduce energy costs. A.J.’s big picture list includes fusion energy, fuel cell technology and “novel glazing materials that actively block heat radiation from coming in and going out while maintaining a high transmissivity for photosynthetically active radiation.”

More options include sophisticated control systems that keep track of weather conditions, crop requirements and energy prices, as well as crop lighting recipes based on crop performance and energy requirements.

On Burkhard’s list is solar power, which he says holds promise, as do whole-climate systems.

“Photovoltaic panels are getting thinner and lighter,” he says. “That means greenhouse structures can be lighter, saving commercial operators money on the construction of greenhouses or expansion of their existing facilities.”

On the whole-climate system, he says the industry will start to see growers invest in these capabilities over the next two to three years. Technology like automation and artificial intelligence (AI) will play a role in monitoring and controlling factors like temperature, CO2, humidity and nutrients inside the greenhouse.

“The whole-climate system will make decisions and control greenhouse processes based on historic and real-time data faster than any human operator can,” he says. “They’ll use more natural sunlight and better manage how much energy is consumed for lighting, heating and cooling.” **IG**

Small Tweaks Any Grower Can Make

Here are more options for growers from Dr. A.J. Both:

- Start growing crops a little later in the heating season (consult with your customers).
- Investigate whether it’s possible to use lower set point temperatures.
- Select plant species/cultivars that are able to deal with lower set point temperatures.
- Allow the outdoor temperature conditions to dictate what the indoor temperature should be (use temperature integration instead of strict set point control).
- Keep a closer eye on energy consumption and utility bills (consider installing energy meters on some of the larger equipment).
- Consider hiring a professional to do an energy audit.
- Get better informed about energy incentive/rebate/loan programs.
- Make a long-term plan (spread out investments over multiple years).
- Don’t be afraid to try out new approaches on a small growing area.