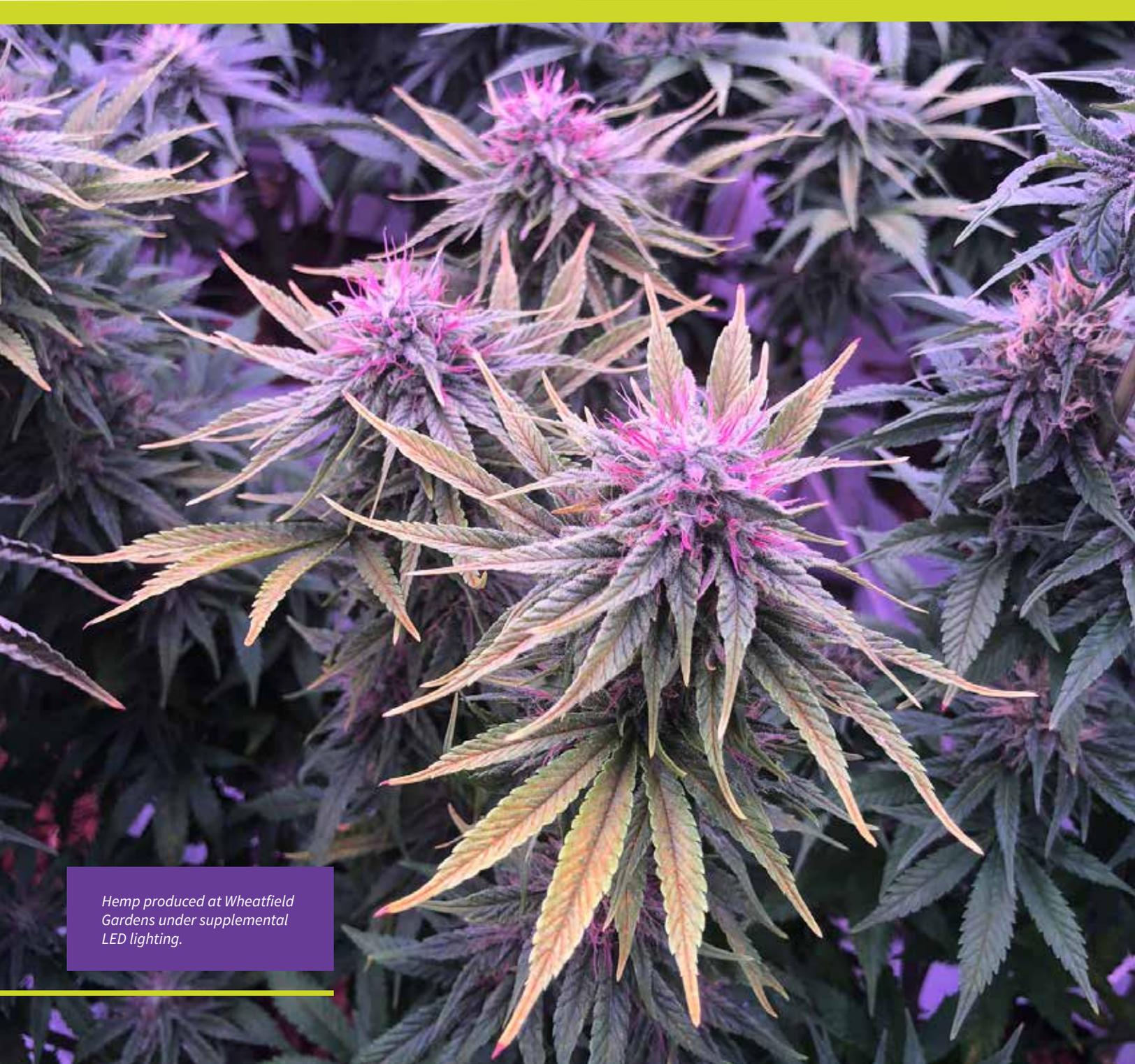




CANDIDUS

**CASE STUDY:  
WHEATFIELD GARDENS**



*Hemp produced at Wheatfield  
Gardens under supplemental  
LED lighting.*



*Paal Elfstrum, owner and CEO at Wheatfield gardens.*

**Wheatfield Gardens is using technology, including the Candidus lighting control system, to grow food and hemp crops more energy efficiently and sustainably.**

## CASE FILE FACTS

### COMPANY:

Wheatfield Gardens

### LOCATION:

North Tonawanda, N.Y.

**CROPS:** Leafy greens, herbs and hemp.

### TECHNOLOGY:

High-tech greenhouses equipped with cogeneration system, LED lights and Candidus lighting control system.

## BACKGROUND

In 2015 a group of investors purchased an abandoned 12.5-acre greenhouse facility in North Tonawanda, N.Y., that they named **Wheatfield Gardens**. Located about 10 miles north of Buffalo, the **Venlo glass greenhouse** was constructed in the early 1990s by a local power company called **Oxbow Power**. The greenhouses were initially operated by **Village Farms** to produce vining vegetable crops.

“In the 1990s in order for utility companies to build power plants, the companies were required to do something with the excess steam that was generated to produce electricity,” said Paal Elfstrum, CEO at Wheatfield Gardens. “Many of these power plants were built adjacent to industrial manufacturing sites. In this case, the power company, which owned a 37-acre parcel of land about a mile away, built the greenhouse facility to be the thermal host for the excess steam the power plant was producing. The steam was piped to the greenhouses to heat the facility.

“Initially it was good idea. But in the late '90s the regulations went away so the utility company no longer needed to have this thermal host and the



*Wheatfield Gardens used Candidus adaptive lighting control system to meet the different lighting requirements of lettuce and hemp. The Candidus system provides Paal the ability to provide his crops consistent lighting conditions year-round in Buffalo, NY*

company eventually lost interest in the greenhouse facility.”

During this time an increasing amount of vine crop produce was coming into the United States from Canada and Mexico.

“The regulations for the power plants went away in the late 1990s so they no longer needed to have these thermal hosts to operate,” Elfstrum said. “Oxbow Power eventually shuttered the greenhouse in 2012. Because of the economics of commodity tomatoes and cucumbers, they could not compete with the imports coming in from Canada and Mexico.”

## CHALLENGE

When Elfstrum and his partners acquired the greenhouse facility in 2015, they initially started with vine crops.

“We made an attempt at growing those crops to compete in the world of commodity greenhouse crops,” he said. “We had a deal with a local grocery chain to grow eggplants, English cucumbers, and beef-steak tomatoes. We were trying to market our crops as the locally-grown option. Unfortunately those three crop categories are highly commoditized.

**It was difficult to differentiate our product, even though it was locally grown. For many consumers it’s difficult to tell whether a cucumber has been grown in the U.S., Canada, or Mexico.”**

Although Elfstrum and his partners wanted to produce commercially profitable crops, more importantly they wanted to use the greenhouse as a proving ground for their own controlled environment technology.

“Some of my partners came from the on-site power industry, specifically designing micro-grids and co-generation systems is our area of expertise,”

Elfstrum said. “We used Wheatfield Gardens as an opportunity to demonstrate our novel patented technology that optimizes the integration of on-site power production with controlled environment agriculture. **Most CEA farms are very energy intensive. We decided to invest in the power infrastructure of the facility to make it very efficient.** Behind labor, the second highest operational cost for most greenhouses and all vertical farms is energy. We took an aggressive approach at improving our resource efficiency by using co-generation and the benefits that come with it, including generating our own heat and electricity. We could also capture the carbon dioxide and deliver it to the plants to increase yields.”

## SOLUTION

**“The Candidus light control system offers enhanced control. It has the ability to track trends, and look at lighting history. The Candidus controller has the functionality that we want. It is more intuitive than any other light controller that we looked at. The Candidus controller was designed by a grower for growers.”**

*- Paal Elfstrum, CEO  
Wheatfield Gardens*

**To differentiate its products, Wheatfield Gardens pivoted away from tomatoes and cucumbers to high value crops, including lettuce and herbs which were added in 2016 and industrial hemp for cannabidiol (CBD) production in 2017.**

Elfstrum worked with researchers at Cornell University and fellow industry colleagues from the GLASE consortium to look at alternative crops. Butterhead lettuce produced in floating rafts became the company’s benchmark crop. In addition to butterhead lettuce, Wheatfield Gardens is producing multiple varieties of hydroponic lettuce, herbs, and auto-flowering hemp cultivars of *Cannabis ruderalis* in deep water culture.

“Lettuce travels so far to get to East Coast markets with 90 percent coming from the West Coast,” Elfstrum said. “That travel time doesn’t make sense to me. They are basically trucking water across the U.S. The flavor suffers as well during the long distance transport.”

During the summer, Wheatfield Gardens can grow a 300-gram head of lettuce in 30 days. In winter, the crop time increases to 36 days.

In 2018 Wheatfield Gardens installed dimmable LEDs that offered light spectrum control.

“The LEDs allowed us to compete with other lettuce growers and enabled us to be a consistent supplier to our customers year round,” Elfstrum said. “The LEDs were more efficient than high pressure sodium as well as being dimmable and controllable. That’s what we wanted because we are trying to be as efficient as possible without sacrificing



*Below: Candidus first commercial controller used at Wheatfield Gardens.*

*Bottom: Candidus adaptive lighting control user interface and sample monthly energy use report.*

quality. For lettuce we look to achieve a daily light integral of 17 moles.”

When the LEDs were installed the company also installed a light controller.

“The original light controller was very comprehensive, but it was over-engineered for the purpose of controlling the lights and what we wanted it to do.”

The company has recently installed a Candidus light control system to compare its features to the original light controller.

**“The Candidus lighting controller enables us to really have tight control over the DLI,”** Elfstrum said.

“We’re measuring how much energy it takes to achieve the DLI on a seasonal basis. We are able to determine if using supplemental light allows us to reach the lettuce head weight we are trying to achieve.

“The lights will come on if we don’t reach the 17-mole DLI threshold. If it was cloudy all day, the Candidus lighting control system automatically realizes the deficit and turns the lights on at night to reach 17 moles. That’s the beauty of this control system. We can graph when the lights are operating so we can see when the lights were needed.”



## BENEFITS

**“If it was cloudy all day, the Candidus lighting control system automatically realizes the deficit and turns the lights on at night to reach 17 moles. That’s the beauty of this control system. We can graph when the lights are operating so we can see when the lights were needed.”**

Elfstrum said the real advantage of installing the Candidus light controller has been the ability to dim the lights on an active basis to save energy and lower costs.

“We can compete in the winter because we have the LED lights,” he said. “If the sun does come out during the winter, we could receive enough light so the Candidus controller automatically shuts off the lights and we save on energy.

**“The Candidus controller offers enhanced control. It begins to dim the lights where our other controller will not. The other controller will just shut the lights off. The dimming function on the Candidus controller is a great option because it allows us to save money and we’re not lighting when the sun is providing all the light the crops need. When the sun emerges and provides the light needed, the Candidus controller reacts to conserve electricity.”**

Elfstrum also likes the Candidus controller’s ability to track trends and to look at lighting use history.

“The controller really has the functionality that we wanted,” he said. “It is more intuitive than any of the other controllers that we looked at. It was designed by a grower for a grower. Many lighting controllers have been designed by lighting company engineers who don’t have growing experience.”



*Butterhead lettuce produced in deep water culture at Wheatfield Gardens.*



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