Voltiris

Energy and crops, without compromise

GET IN TOUCH

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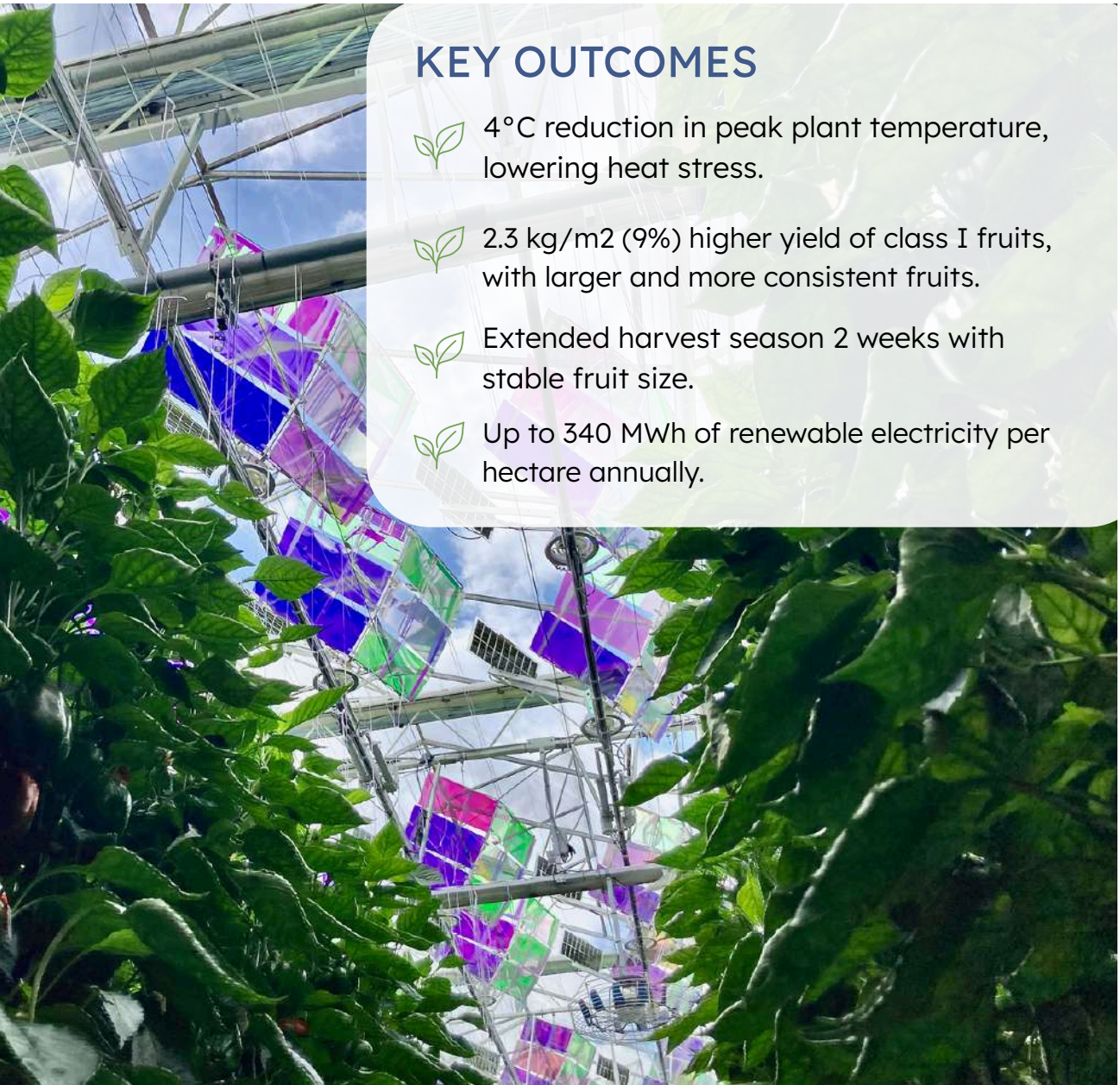
Voltiris in Bell Peppers: Agronomical Trial

Voltiris is transforming greenhouse horticulture with a smart solar solution that allows growers to harvest sunlight twice—once for crop growth and once for clean energy. Based on recent results, Voltiris can generate up to 340 MWh of energy per hectare annually, while improving crop production.

To assess the agronomical effects, a successful trial at the Delphy Improvement Centre has been conducted in 2024. This trial demonstrated several benefits regarding crop yield and health. The solution reduced average plant temperature by 4 °C in summer, without affecting the climate in winter. At the same time, pepper plants yielded 9% more class-I fruits per m^2, compared to the reference compartment. The trial showed potential to optimize ventilation and screening thresholds, so that CO_2 can be used more efficiently and more light is allowed into the greenhouse.



KEY OUTCOMES

- 4°C reduction in peak plant temperature, lowering heat stress.
- 2.3 kg/m2 (9%) higher yield of class I fruits, with larger and more consistent fruits.
- Extended harvest season 2 weeks with stable fruit size.
- Up to 340 MWh of renewable electricity per hectare annually.

The Voltiris Solution

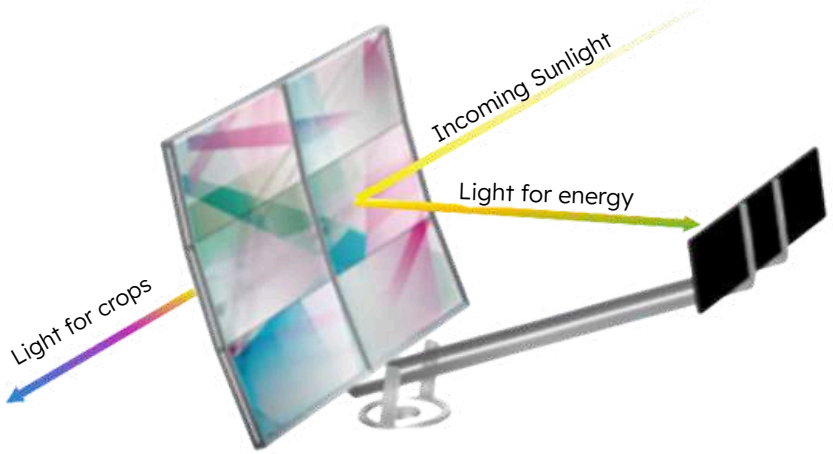


Fig.1 Voltiron, the solar module for energy production in greenhouses

Voltiris has developed a unique dichroic filter in collaboration with 3M to split sunlight into two parts. The light needed for crop growth passes through to the plants, while the excess heat radiation is reflected and concentrated onto a solar module to generate electricity. The modules follow the sun's path throughout the day to maximize energy yield, achieving up to 20% higher power generation compared to rooftop solar.

Energy for Greenhouses

Energy is one of the largest cost drivers in modern greenhouse production. Growers need reliable power for heating, lighting, ventilation, and irrigation. With Voltiris, growers can take greater control of their energy supply by generating their own renewable electricity directly within the greenhouse, reducing dependence on the grid by up to 30%. The system produces up to 340 MWh/ha/yr of on-site renewable electricity. This energy is harvested from surplus heat radiation, currently escaping the greenhouse through the air vents.

By producing electricity at the point of use, growers reduce exposure to volatile energy prices, improve long-term cost stability, and support the transition toward low-carbon and sustainable food production systems.

Voltiris' Energy Performance

435 kWp	340 MWh	30%
Per hectare	of energy per hectare per year	Energy cost reduction

Heat Stress in Greenhouses

In high-tech greenhouses, managing excess heat is critical for crop health and productivity. Almost half of the incoming solar radiation is near-infrared (NIR), which does not contribute to photosynthesis but adds unwanted heat. For bell peppers, excess heat leads to smaller fruits, a need for screening, increased ventilation, and in severe cases, plant stress and yield loss. Traditional cooling methods like screening, coating and ventilation reduce valuable PAR light and waste CO_2. Growers need a way to keep the light while getting rid of the excess heat.

The Voltiris system tackles this challenge by filtering out the heat-producing part of sunlight and turning it into renewable electricity. This results in a cooler and more stable growing climate that supports consistent crop quality and yield.

In 2024, the agronomic effects of the solution were evaluated in a bell pepper trial at the Delphy Improvement Centre (Bleiswijk, NL) under operational cultivation conditions.

Successful Trial at Delphy IC

The agronomic trial focused on 'Alzamora' bell peppers grown in two compartments, of which one was equipped with 48 Voltiris modules. Both compartments were managed under similar climate settings and cultivation protocols, with yield and quality monitored from April to November 2024. Differences in compartment size were corrected for as much as possible.

The results confirm the Voltiris system's potential to lower plant temperature. During sunny periods, plant temperatures were reduced by an average of 4 °C, while greenhouse air cooled by 2 °C. This effect only occurs under direct sunlight. In other words: when it's warm.

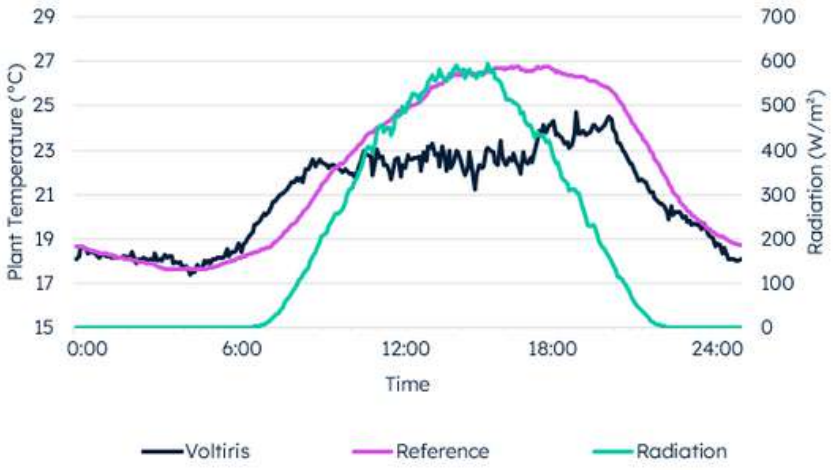


Fig 2. Cyclic average of plant temperature of May 2024

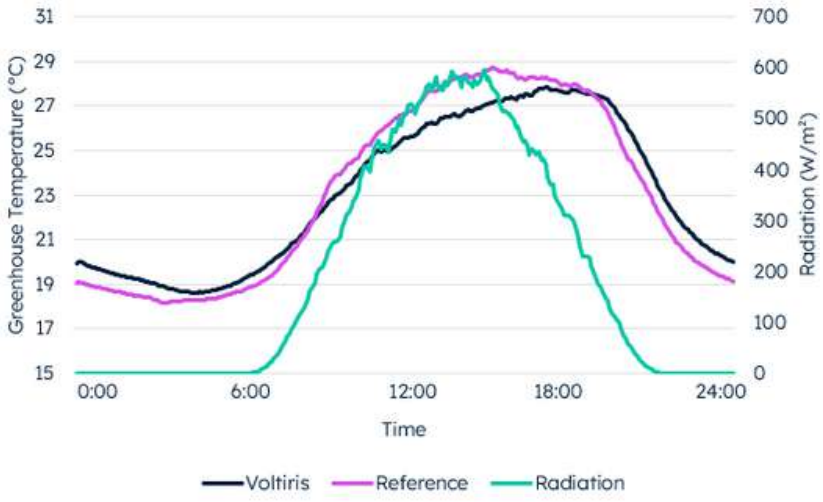


Fig 3. Cyclic average of greenhouse temperature of May 2024

Climate, Yield, and Quality Effects of Voltiris at Delphy IC

SETUP

A 250 m² compartment with 48 Voltiris modules. Reference of same variety and plant date.

CULTIVATION METHOD

'Alzamora' bell peppers grown without supplemental lighting using a standardized three-stem method (6.7 stems/m²).

CLIMATE CONTROL

Heating at 21°C, ventilation at 26°C, and shading triggered at 700 W/m².

> "With Voltiris reducing plant temperature, we could raise the ventilation and screen setpoints, improving CO_2 retention and light entry."

Jeroen Zwinkels
Crop Advisor, Delphy

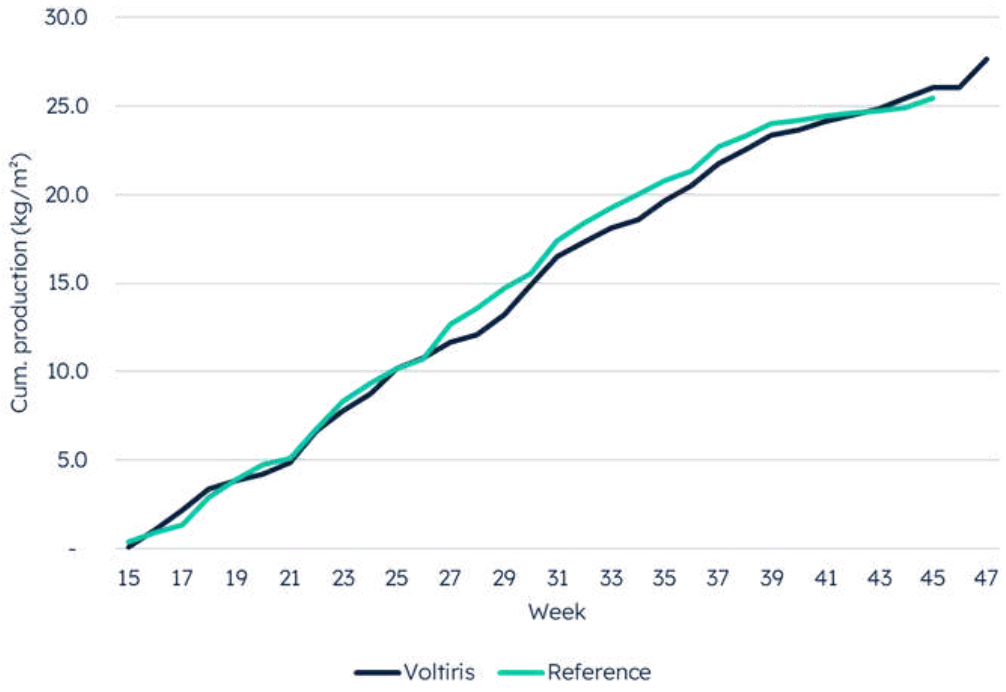


Fig 4. Fruit weight over the season in Voltiris and the reference compartment

More Marketable Yield, Larger Peppers & Longer Season

The Voltiris compartment maintained overall more stable fruit weights compared to the reference. For Voltiris, weights of approximately 210 grams were measured until week 32, and on average 180 grams until the end of the season. In the reference, fruit weight dropped below 200 grams as early as week 26. This decline continued into the late season, eventually falling well below 140 grams in week 38. As a result, the Voltiris compartment produced larger peppers and over a longer period of time.

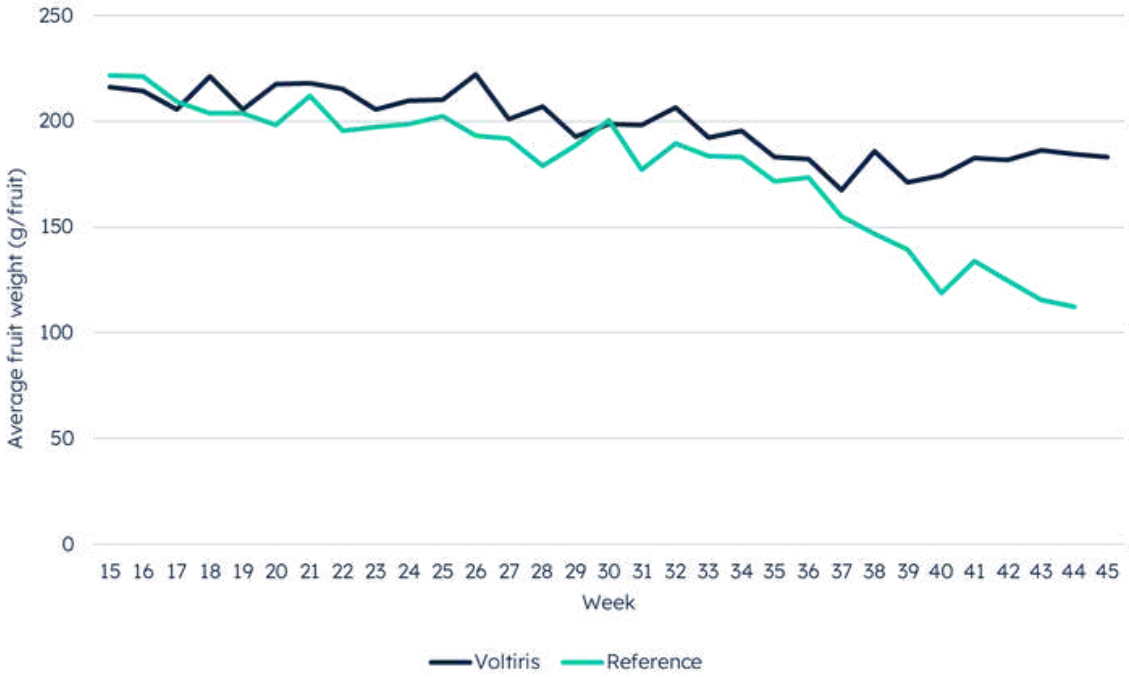


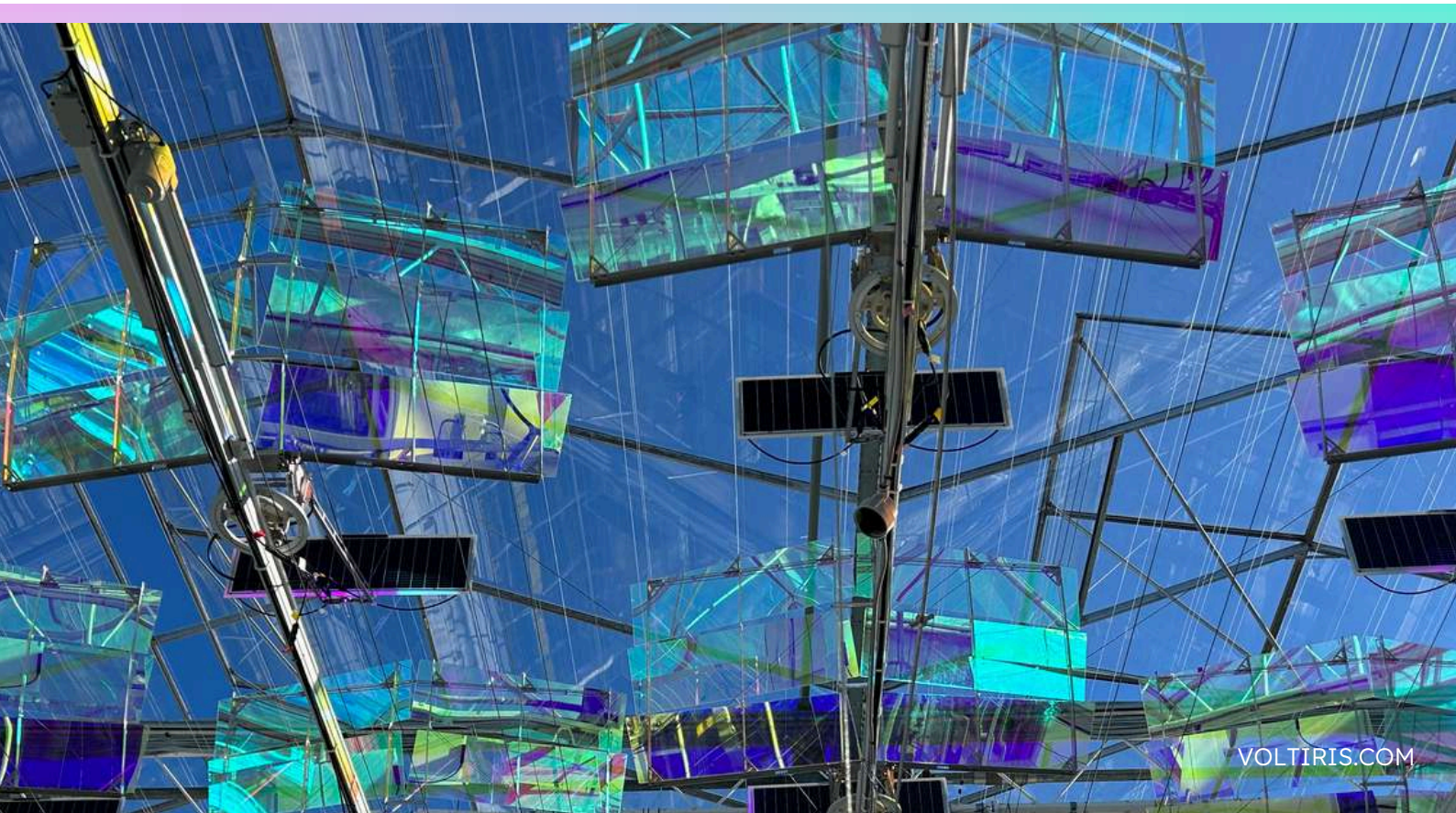
Fig 5. Cumulative production (kg/m²) for Voltiris and reference

Both compartments at Delphy IC showed similar cumulative yields of bell peppers during the early and mid-season. A slight lag in the Voltiris compartment was observed, likely due to lower canopy temperatures slowing the development. From week 36 onward, the Voltiris compartment began to outperform the reference in class I fruits (>140 grams and no deformities). By the end of the production cycle, it achieved a 9% increase in class I fruit yield. The reference compartment produced more class II and waste fruits.

These results suggest that the reduction in heat stress associated with Voltiris' NIR-filtering effect can positively influence both yield and fruit quality. However, this trial does not establish causality, and further research is needed to confirm the relationship.

Impact for the Grower

- 9% increase in class I production
- 4 °C lower plant temperature peaks in summer
- Generate up to 340 MWh/yr of renewable energy
- Reduce energy bill by up to 30%



Commercial Demonstration at Scale

Following the successful 2024 trial at the Delphy Improvement Centre, Voltiris has demonstrated its potential in commercial greenhouses. In early 2025, Voltiris completed its first full-scale commercial installation at Meier Gemüse in Rütihof, Switzerland.

Almost 2'000 modules now cover one hectare of tomatoes, generating around 1 MWh of renewable electricity per day. This project showcases the system's performance, reliability, and economic value in everyday operation. Even with minimal time to adapt, Meier Gemüse reached comparable tomato yields under Voltiris' modules in 2025 — and targets higher production in 2026.

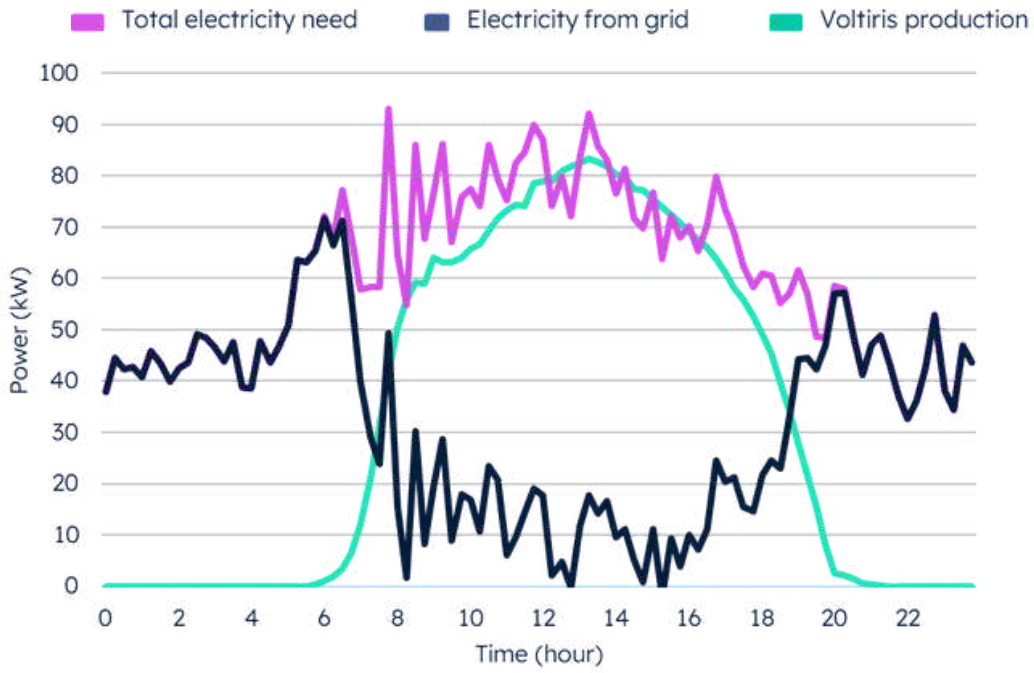


Fig 6. On this summer day, Voltiris modules covered 54% of Meier Gemüse's total electricity needs, with the greenhouse using 89% of the energy produced on-site.

World's First Hectare-Scale Spectral Filtering Solar Installation
Around 2,000 Voltiris Modules in Operation

Watch the project walkthrough video to see the Voltiris installation in action at Meier Gemüse.

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Interested to learn more about our solution?

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