Aston University
BIRMINGHAM UK

EBRI
Energy & Bioproducts Research Institute

CASE STUDY

Practical help for businesses

HydroVeg

European Union
European Regional Development Fund

Hydroponics is a method of growing plants in nutrient-rich water which uses significantly less time than growing in soil.

Although commonly used indoors, outdoor hydroponics systems are easy to maintain and are ideal for small gardens, but rely on plug-in power to run.

Plants will grow in standing water for a short time, but the water must be continually re-oxygenated for the plants to thrive in the long term.

A new solar-powered hydroponics system could make hydroponics a reliable and sustainable approach to agriculture as well as domestic gardening.

Redesigning traditional hydroponics systems to use solar power could supplement conventional agriculture in countries with hot climates, poor soil quality and less access to clean water.

Hydroponics systems pump the water through a loop, allowing more oxygen to dissolve, and supplement it with nutrients to create perfect growing conditions.

Hydroponic plants use 70% less water than soil-grown plants and can grow up to 30% faster.

Case study

HydroVeg Limited make outdoor hydroponics systems for growing plants quickly in a small space. The system comprises a network of tubes that pump nutrient-rich water around in a cycle, with holes for mesh-like plant pots that submerge the roots in the running water. The pumping reoxygenates the water, so the plants can access everything they need to grow quickly and healthily.

Hydroponics is extremely effective for growing plants quickly and can produce bigger crop yields than ordinary soil planting, but are also around 30% faster. For people with small outdoor spaces, like urban gardens, restaurants, and pubs, hydroponics is an effective way to grow a large number of plants. Hydroponic growing is also a promising form of agriculture for places with poor soil quality, limited access to water, or less reliable energy infrastructure.

Company background

HydroVeg was founded by Sue Tonks, a Magistrate from Coventry, who owns a business selling alkaline water for health. A by-product of the manufacturing process is a slightly more acidic water, which was previously going to waste. Following a chance encounter with a hydroponics expert in a Fish and Chip shop, Sue realised that the more acidic water was the perfect base for nourishing hydroponic plants.

Sue began to develop a prototype kit, with a large pipe that crosses back and forth across a frame, with regular holes for the plant pots. The water would be pumped from a tank up to the top of the frame, where it would run down through the system and back to the bottom.

Sue was building and shipping the kits herself, alongside her other jobs, and approached Aston University's Energy & Bioproducts Research Institute (EBRI) to help improve the sustainability and safety of her products.

Support from EBRI
Help to identify new market opportunities

HydroVeg first approached EBRI to address a range of questions about how HydroVeg's products could be made more efficient, and whether they faced any chemical risks from their current materials. EBRI's team of scientists and business advisors arranged a virtual Low Carbon Challenge consultation to explore the issues in depth.

The primary investigation was into the use of a solar panel to power the pump which circulates the water. While the pump only needs to run during the day, variable weather conditions in the UK would still impact the reliability of solar power. EBRI's consultation explored different approaches to solar power, and different specifications for the panel or panels, to find an approach that would give consistent and reliable solar power to the pump throughout the year. A robust solar solution will make HydroVeg Kits a sustainable investment for their customers, and cheaper in the long run.

As the business had grown, Sue had also become increasingly aware of the risk of plastic 'leaching' into the water. PVC contains Phthalic Acid Esters (PAEs), which can damage the plants, or make them inedible, if absorbed. There are PAE-free plastics available, but these lack the rigidity of PVC, so cannot be used for the HydroVeg Kits. EBRI investigated the leaching risk in-depth to help Sue guarantee the safety of her products.

Findings and recommendations

Following the online consultation with Sue, the EBRI team produced a detailed summary of their research, including their recommendations and proposed guidelines. There were several ways to incorporate solar power into the HydroVeg Kits, split into 'on-grid' and 'off-grid' designs. The former approach uses a solar panel, or collection of panels, as a contributing power source to the grid, to which the pump is also connected. The panels will offset the energy demands of the hydroponics system, and the excess energy can be sold back to the grid, while the grid gives the system a reliable energy source when there is less sun.

Off-grid solar power creates an isolated loop in which the solar panel directly powers the pump, and also charges a battery that will store the excess energy for days with less sun. Off-grid designs are more straightforward to operate, and their independence makes them ideal for use in countries with less energy infrastructure, but they do lack the reliability of the grid. Following EBRI's guidance, Sue will further explore which approach will work best for her variety of customers, and she plans to work on this with EBRI in the future.

When EBRI's team explored the leaching risk from PVC, it became clear that there are no PAE-free plastic pipes available that are wide and strong enough for this purpose. PAEs can be absorbed by plants and then cause harm to humans when consumed, so the challenge for HydroVeg is to mitigate this risk as much as possible. EBRI's report found that the rate of leaching decreases over time, so most leaching will happen early in the PVC's lifetime. They proposed that each HydroVeg customer runs the system empty for five days before use, and with warm water, which can then be safely discarded. As another precaution, EBRI suggested customers refresh the whole water system at regular intervals, to avoid leached PAEs building up.

"EBRI's report was very reassuring, and was explained in simple language that made it easy to understand. I can now give proper advice to customers about how to safely use their kits and avoid leaching."

HydroVeg Kit®
GARDENING MADE EASY

Sue Tonks
Founder, HydroVeg Limited

Outcome

Sue plans to expand HydroVeg significantly, and EBRI's consultation has given her a clear direction towards solar power, and a robust procedure to mitigate the risk of leaching.

"So many businesses try to do things themselves without asking for help. EBRI was fabulous; they have a wealth of experience and a deep understanding of the science behind HydroVeg, and that's made a huge difference for our business."

Sue Tonks
Founder, HydroVeg Limited

Most importantly, this gives HydroVeg a strong platform for pursuing new markets, including the fast-growing vegetarian and vegan food sectors, schools for year-round teaching, and countries with limited access to quality soil and stable grid connection. The report will also help them expand their existing customer base of garden owners, allotments, and restaurants that grow their own herbs and vegetables.

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The Energy & Bioproducts Research Institute (EBRI) at Aston University provides practical solutions for businesses to explore the growing bioenergy, Energy-from-Waste (EfW) and bioproduct markets, and the opportunities they offer.

Companies can benefit from specialist support, cutting-edge technologies and bespoke events to stimulate business start-up and growth, plus the development of new low carbon products and services.

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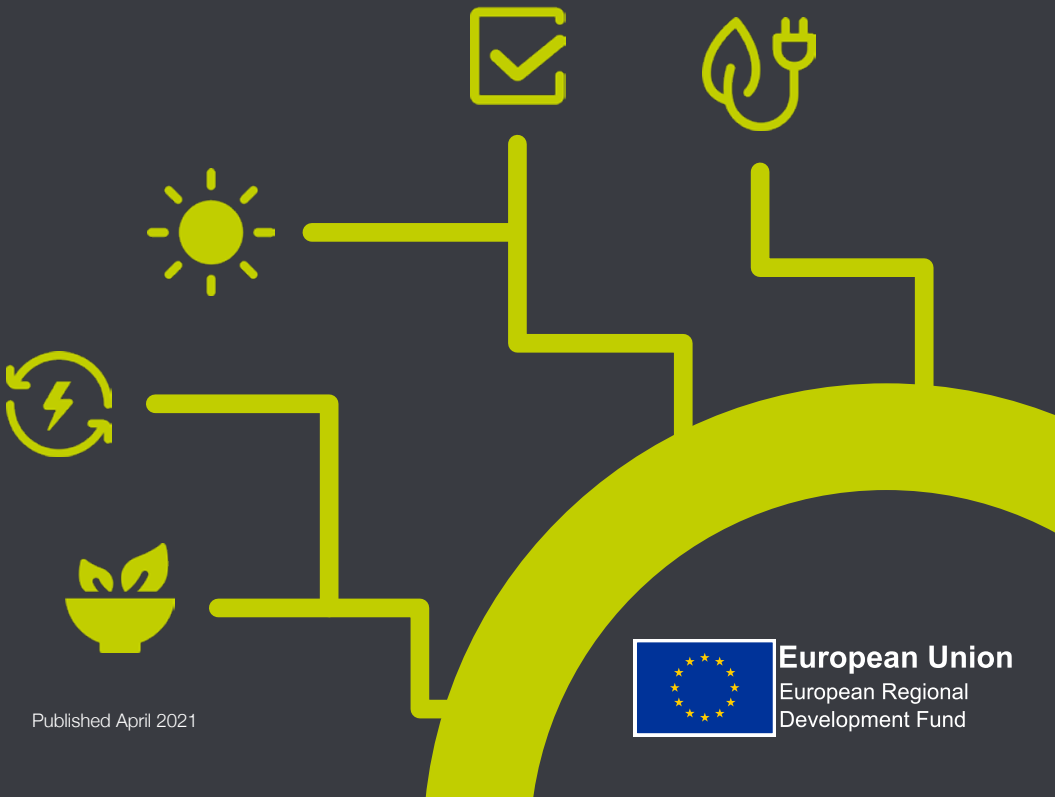

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