

Food2Waste2Food

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INFORMATION ON THE ECO-INNOVATIVE SOLUTION PROVIDER

This eco-innovative solution is the output from the project titled “Food to Waste to Food (F2W2F)” co-funded by the European Commission within the framework of the Competitive and Innovation Program. This solution has been developed by a team coordinated by the Norwegian Lindum AS, in partnership with Jacinto Environmental solutions (NL), BBBL Solutions AS (NO) and Uniwersytet Przyrodniczy W Poznaniu (PL).

SHORT DESCRIPTION OF THE ECO-INNOVATIVE SOLUTION

The solution consists of an integrated process for converting organic waste into biogas and digestate used in a resource-efficient greenhouse constructed with advanced insulation material. In a first step, organic waste is treated and converted into biogas and digester residue. The biogas is cleaned and separated; the CO₂ is used for plant growth and the methane from the biogas is sold. The solid element of the digestate is converted into a growth substrate for plants, while the liquid part is used as a nutrient solution, replacing the use of any additional chemicals for plant growing.

The second component of the solution is a semi-closed greenhouse where vegetables and fruits are grown all year around. The greenhouse has an insulated cover that can be filled on demand with insulating soap bubbles, as in a bath. The automated system ensures optimal growth conditions on a continuous basis. The energy consumption of the greenhouse is 80% lower compared to conventional greenhouses and resource recovery is close to 95%.

INDUSTRIAL SECTOR – MARKET SEGMENT AND ACTUAL APPLICATION IN INDUSTRY

20 Food and Kindred Products

INDUSTRIAL CLASSIFICATION - NACE CODE;

38 Waste collection, treatment and disposal activities; materials

1. DESCRIPTION OF ECO-INNOVATIVE SOLUTION

Technical aspects of the eco-innovative solution

Food2Waste2Food is a cost effective solution consisting of:

- Separated household and commercial food waste valorisation. A pre-treatment plant grinds and separates plastics and transports a substrate to the digester.
- The digester. The substrate is digested and converted into biogas and digestate. The biogas is separated into two elements: the CO₂ that can be released into the greenhouse environment directly for fertilizing the plants and the methane that can be used as a green gas.
- Paper filtering systems separate the dry fibrous element of the digestate from the liquid one. The solid part is used to produce mushroom compost. The spent mushroom compost is converted by vermicomposting to produce potting substrate for plants. The liquid element of the digestate is cleaned and used for the irrigation and the fertilization of plants in the greenhouse.
- Greenhouse. An advanced energy-efficient greenhouse that uses innovative forms of insulation and cooling. The design of the BBBS™ greenhouses has two main components: the bubble insulation and the heat storage. When protection against cold or heat or when shade from the sun is needed, the double-layer cavity roof is filled with soap bubbles to provide insulation. Insulation goes up by a factor of 10. When insulation is not required, the bubbles are removed to permit maximum light transmission. During the day humidity is reduced and heat is stored in buffers. The stored heat is used at night in the greenhouse. The greenhouse can operate in normal conditions and the internal climate can be controlled within a range of 18° to 30° degrees and with relative humidity below 80%. The insulation capacity of the BBBS soap covers can protect against cold at night but also against heat during the day, enabling high growth conditions with sufficient diffuse light. The internal cooling system prevents heat stress in the crops with limited ventilation, enabling high CO₂ levels and plant growth.

Economic and environmental benefits of the eco-innovative solution

Economic benefits depend on project size, local conditions and customer requirements. Commercial horticulture projects from 5000 m² and up can be realized for competitive prices. Smaller projects can be built, but will have a lower return on investment.

The estimated benefits for the BBBS greenhouse are summarized below:

- Improvement of revenues before interest and taxes (EBIT) between 6% and 11% (absolute percentage points)
- Internal Rate of Return 15%
- ROI time 5 years
- Higher revenues can be achieved for organic crops (not taken into account in ROI). Investment, cost and revenues for the organic waste treatment and digestion are calculated on a project-by-project case.
- The investment for the BBBS greenhouse is approximately 20% higher compared to that for traditional greenhouses.
- The investment level for the BBBS greenhouse and climate control is approximately 235 €/m².
- Maintenance costs estimated at 2.5 €/m² per year
- Thanks to the closed greenhouse design, high CO₂ levels (1,000 ~ 1,200 ppm) can be achieved and evaporation is reduced, increasing yield.
- The investment level, operating costs and savings for the organic waste processing are dependent on the local situation and will have to be agreed with the customer.

The environmental benefits are high;

- 80% saving on heating energy consumption of the greenhouse running costs
- 80% saving on water consumption with humidity under control in semi-closed greenhouse
- Reduction of greenhouse gas emissions from waste and food production, from 6.9 kg CO₂/kg to 0.12 kg CO₂/kg
- The use of organic waste as fertilizer instead of artificial fertilizers, with equal yields
- The Food-2-Waste-2-Food system is very well suited for local sustainable loops and can improve the availability of food and electricity and reduce carbon footprint.
- The concept of a locally closed loop promotes the separate collection of waste and increases the recycling of materials.

2. AVAILABILITY OF THE ECO-INNOVATIVE SOLUTION AND BUSINESS PARTNERSHIP

Market readiness, Trade mark, existing market coverage, commercialization strategy

The trademark is protected. A patent is pending on the technology. Since 2012 the technique has been demonstrated with a successful prototype in Norway and a demonstration plant in Poland. The first commercial scale greenhouse of 1,500 m² in Norway is under construction. Commercialization will be done through direct sales in home markets and through partners in other regions/countries. One of the partners, VDH, is exporting 80% of its products outside The Netherlands, and is among the top 10 greenhouse suppliers in The Netherlands.

Requirements to adapt the solution to the local market and potential applications/market size

The design needs to be adapted for the relatively high night-time temperatures in Mediterranean climate zones. The customer or installation partner needs to ensure a level surface and to arrange for water and electricity supply, local permits, compliance with regulations and safety instructions. Co-operation with a local installation company is preferred for fast assembly and the smooth transfer of service know-how. Greenhouse components will be pre-fabricated and assembled on-site. Climate control will be containerized and pre-fabricated. Installation and connections in the greenhouse will be done on-site. The design of the organic waste treatment, digestion and gas treatment will be designed and adapted per project. All equipment will be supplied and engineered by BBLS and its suppliers. The availability of local organic waste and the existing infrastructure will have to be investigated and organized as and where needed.

On-site after-sales services support and the technical assistance requirements

The climate control system is computer-based and can be monitored online. For fast service, all service and maintenance will be done with a local installation partner.

Targeted local business partners

Engineering, installation or construction companies in horticulture, and/or local greenhouse construction companies. Local partners should cover:

- Engineering to local requirements
- Local installation
- Service
- Regional sales

Type of local business partnership sought

BBLS is searching for local partners who the pre-fabricated components will be sold to. The local partner will sell the complete equipment including installation and service to the end-user. Technical support will be provided to the local partner during installation and service. Royalty or license payment structures can be discussed once the business has matured.