POWERFOOD: Enhancement of thermal energy from biogas for the integrated production of proteins

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Powerfood Project

Granting:
Rural Development Plan (PSR) 2014-2020 Piedmont Region, Measure 16.1.1

Partners:
- Three farms located in the Piedmont region (Italy)
- University of Milan - Department of Agricultural and Environmental Sciences - Production, Territory, Agroenergy – RICICLA Group
- University of Turin - Department of Agricultural, Forest and Food Sciences
- Consorzio Monviso Agroenergia (CMA) - an organization gathering more than 150 biogas plants in agricultural context

Aims of the project

The "**POWER**" of the project is the **recovery** of **heat** for production of **alternative protein sources** without any generation of undue pressure on ecosystems, land resources and air quality.

MAIN PURPOSE

Recovering and **reusing in terms of Circular Economy**

- Exploitation of thermal energy produced by CHP unit of rural biogas plants
  - ✓ **BSF breeding** for **feed production,** using by-products and raw materials as substrates
  - ✓ **Cultivation of Spirulina** (*Arthrospira platensis)* using digestate as fertilizer

DESIRED SIDE EFFECTS

- Creation of a new supply chain (***short supply chain***)
- Chance for the creation of **employment**

Biogas sector in Italy: some numbers

Main features

- Italy is the second largest biogas producer in Europe
- Around **2,200** plants active in CHP (combined heat and power) mode, of which 1,700 in rural areas
- Total installed power: 1,45 TW_e
- Average installed power: 650 kW_e
- Electricity produced: 8,2 Twh_e/y
- Average methane production: ~ 2 bln sm^3/y

Strenghts for farms:

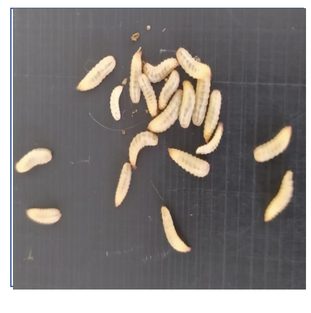
- Renewable electricity production
- Possibility to exploit heat
- Saving on chemical fertilizers through the use of digestate

Agricultural feedstocks managed

- Manure
  - 20 Mt/y of livestock effluent managed
  - 500 mln sm^3/y of methane produced
- Silages
  - 17 Mt/y of biomasses managed
  - 1,650 mln sm^3/y of methane produced

Why BSF and spirulina?

- Extensive knowledge
- Robust species
- Versatility for the insertion at farm level
- Marketable protein sources

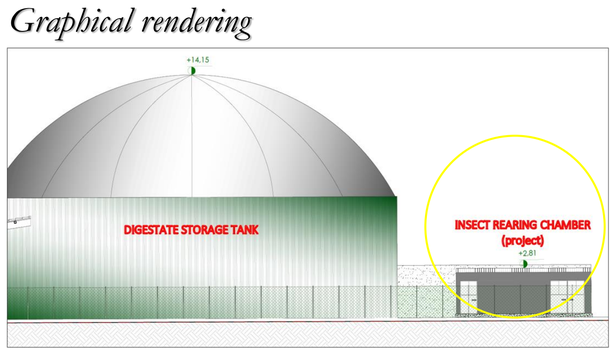


PILOT PLANTS: Insect rearing facility (BSF) & Spirulina (*Arthrospira platensis)* - *FEED & FOOD*

BSF rearing facility – FRONT VIEW

Site

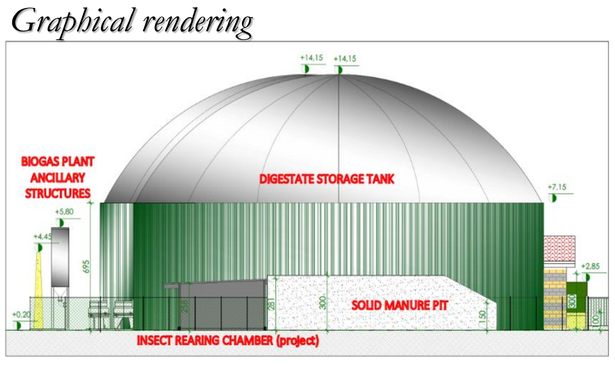
Graphical rendering



BSF rearing facility – SIDE VIEW

Site

Graphical rendering

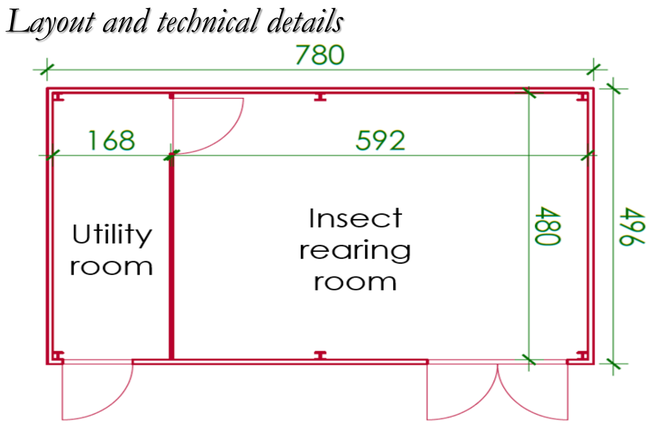


Key information about FEED production

- Environment control
  - ✓ Temperature **28 ± 0.5** °C
  - ✓ **70 ± 5**% RH
- Breading the **larval stage** for feed production
- Fed with raw materials found on the farm and in local areas
- Use of frass in biogas and / or as fertilizer for creating a closed circular economy
- Expected production of **1 tonne/year** of meal (**DM**), equivalent to an average income of **20,000 €/year**

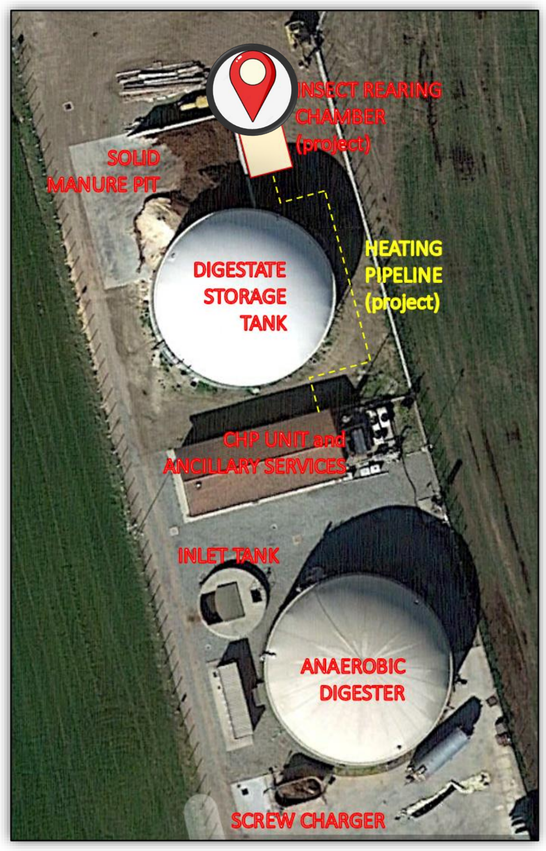
BSF rearing facility

Layout and technical details



- Insulated structure made of galvanized steel and sandwich panels
- Heating from CHP unit of biogas plant
- Estimated heat requirement is around 5,000 kW_t/y

Aerial shot of the area and biogas plant structures



Key information about FOOD production

- Raceway pond technology hosted in a dedicated greenhouse
- Exploitation of heat from biogas to warm up the culture media
- Exploitation of the digestate as nutrient source

Not only insects…but also Spirulina!

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Credits:
Icons from flaticon.com