



AQUAFARM

Mostra convegno per l'acquacoltura sostenibile e l'industria della pesca

26-27 GENNAIO 2017
PORDENONE, ITALIA - PORDENONE FIERE

**La produzione di spirulina in fotobioreattori:
II PROGETTO ECO-LOGIC GREEN FARM**

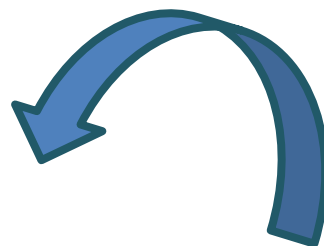
**Spirulina production in photobioreactors:
the ECO-LOGIC GREEN FARM**

THE EU FRAMEWORK PROGRAMME
FOR RESEARCH AND INNOVATION

HORIZON 2020



EXCELLENT SCIENCE
COMPETITIVE INDUSTRIES
BETTER SOCIETY



Geometra Thomas Caltarossa

- **meno burocrazia**
- **assistenza**

realizzazione di idee innovative

PROGETTO ECO-LOGIC GREEN FARM

PROGETTO ECO-LOGIC GREEN FARM

Polli e Spirulina Biologici



Arthrospira platensis F&M-C256

Impianto di Produzione della Spirulina

Serra

energia termica



CO₂

Cogeneratore



Spirulina



energia elettrica





20 Ha organic farm

14 Ha fields and woodland

3 Ha poultry farm

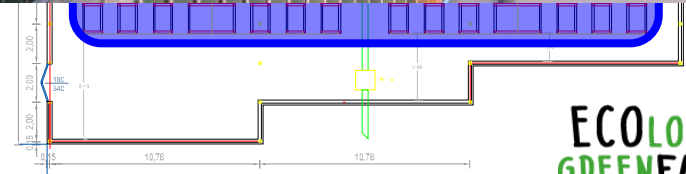
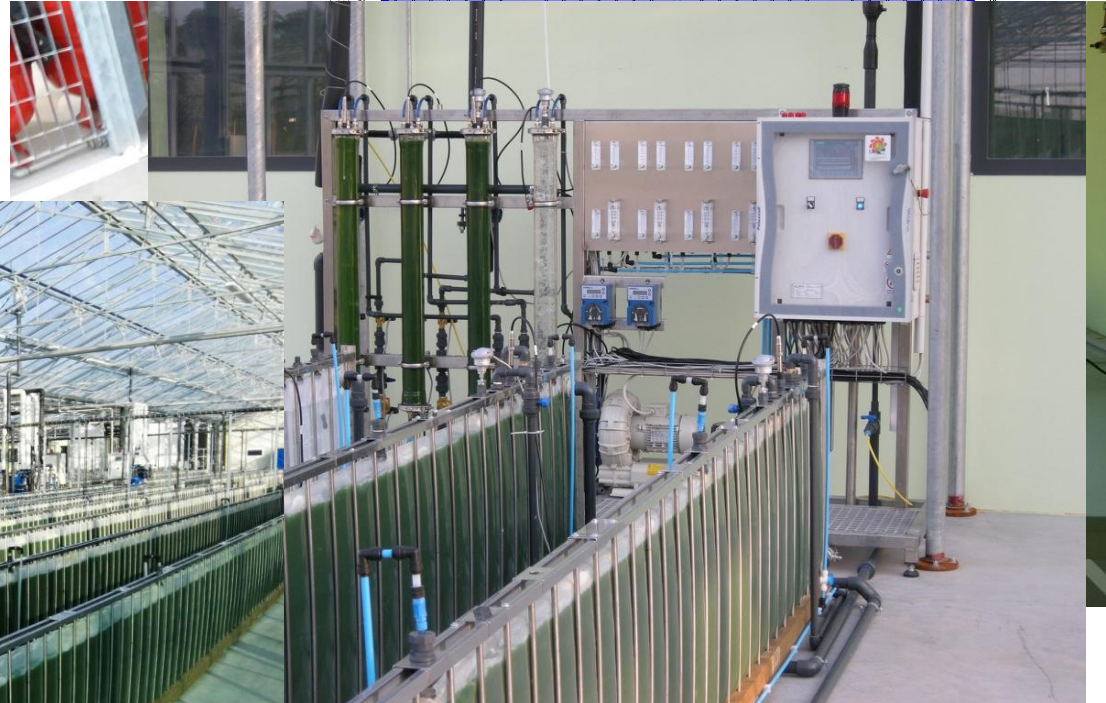
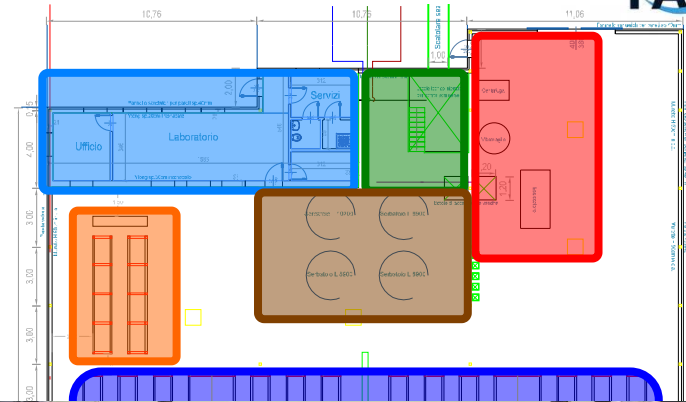
50 Kw_e syngas generator

2000 m² greenhouse for microalgae

Eco-Logic Green Farm project layout

The microalgae greenhouse

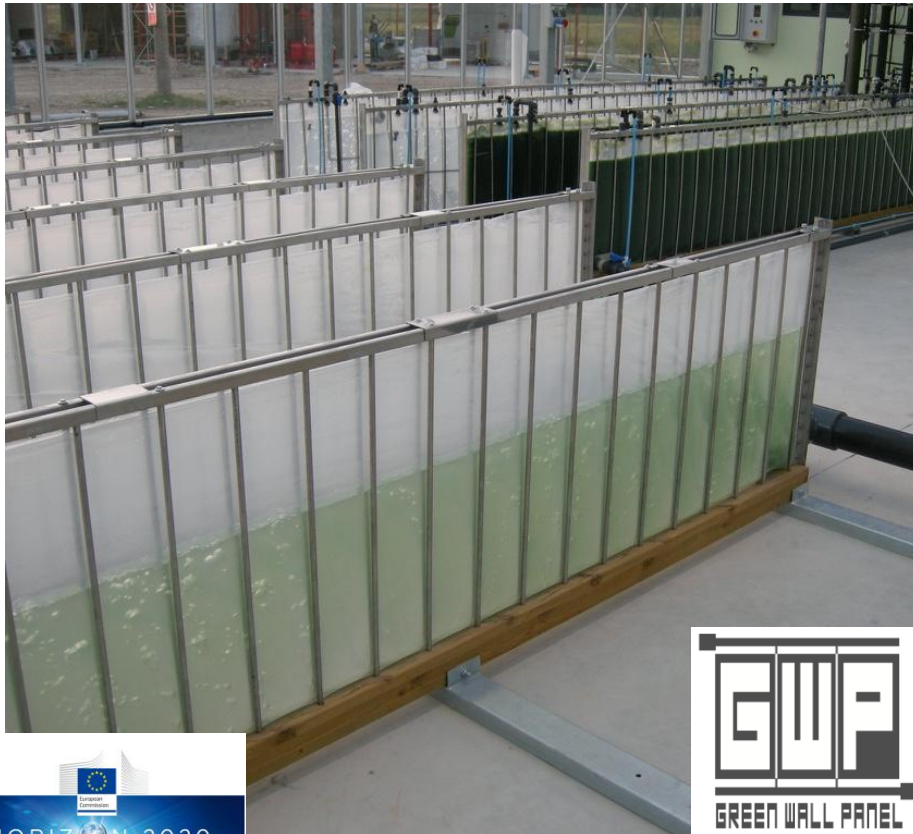
- 2000 m²
- Made with glass and insulated panels
- **Laboratory** for quality control
- **Harvesting** and **packaging** room
- **Medium** preparation and regeneration
- **Thermoregulation** station
- **Inoculum** production
- **Production** sections (4 lines)



The GWP[®] photobioreactor

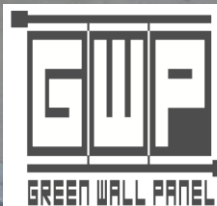
A **flat disposable photobioreactor** designed in 2004 and patented (WO 074423; WO 013104)

The **flexible culture chamber** is contained within a **rigid frame**.



Currently used for:

- **research and demonstration** in EU FP7 and H2020 projects
- **commercial production** of microalgae
- **R&D projects** by several companies



The GWP[®]-III.A - an automatically inclinable GWP[®]



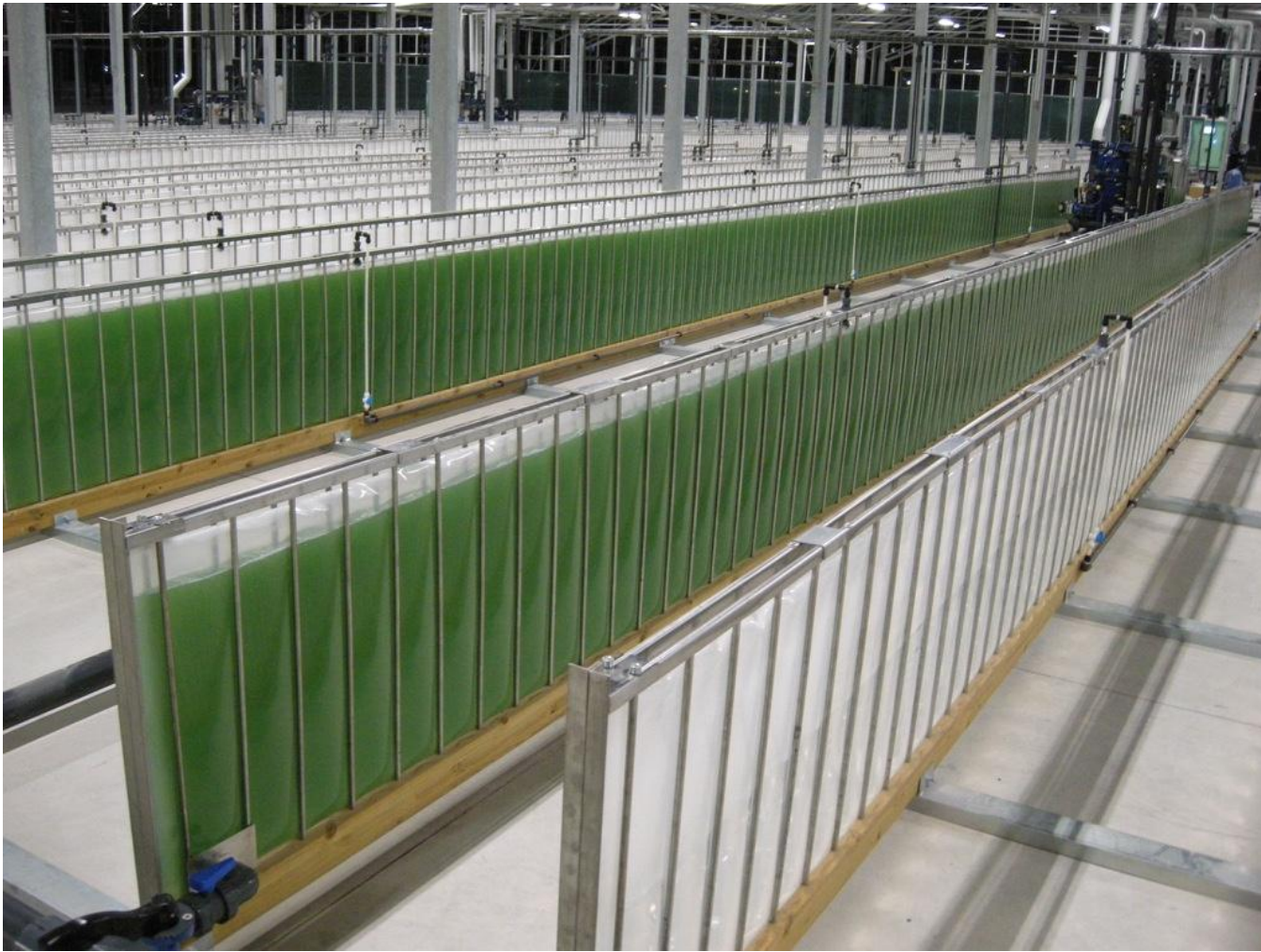
For **research** purposes

Possibility to change the panel's **inclination**

Made of **stainless steel**

Fully **automated** and PLC **controlled**

The GWP®-II



For **industrial** purposes

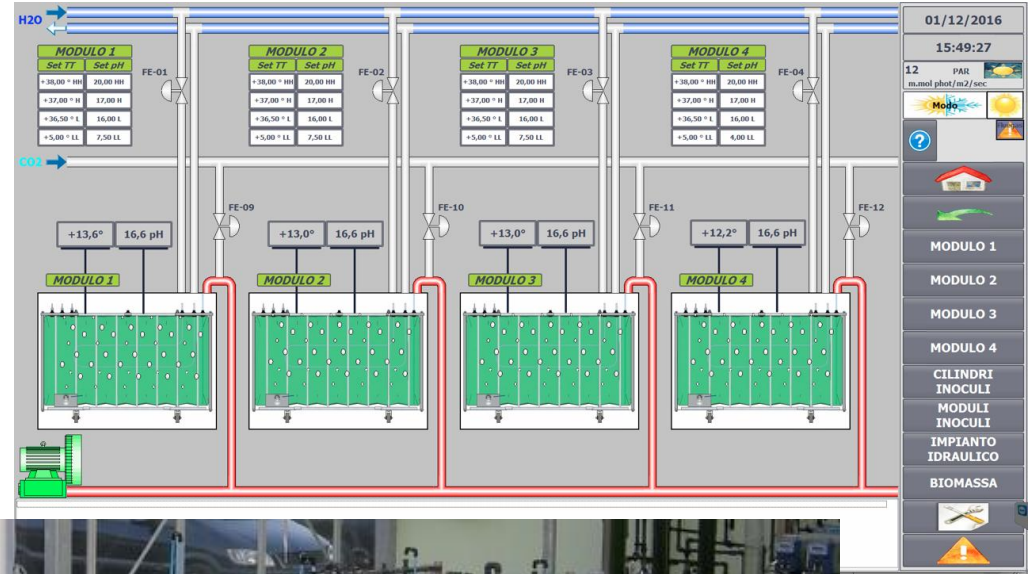
Several rows can be connected

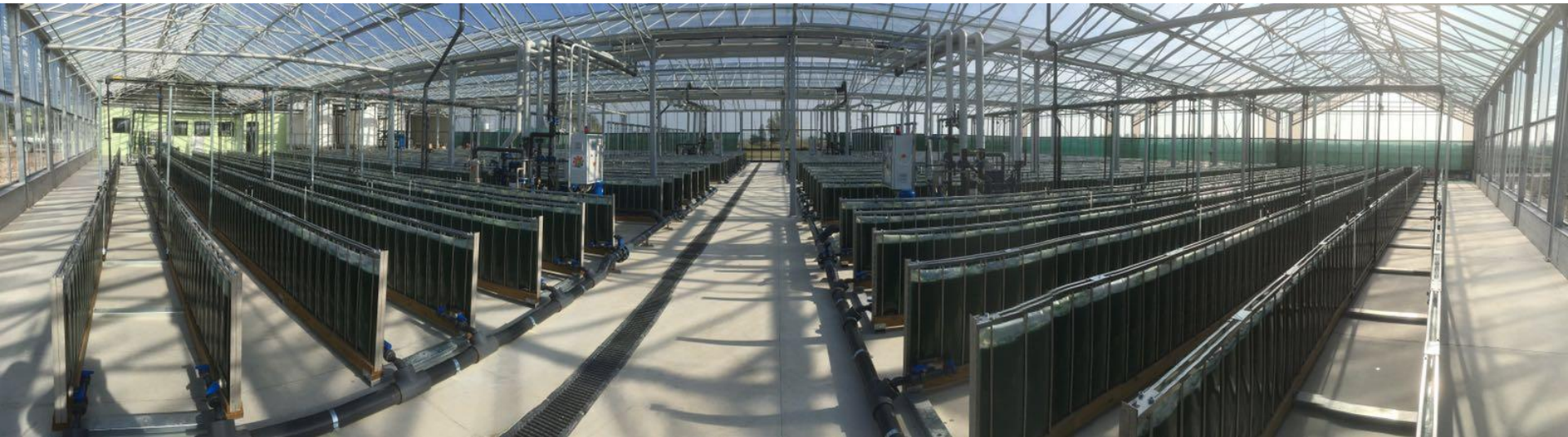


The inoculum section

GWP®-II photobioreactors

- Four GWP®-II of 6 m
- 200 L each
- Each PBR is **independent**
- Possibility to be used as a **single module** (airlift pumps)
- **PLC** controlled





The production section

The 250 m² GWP[®]-II modules

1000 m² of production area

36 m³ of culture

4 production module of 250 m² GWP[®]-II

- 14 rows of 18 m each
- Connected by **manifolds** at both ends
- Circulation through a central unit (**skid**) for control and parameter regulation
- **Low energy** consumption 9-14 Wh/m²



Air/flue-gas injection

- Each module is equipped with a **blower**
- The blower is fed with **air** or **flue-gas** (according to pH)
- Variable flow rate according to **light intensity**
- The air is **filtered** (0.2 μm)
- **Pure CO₂** is injected when flue-gas is not available

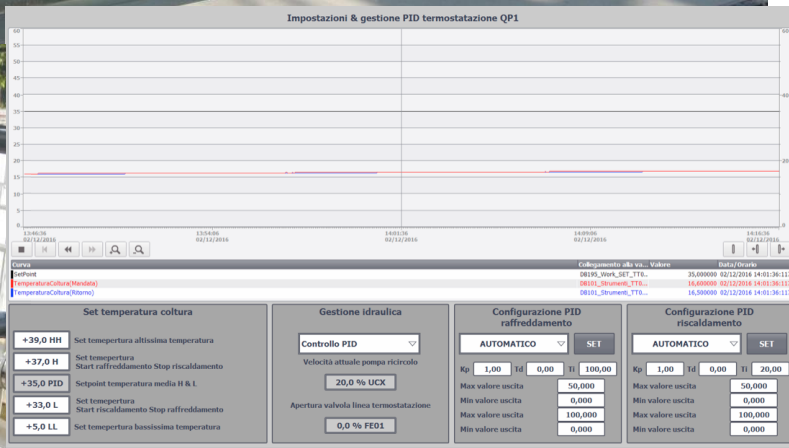


With the use of flue-gas < **12€/kg** of production cost



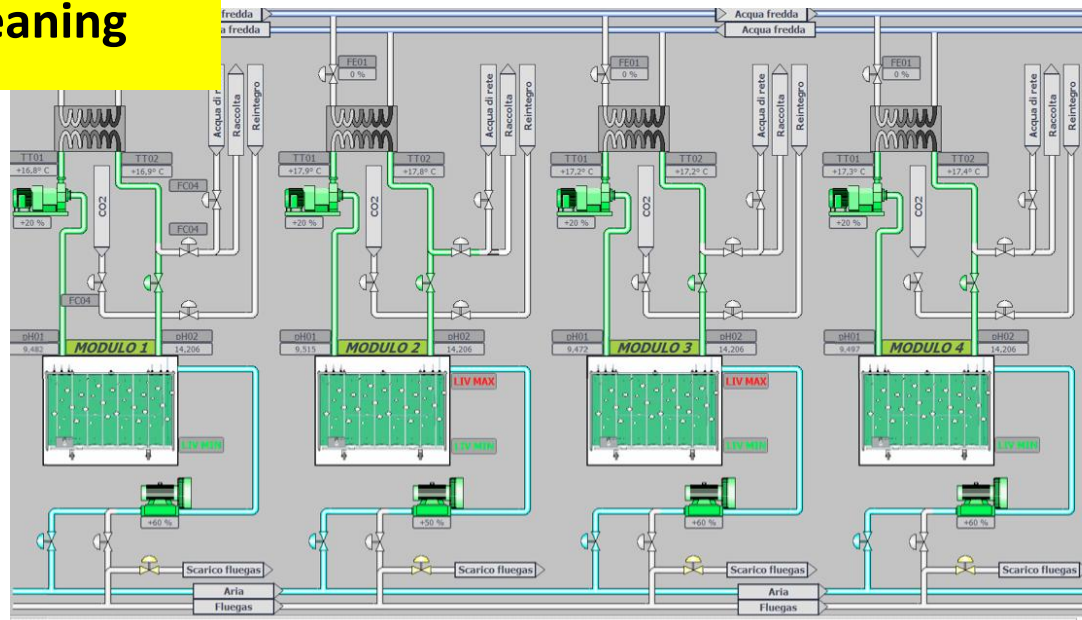
Temperature control

- The culture is continuously pumped (low shear stress pump)
- **Variable flow** rate depending on the cooling/heating needs
- Titanium plate **heat exchanger**
- **PID** control
- A **300 m³** tank to store cooling water



Automatic dilution and cleaning

- The culture is automatically **diluted**
- Automatic **filling** and **discharge** (for cleaning)
- Automatic **pipe cleaning**



02/12/2016
14:06:24

320 PAR
m.mol phot/m2/sec

Modo

MODULO 1
MODULO 2
MODULO 3
MODULO 4
CILINDRI INOCULI
MODULI INOCULI
IMPIANTO IDRAULICO
BIOMASSA

Controllo temperatura

TT01 Ritorno scambiatore	TT02 Mandata scambiatore
+5,0 LL	+5,0 LL
+33,0 L	0,0 % F101
+35,0 PDI	+39,0 HH
+37,0 H	
+39,0 HH	

Controllo PID

Vel. Bassa	Vel. Media	Vel. Alta	Vel. Col. Rise	Vel. Raccolta	Vel. Manuale	Attuale
20,0 %	30,0 %	40,0 %	40,0 %	20,0 %	2,0 %	20,0 %

Controllo bubbling

pH01	pH02
7,50 LL	7,00 LL
9,48 L	15,00 HH
9,50 H	
9,80 HH	

Raccolta cultura

Chiamata raccolta	Forza raccolta
3000,0 L	3000,0 L

Report raccolte

Id	Vol. Raccolta	Vol. Rinfresco	Vol. Lavaggio	Data	Tempo
11	3000,0 L	3000,0 L	250,0 L	02/09/2016	09:12:43
12	3000,0 L	3000,0 L	250,0 L	02/09/2016	09:07:43
13	400,0 L	260,0 L	110,0 L	02/09/2016	12:43:39
14	2000,0 L	180,0 L	170,0 L	02/09/2016	13:38:48
15	200,0 L	100,0 L	50,0 L	02/09/2016	17:07:29
16	1000,0 L	350,0 L	100,0 L	02/09/2016	17:03:55
17	100,0 L	95,0 L	50,0 L	02/09/2016	16:25:14
18	100,0 L	95,0 L	50,0 L	02/09/2016	09:15:52
19	100,0 L	95,0 L	50,0 L	02/09/2016	09:14:58
20	50,0 L	03,0 L	0,0 L	02/09/2016	09:07:13

The software

- All culture parameters are **recorded**
- Possibility to **remote control** of the whole plant



Harvesting section

Biomass harvesting

Vibrating screen for *Arthrospira* sp.
Centrifugal separator



Drying

Cold (30°C) dryer for higher quality



Medium preparation and regeneration

- **Four 10 m³ tanks** for medium recycling and regeneration
- A 2 m³/h **ultrafiltration system** for medium regeneration
- Up to 2 different culture media
- **Automatic** culture media preparation



The regeneration of the media reduce by 43% the cost of medium preparation

Thanks for your attention!



A special thanks to **Soc. Agricola Serenissima s.s**



Contacts:

giacomo.sampietro@femonline.it

www.femonline.it

+39 05545744013

**ECOLOGIC
GREENFARM**