EnhanceMicroAlgae Project

An overview of marine microalgae production systems for aquaculture

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La Rochelle, 20th october 2022

00 Brief view

Topics that will be presented

1. My background, present & future
2. AQUALGAE: what we do?
3. AQUALGAE: where we are?
4. Microalgae culture: main parameters and a key factor
5. Traditional cultures in aquaculture and the usual problems
6. Case study 1: starter cultures
7. Case study 2: finfish hatchery
8. Case study 3: clam hatchery
9. Enhance Microalgae project
10. State of the project

01 Past, present and future

From science to industry

2005 — Microalgae Biotechnology USC - Spain

2009 — PhD Tesis Aquaculture - USC

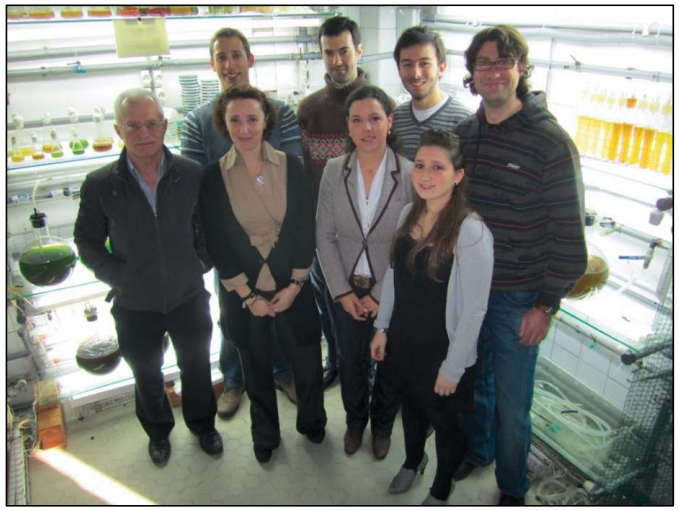
2010 — 8th European Workshop Biotechnology

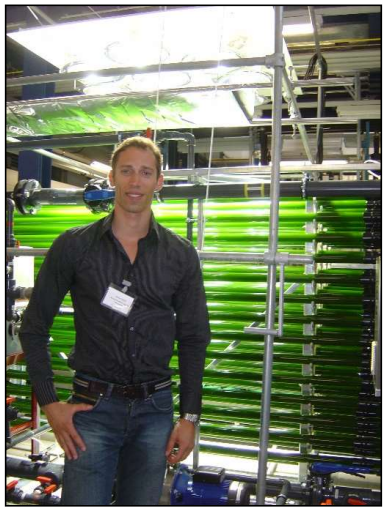
2011 — Birth of AQUALGAE

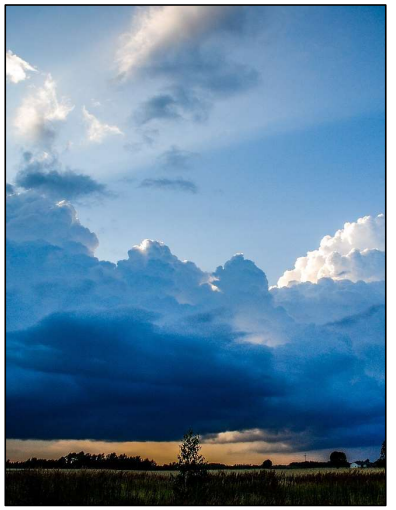
2016 — Almost bankrupt

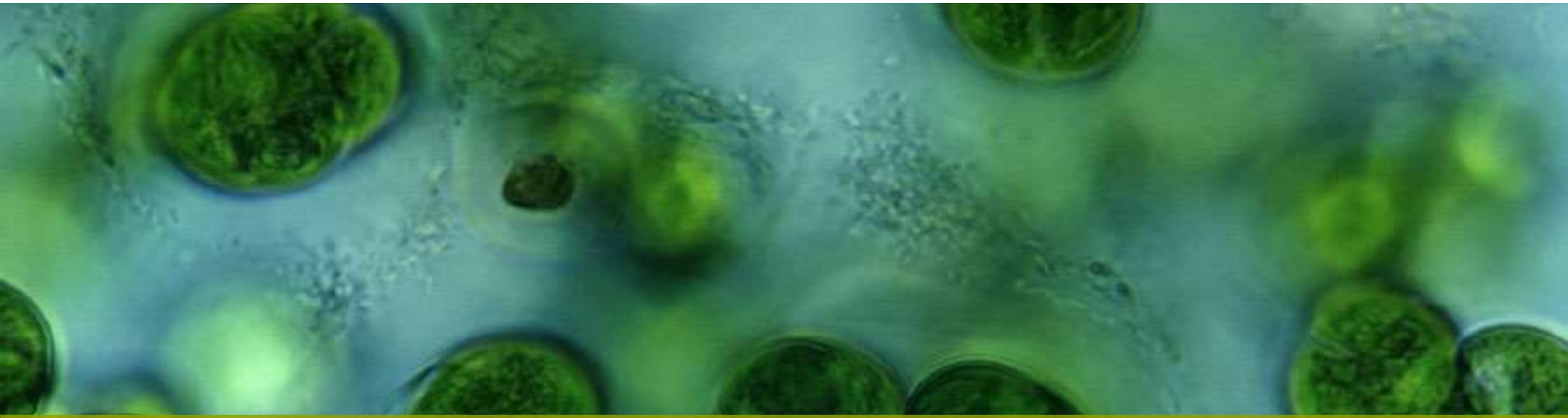
2020 — Covid-19 pandemia

2022 — New challenges: economic, market, inflation, energy…









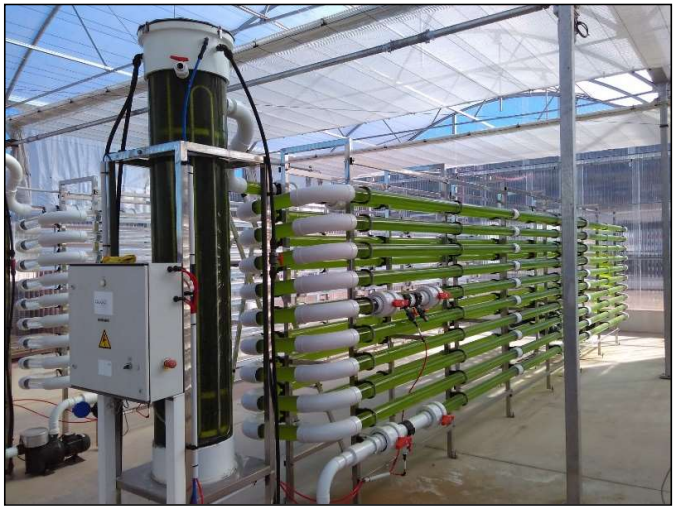
02 AQUALGAE

What we do?

02 Aqualgae

What we do?

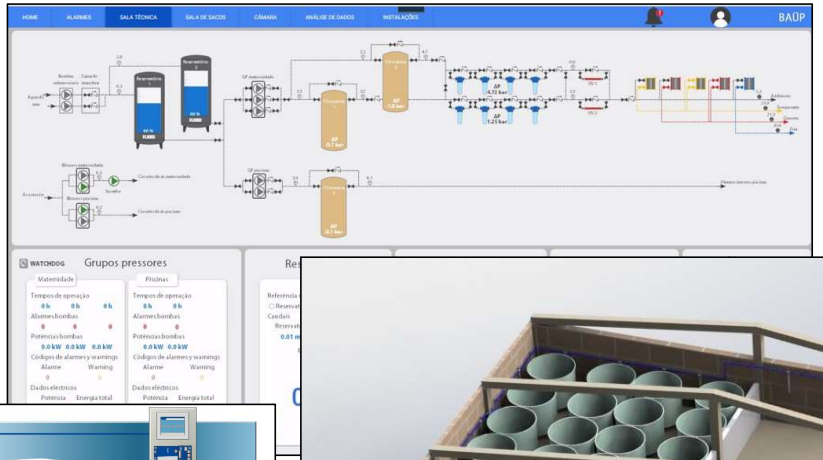
- Design, manufacture and supply photobioreactors and other microalgae production systems
- Supply microalgae starter cultures
- Supply culture media

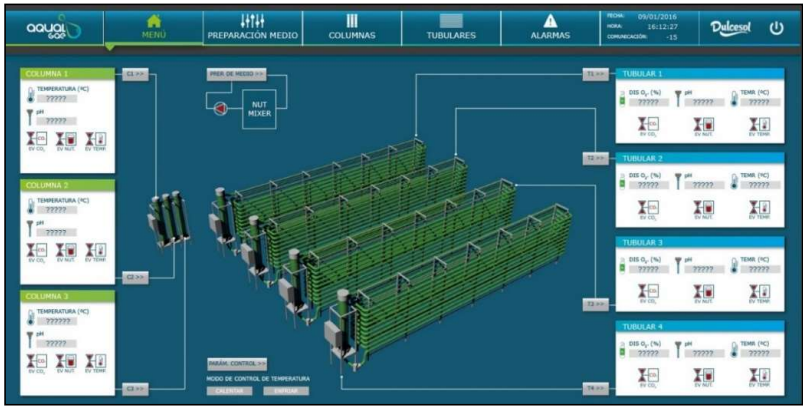


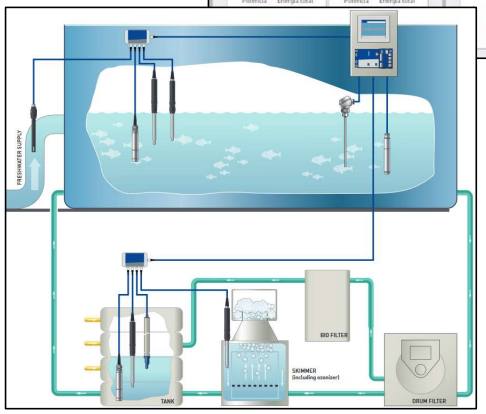
02 Aqualgae

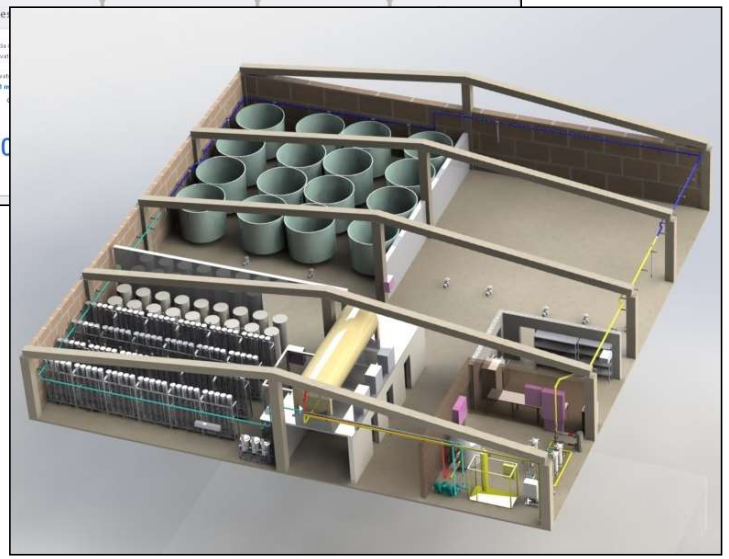
What we do?

- Automation and IoT
- Supervision and control SCADAs
- Consultancy
- Optimization of production KPIs
- Turn-key solutions for aquaculture pilots units or hatcheries



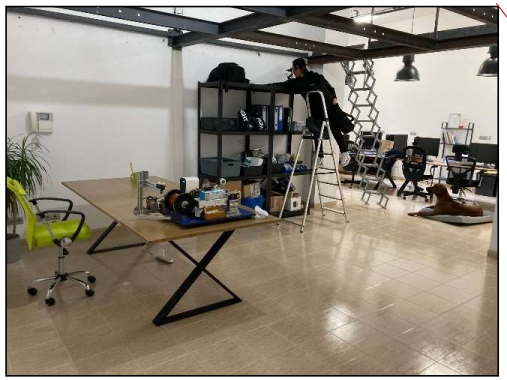






03 Aqualgae

Where we are?



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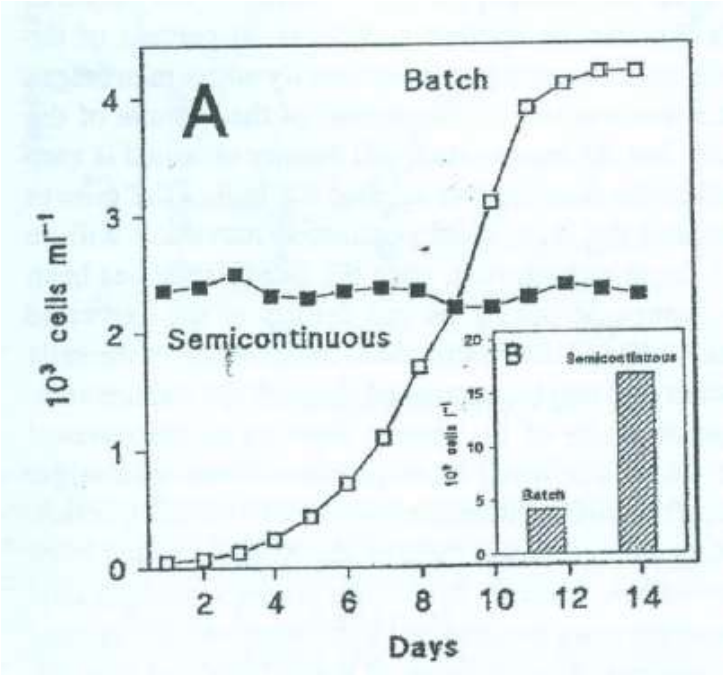
04 Microalgae culture

Main parameters and a key factor



LIGHT

TEMPERATURE

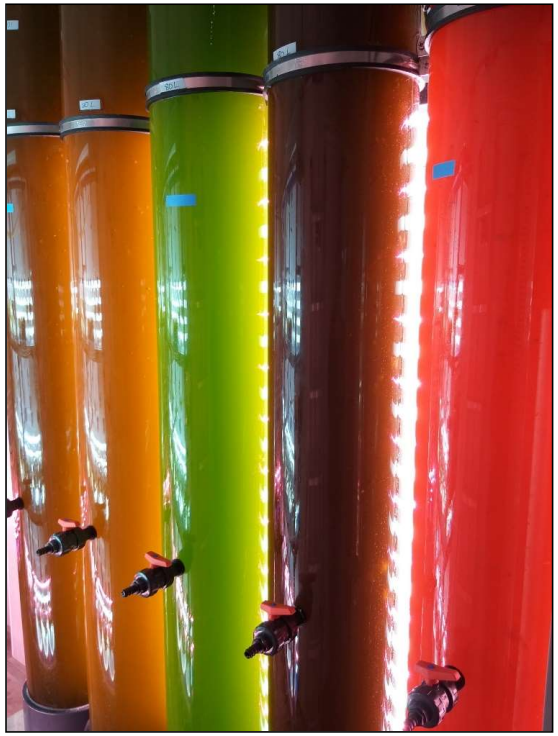
NUTRIENTS

pH / CO_2

SALINITY

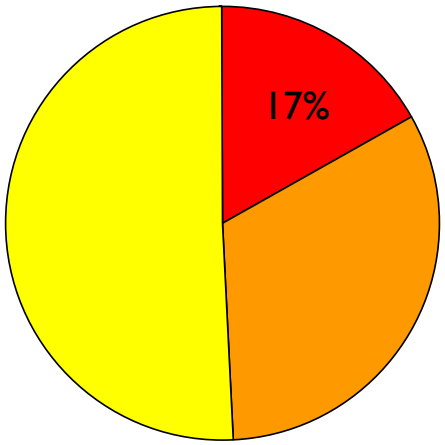
MIXING/ O_2

Water treatment

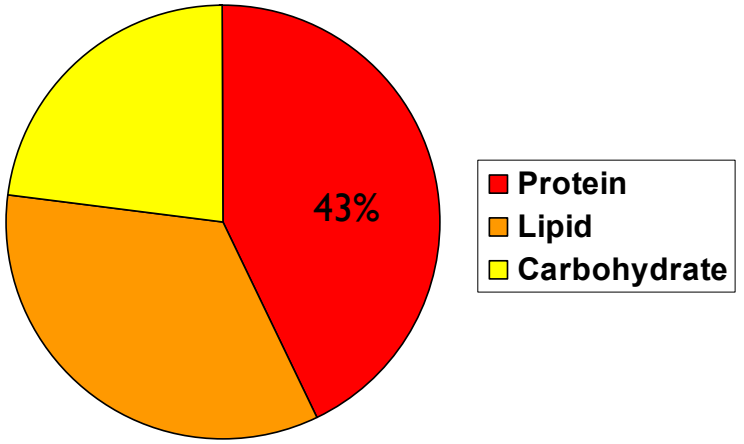


Operation is a key factor

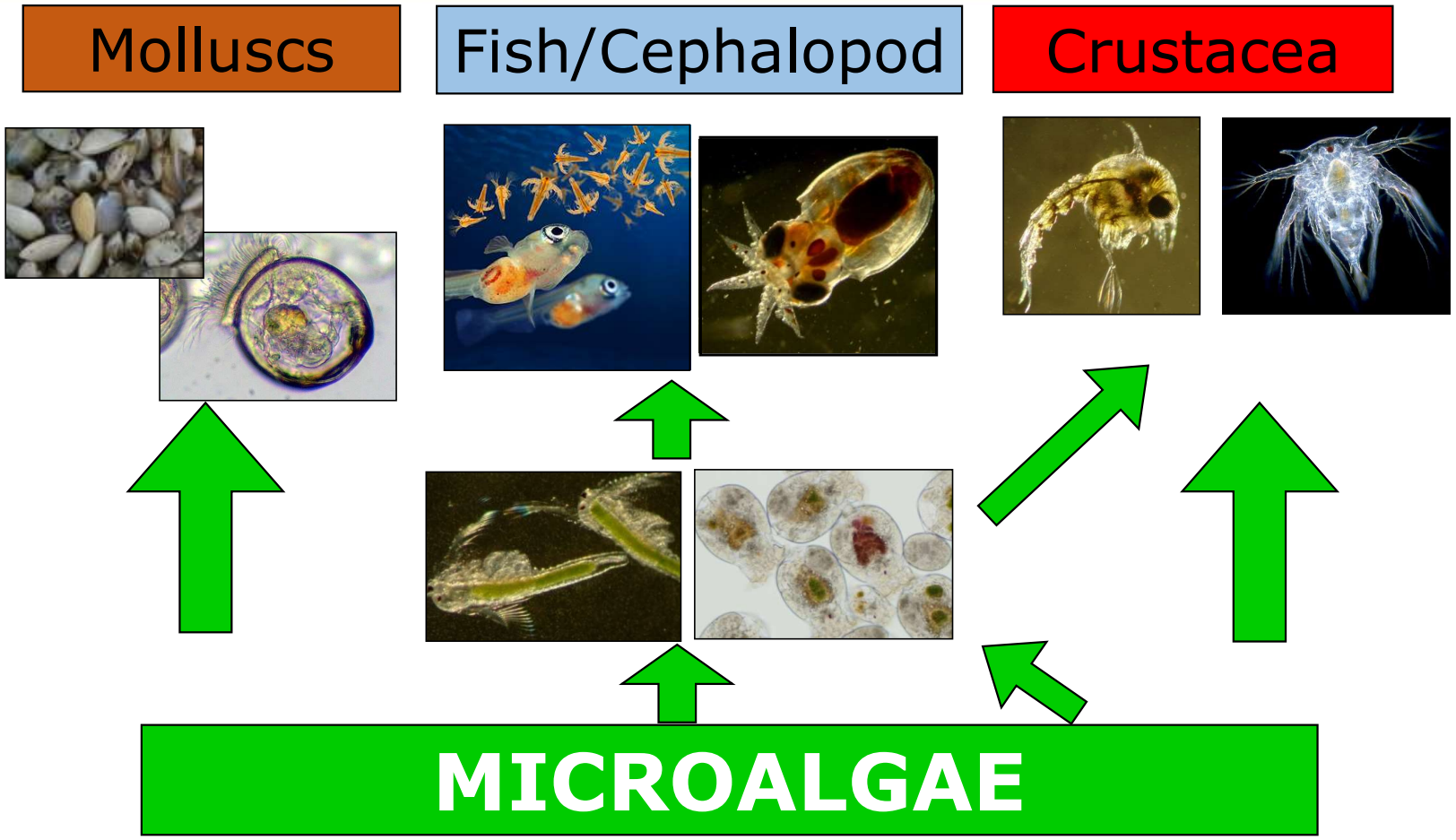
T-Iso



Daily renewal rate
10%



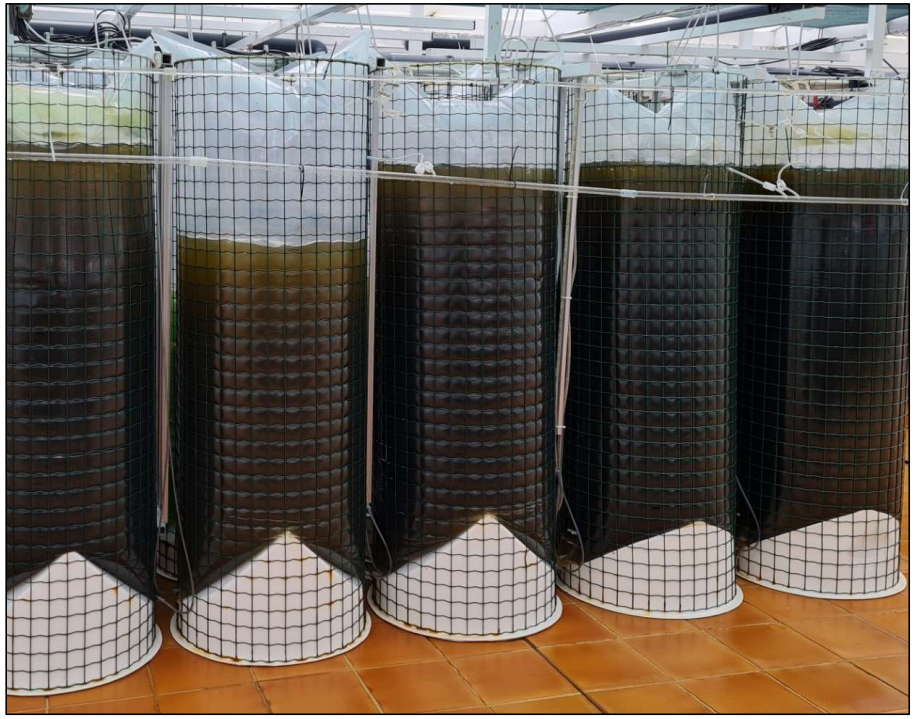
Daily renewal rate
40%


Molluscs
Fish/Cephalopod
Crustacea
MICROALGAE

05 Traditional microalgae cultures

The usual problems

- Poor productivity
- Hand work
- Unstable nutritional composition
- Culture crushes
- Contaminations
- Plastic waste
- Lots of space required
- Difficult to control temperature

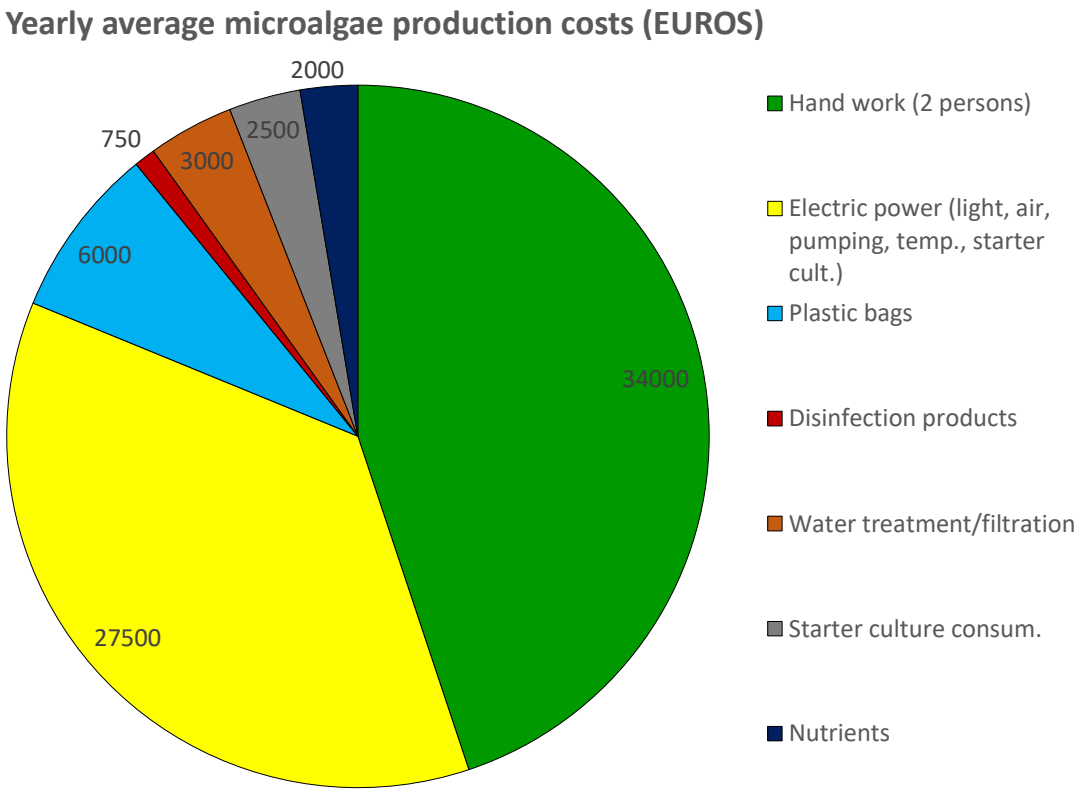


05 Traditional microalgae cultures

Major production costs

Example of yearly average costs for small hatcheries, managing:

- A room with starter cultures
- A room with 60 bags 500-L (30.000L)
- 12 tanks 3.000 L (36.000 L)



05 Traditional microalgae cultures

Differences between biotechnologists and aquacultures

	Algal Biotechnology	Aquaculture
Operation site	Outdoor (mainly)	Indoor / Greenhouse
Operation mode	Continuous	Batch
Biomass units	g/L	Cells/ml
Productivity	Kg m^{-2} day^{-1}	Cells L^{-1} day^{-1}
Price	5 to 200 EUR/Kg	150 to 2.000 EUR/Kg
Productivity restrictions	Quantity	Quality
Production plants	One species	Multi-species

End of 90´s/00´s

No more live microalgae in aquaculture

Dried products are cool and user friendly!

Didn't last too many years that theory...

06 Case study 1: starter cultures

Clam's hatchery: management of starter cultures

- Six microalgae species
- 8 to 10-days batch cultures
- 30 new 5-L glass flasks per week-day (750L sterilized water/week)
- 20 new 5-L plastic bottles per week-day treated with bleach
- Light 24H/24H
- No CO_2 injection

Goals of this project:

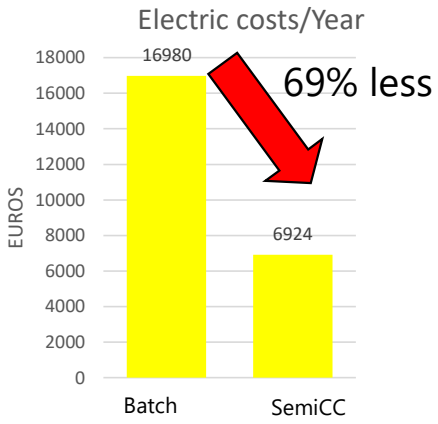
1. Reduce hand work to half time by applying SCC
2. Save energy at least by 30% (light, autoclave and temperature control)
3. Introduce CO_2 injection

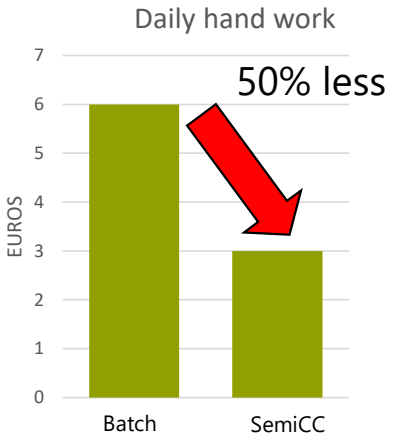
06 Case study 1: starter cultures

Clam's hatchery: management of starter cultures

Goals achieved:

1. Reduction of hand work by 50%
2. Reduction in electric consumption by 69% (LEDs, photoperiod, autoclave, AC)
3. Same microalgae yield, but in 25% volume



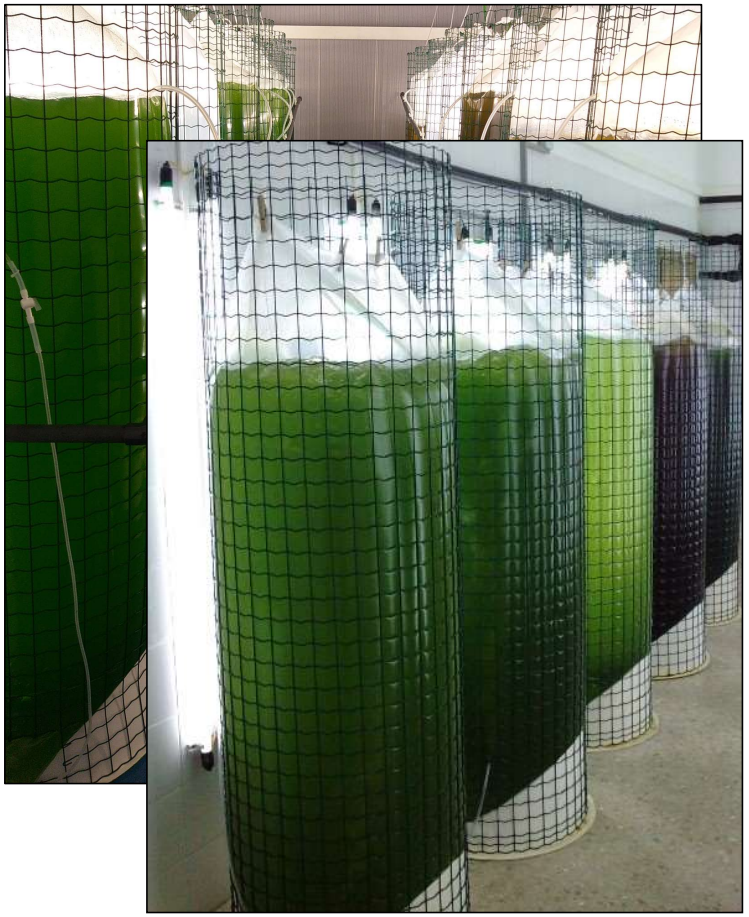


CO_2 costs
1.200 EUR/Year

07 Case study 2

Flatfish hatchery: microalgae for greenwater technique

- *Tetraselmis* and *Nannochloropsis* production
- Continuous production with a daily renewal rate of 20% or 8-days batch cultures (some bags)
- Total 60 bags 500-L inside a room (15 x 10 m = 150 m^2)



Goals of this project:

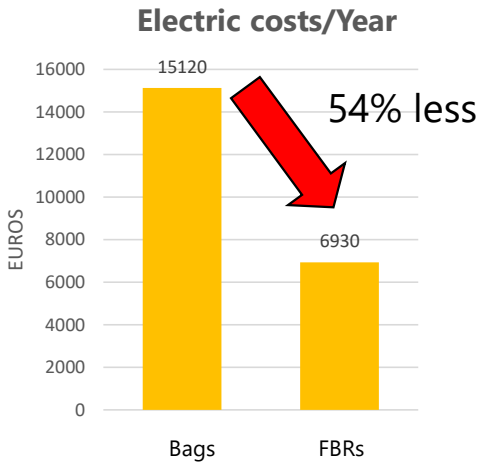
1. End with 1000 plastic bags waste per year
2. Reduce hand work to half time
3. Save energy at least by 30% (light, temperature control and blower)
4. Investment in automated PBRs

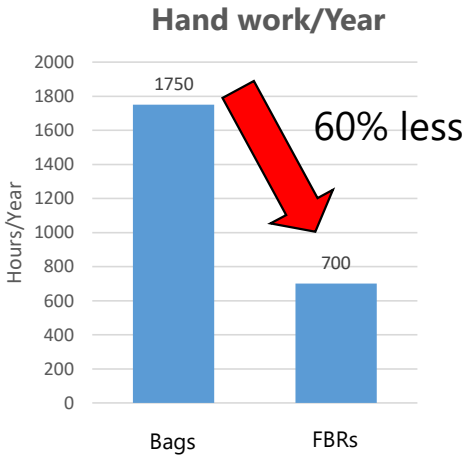
07 Case study 2

Flatfish hatchery: microalgae for greenwater technique

Goals achieved:

1. Reduction to ZERO plastic bags
2. Reduction of hand work in 60%
3. Reduction in electric consumption by 54% (photoperiod and AC)
4. Room for 10 units PBR5C with 30m^2 *vs* 150m^2 for 60 bags



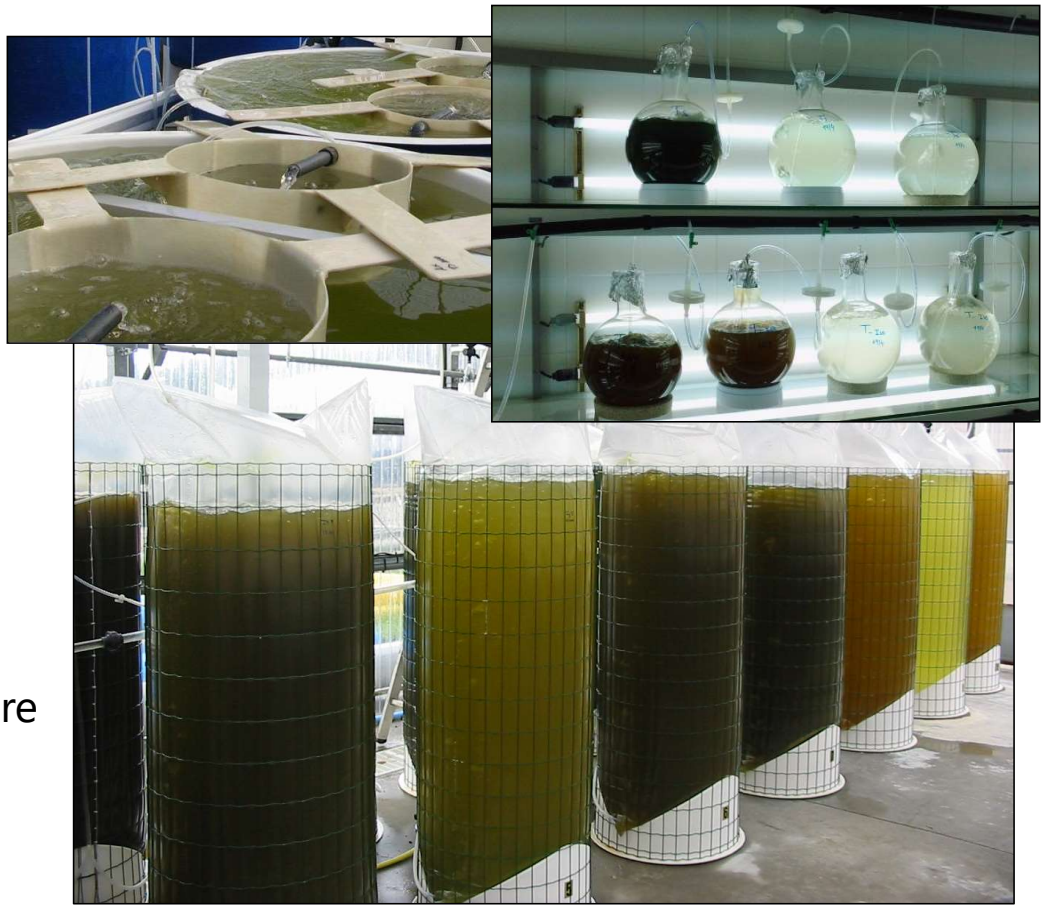


CO_2 costs
2.500 EUR/Year

08 Case study 3

Clams hatchery: old way *versus* biotech way

- Six microalgae species
- Continuous culture 15 to 20% total vol. in 60 bags 500-L and batch in 21 tanks 3000-L inside a greenhouse (25 x 10 m = 250 m^2)
- No CO_2 injection
- Artificial light only during “night” (15H light)



Goals of this project:

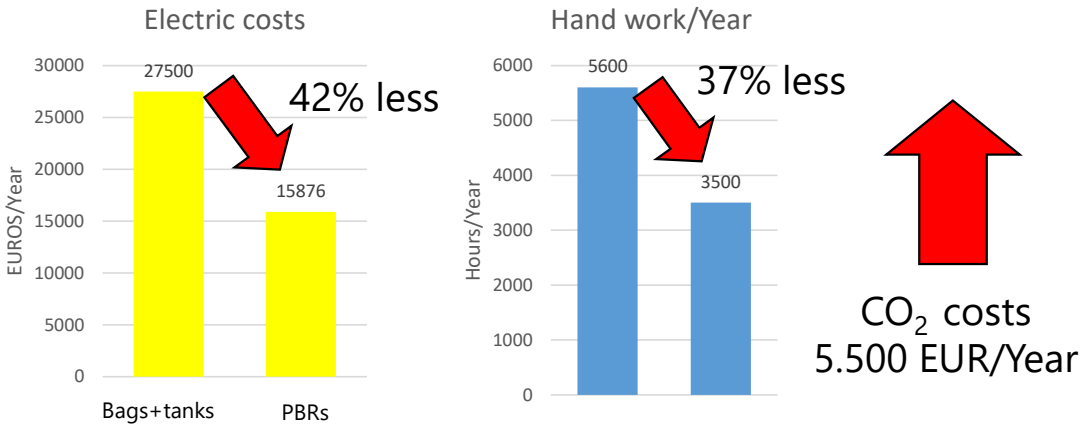
1. Implement automated PBRs
2. End with 1000 plastic bags waste per year
3. Reduce hand work to half time
4. Save energy at least by 30% (light, temperature control and blower)

08 Case study 3

Clams hatchery: old way *versus* biotech way

Goals achieved:

1. Reduction to ZERO plastic bags
2. Reduction of hand work in 37%
3. Reduction in electric consumption by 42% (LEDs, photoperiod and AC)
4. Room for 24 units PBR5C with 80m^2 *vs* 250m^2

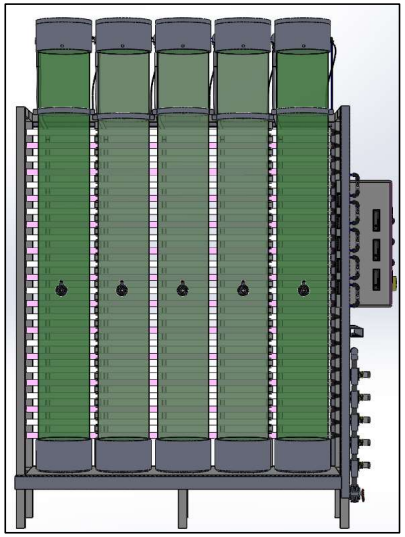


09 Enhance microalgae project

Major goals

Top sales PBR: 5 columns 100L each
Columns D.250mm

ANFACO



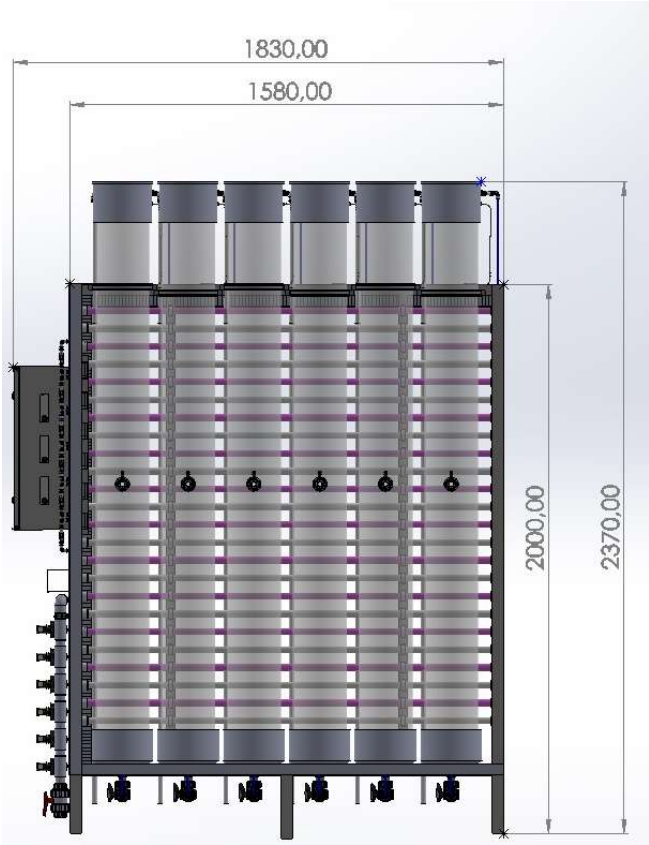
NEW MODEL

6columns 60L each
3pairs twin columns
Columns D.200mm

Higher productivity?

Less expensive model?

Smaller starter cultures, lower production costs?



10 Enhance microalgae project

State of the project

- **Recently installed**
- **Ready for the kick-off**
- **3 microalgae species will be tested**


Thank you!
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ENHANCE
MICROALGAE
Interreg
Atlantic Area
European Regional Development Fund
EUROPEAN UNION