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# AQUASEF

ECO-EFFICIENT TECHNOLOGIES  
DEVELOPMENT FOR ENVIRONMENTAL  
IMPROVEMENT OF AQUACULTURE

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ENVIRONMENTAL IMPROVEMENT OF AQUACULTURE



PARTNERSHIP



Hydrogen technology

Coordinator

ctaqua

CENTRO TECNOLÓGICO  
DE LA ACUICULTURA

Technology Centre



Generación de burbujas y cultivos biológicos

Gas diffusion & algae



excelencia en productos del mar

Fish farming



Efficiency &  
Renewable energy

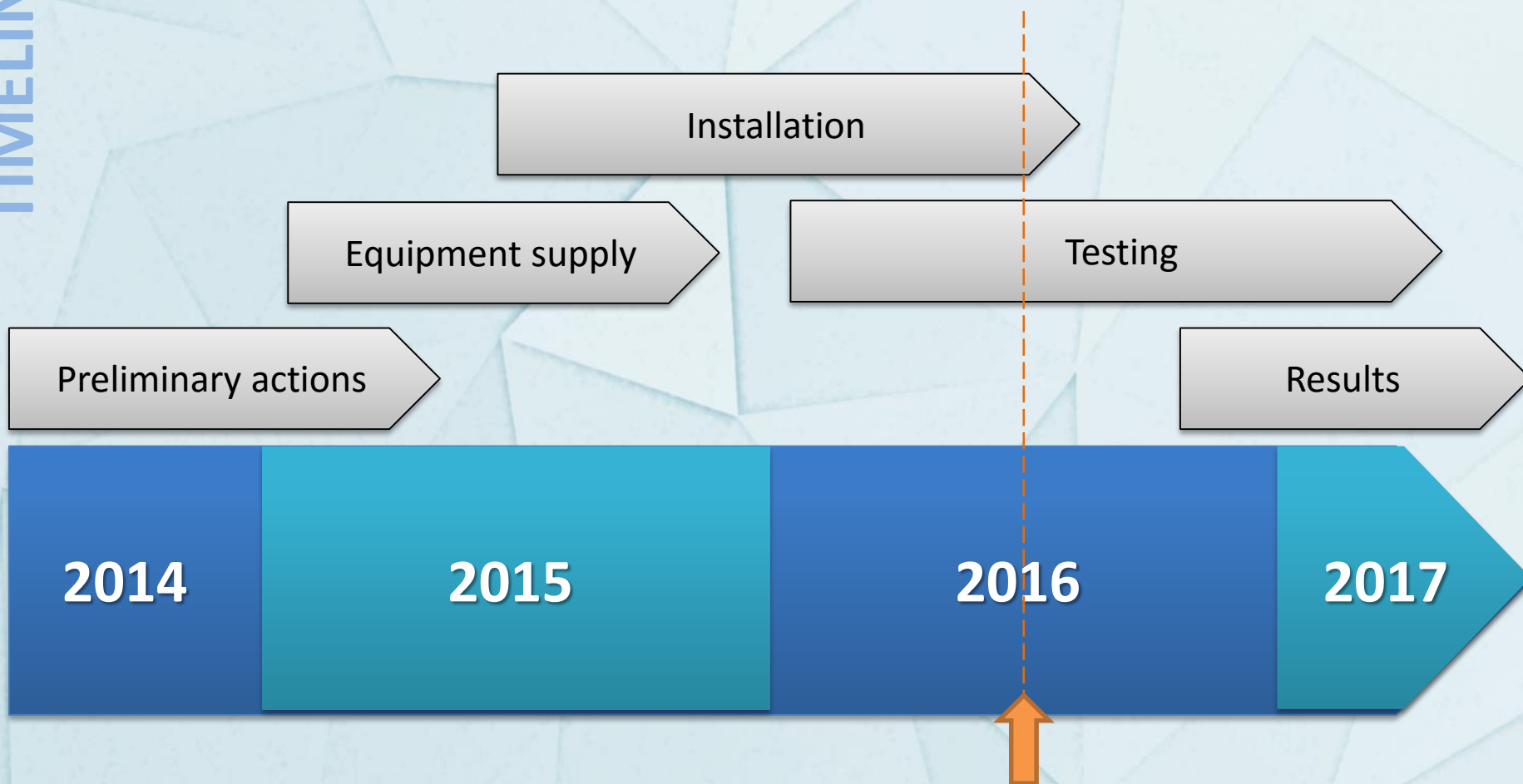


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TIMELINE





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THE FISH FARM

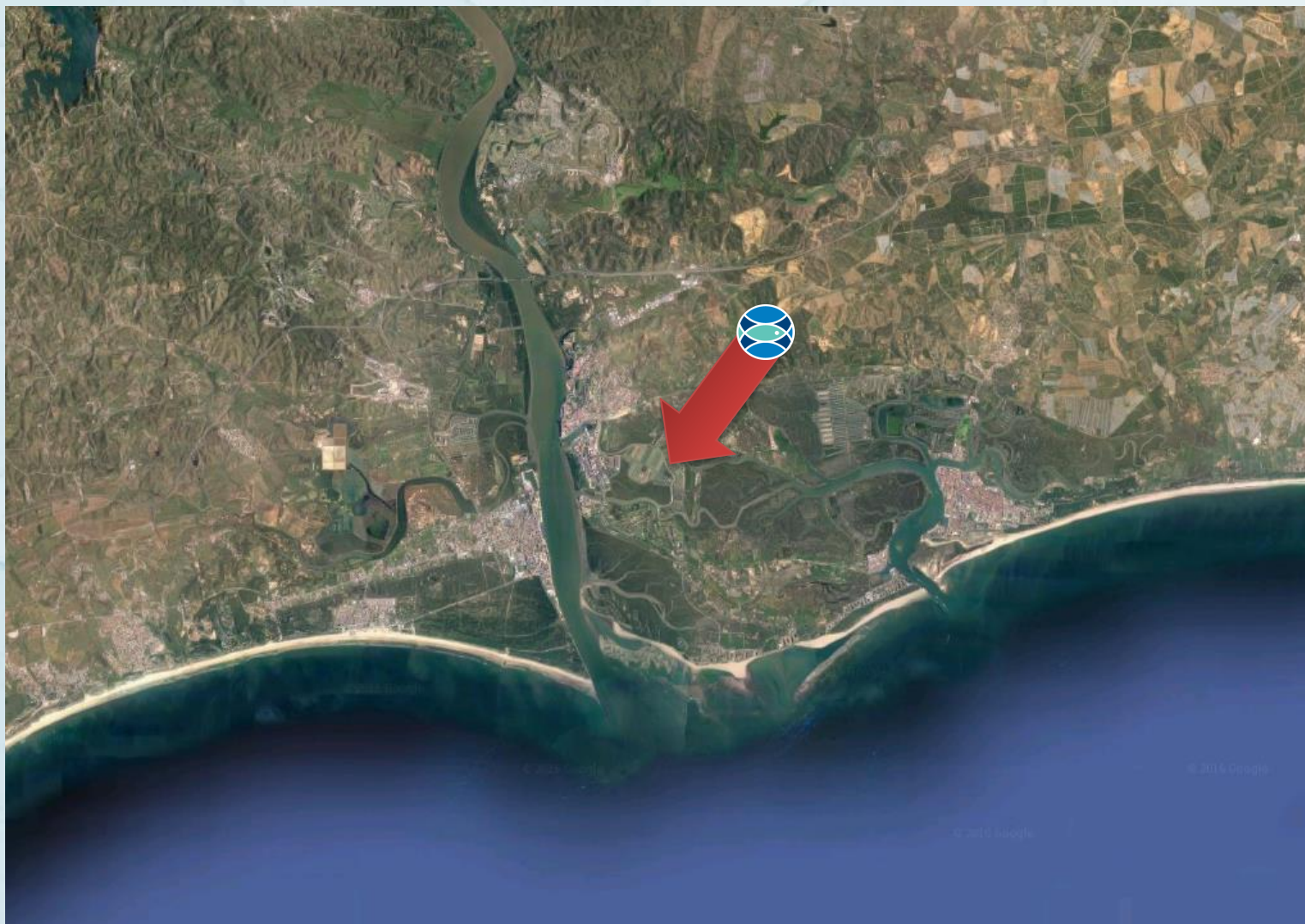
Ayamonte,  
Huelva





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THE FISH FARM



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## THE FISH FARM





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THE FISH FARM





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THE FISH FARM





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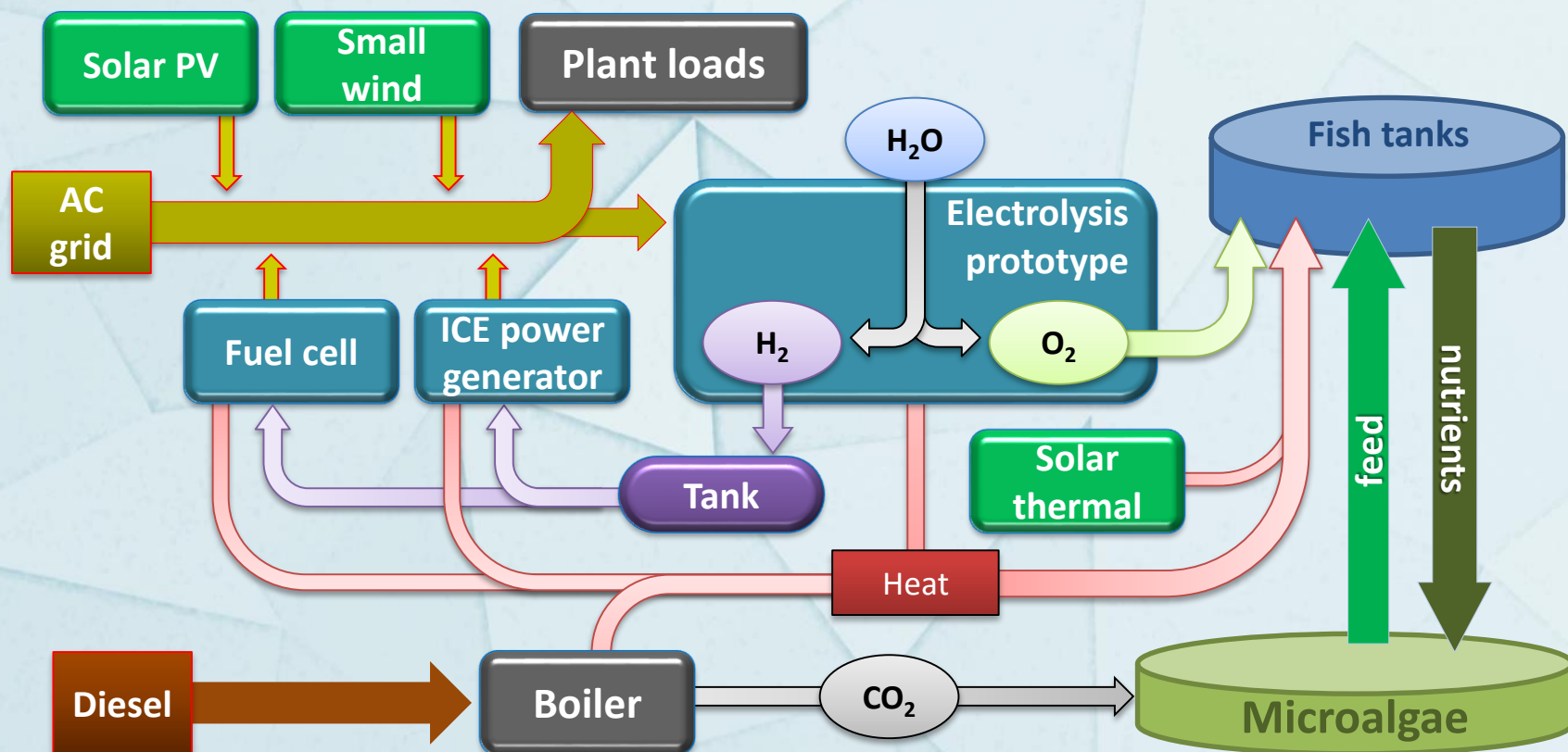


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THE PROJECT



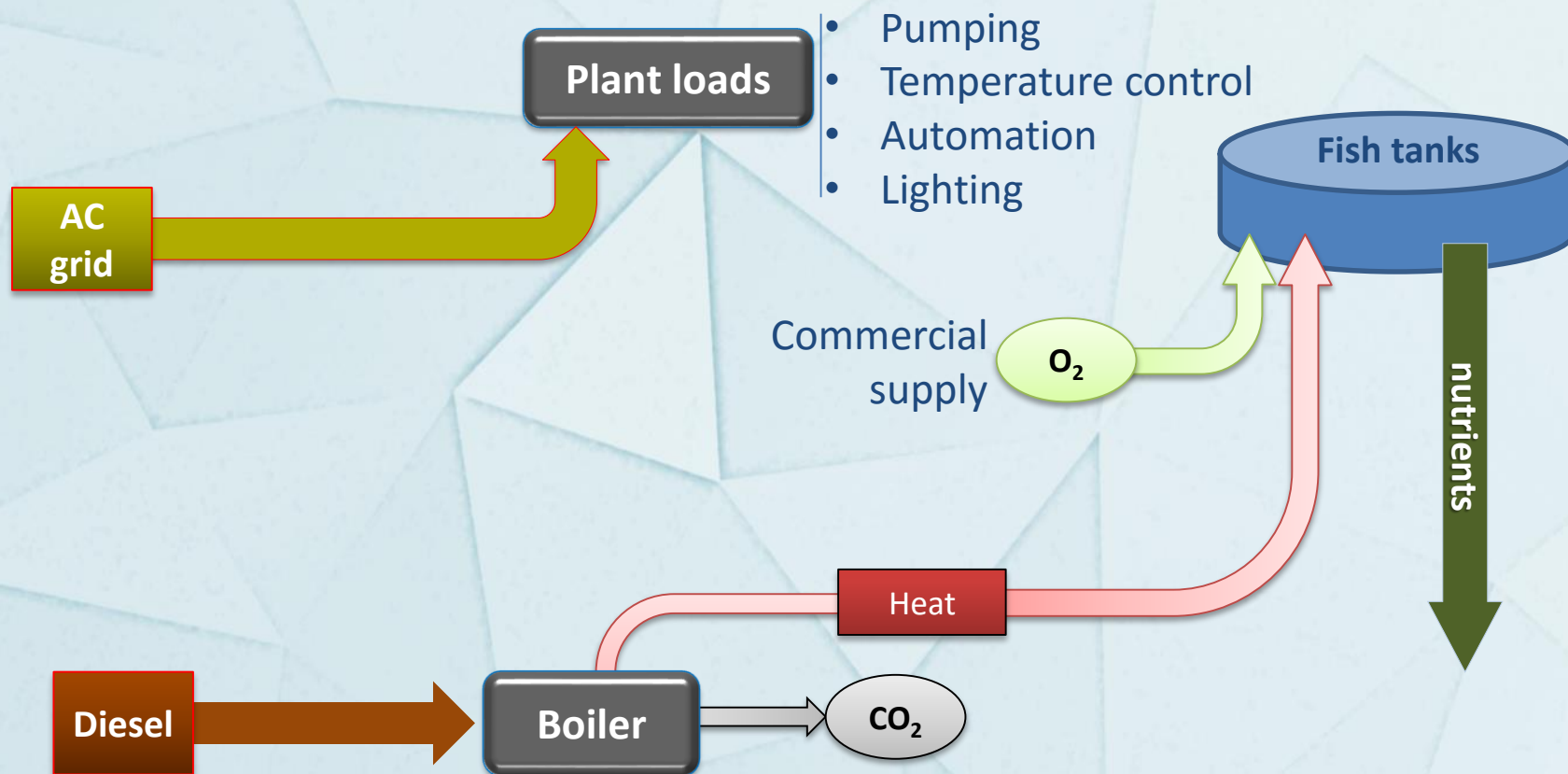


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## THE PROJECT



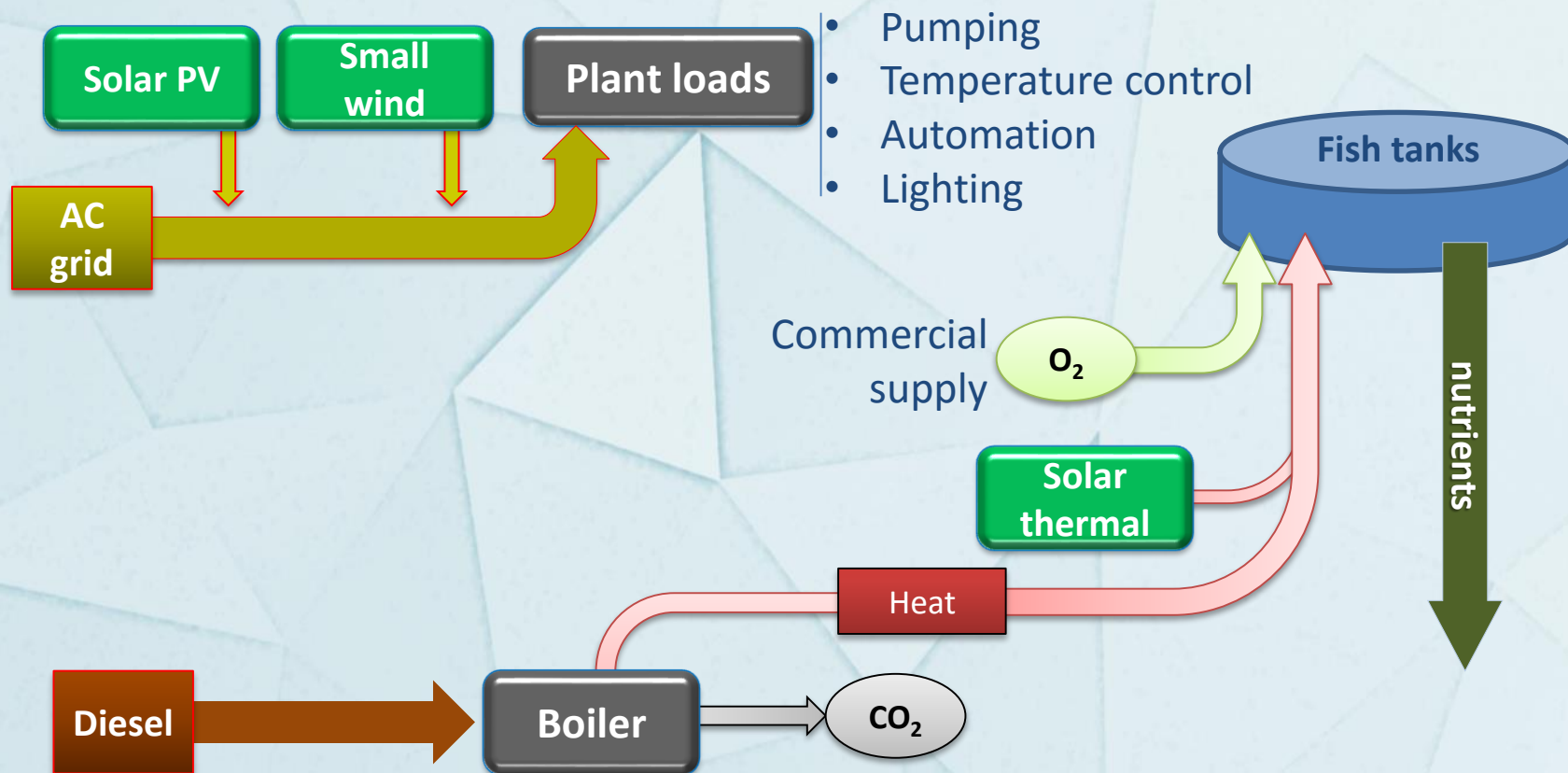


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## THE PROJECT



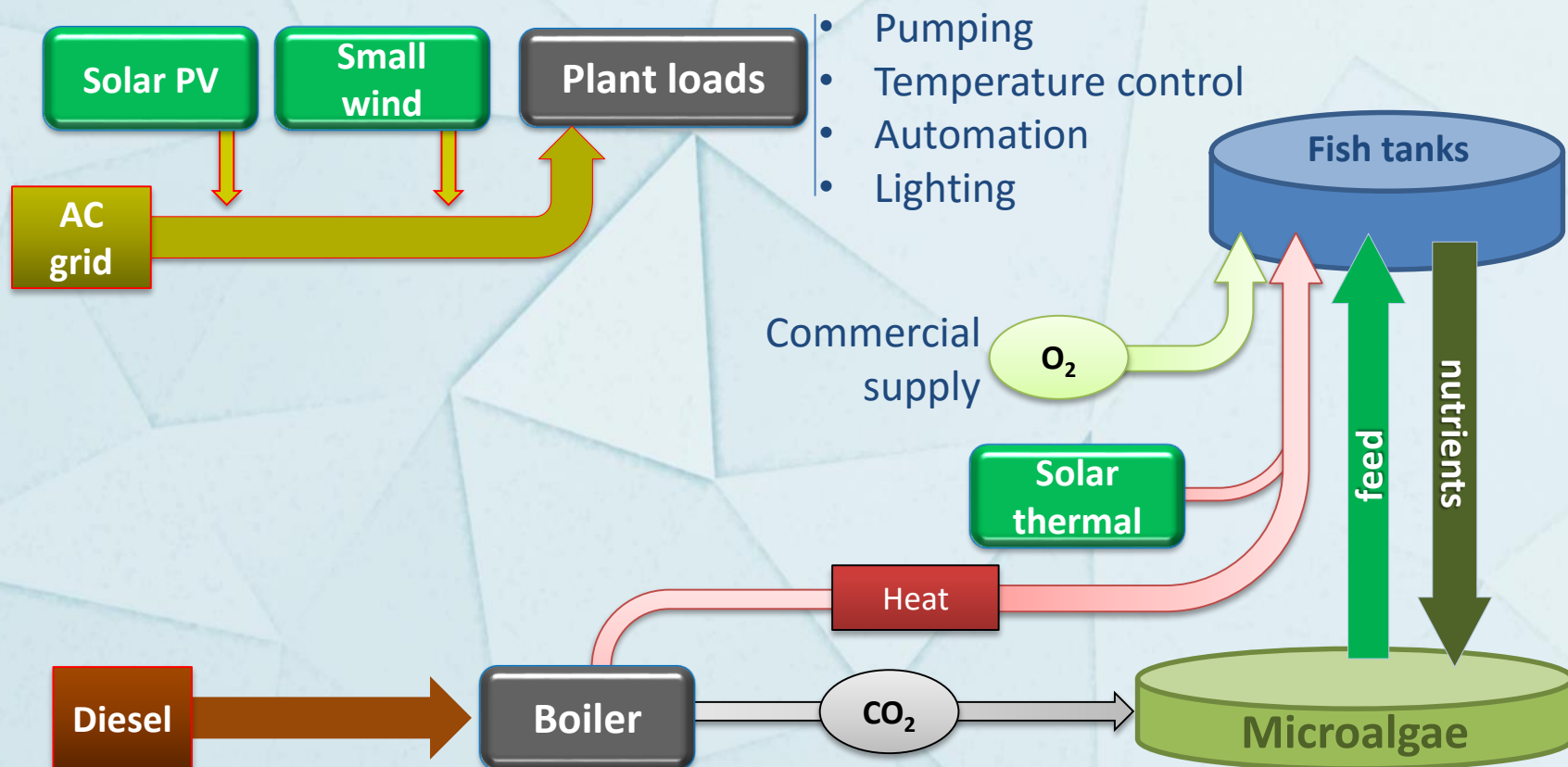


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## THE PROJECT



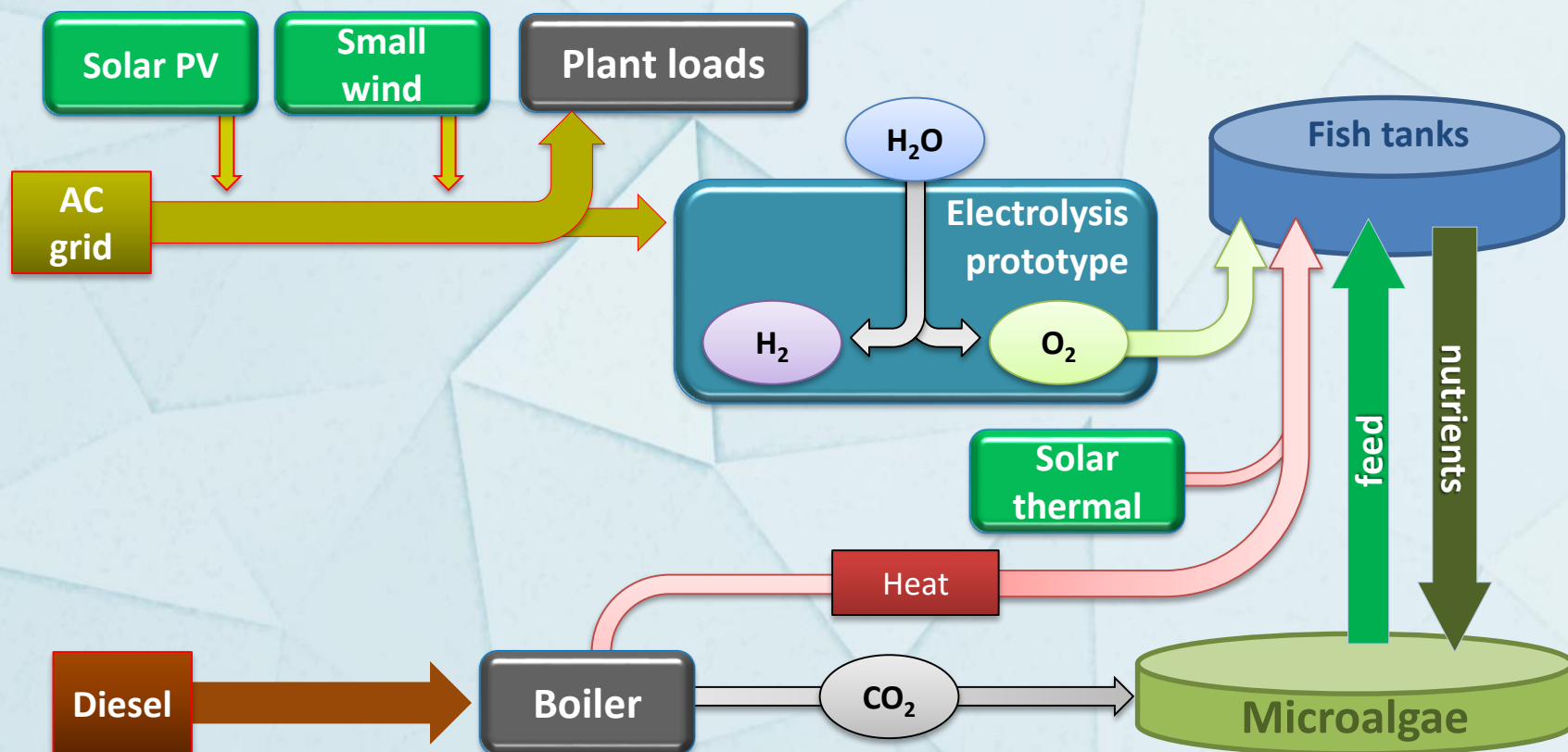


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THE PROJECT



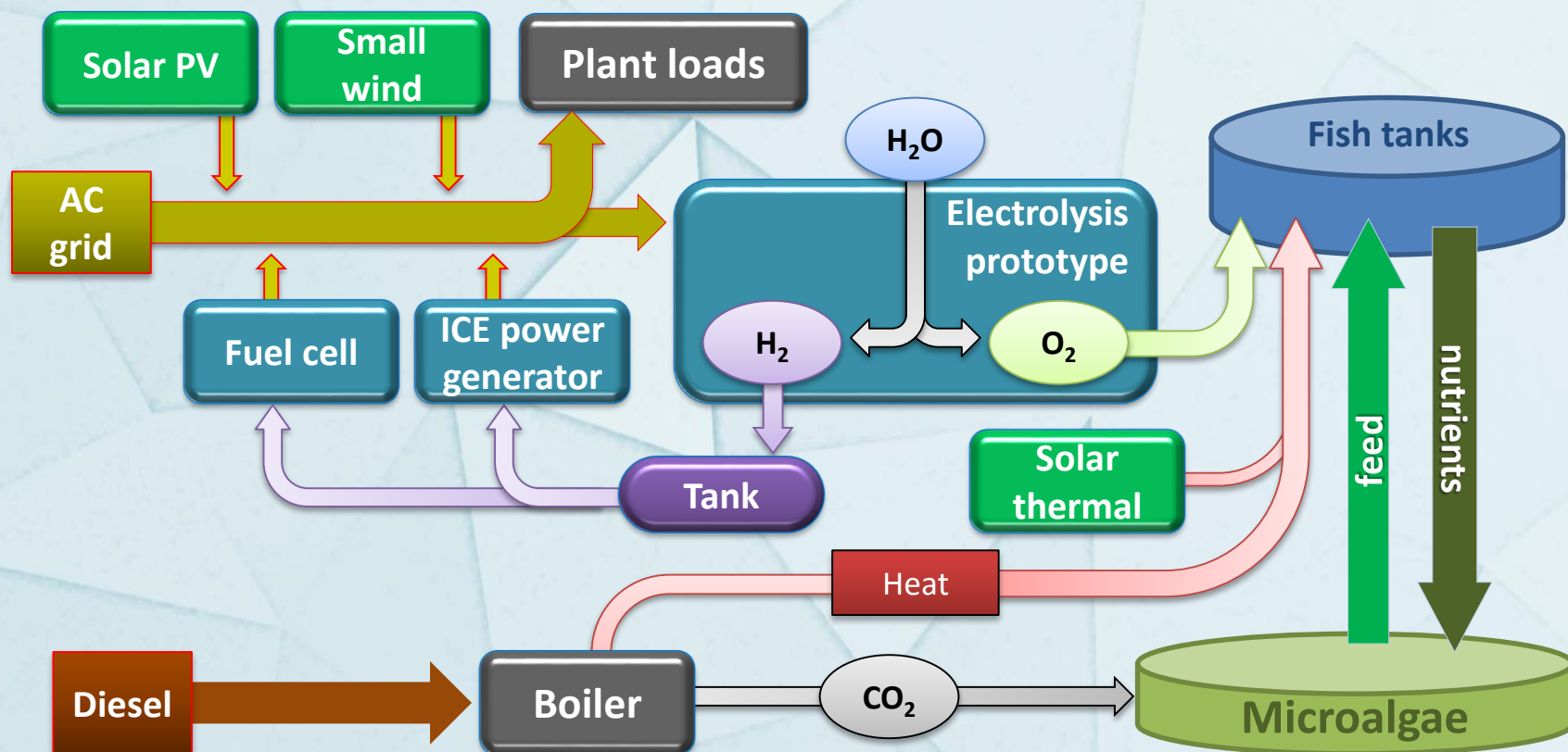


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THE PROJECT



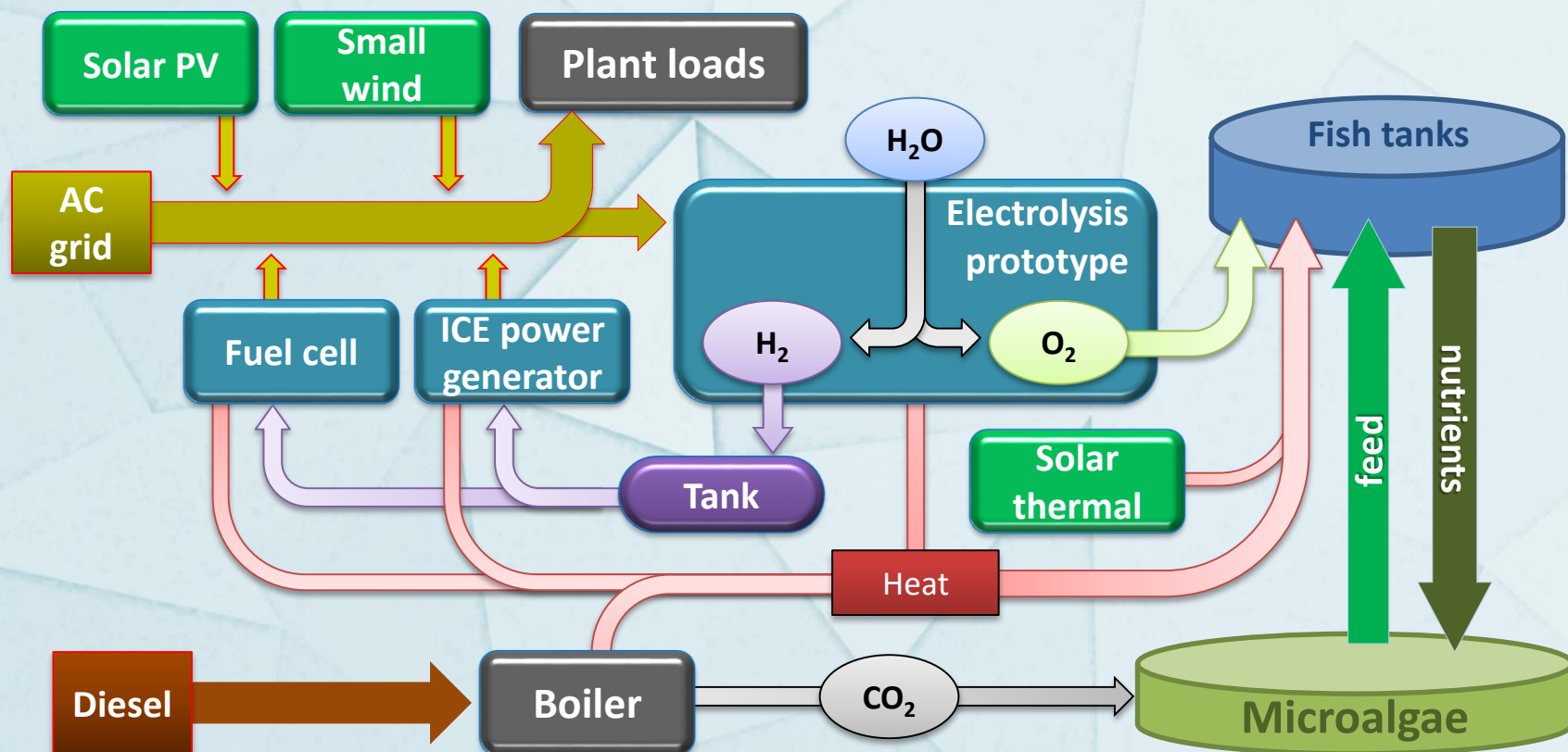


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THE PROJECT





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OBJECTIVES

## ***AQUASEF: Challenges addressed***

*global*

FEED dependence

Protein, oil, additives

ENERGY dependence

Pumping, heating

CO<sub>2</sub> footprint

Direct & indirect

*local*

OXYGEN dependence

Aeration

EFFLUENT treatment

Eutrophication

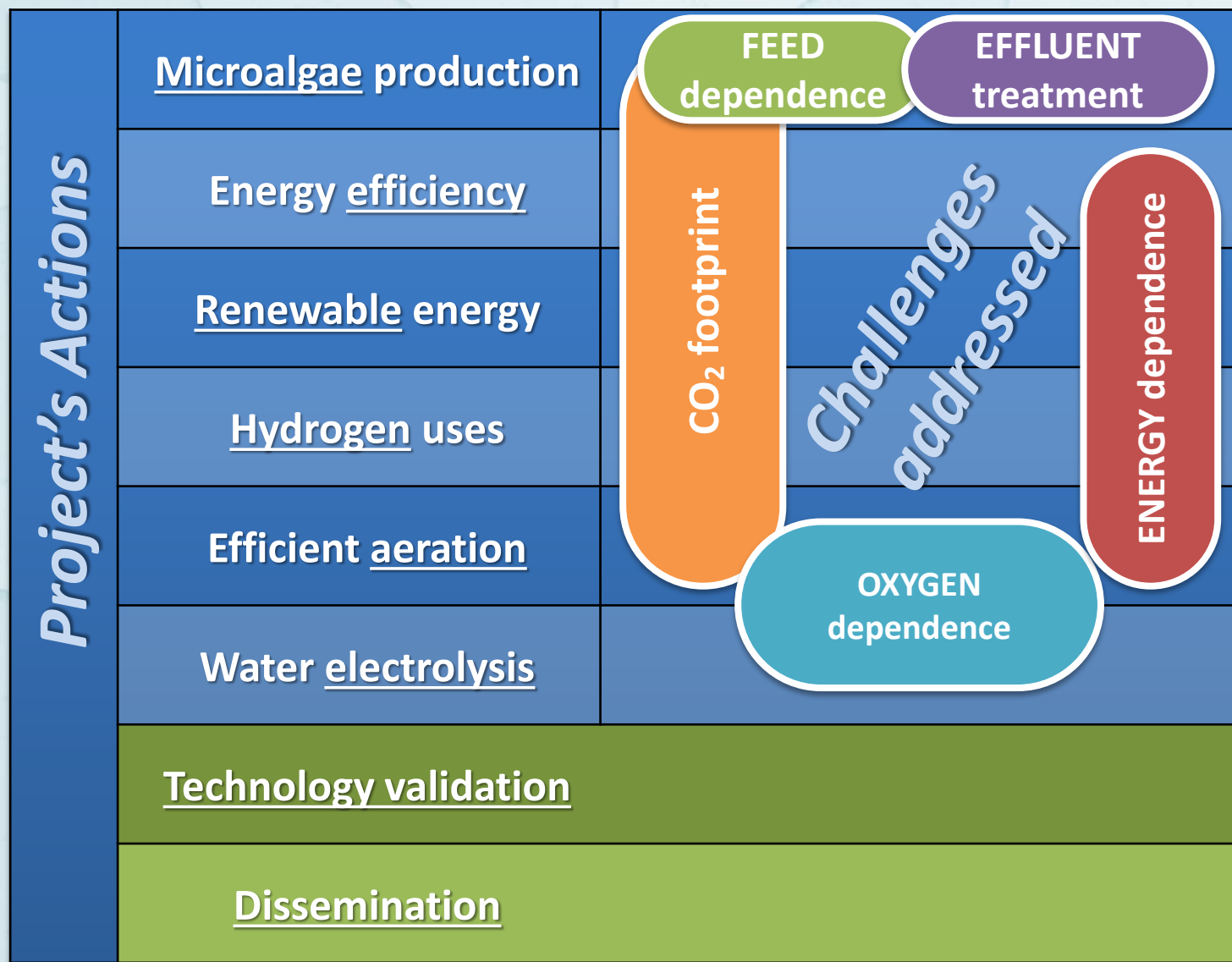


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## OBJECTIVES





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## OBJECTIVES

|                   |                              |                                                                                                                                               |
|-------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| Project's Actions | <u>Microalgae production</u> | <br>Generación de burbujas y cultivos biológicos           |
|                   | <u>Energy efficiency</u>     |                                                            |
|                   | <u>Renewable energy</u>      |                                                            |
|                   | <u>Hydrogen uses</u>         |                                                            |
|                   | <u>Efficient aeration</u>    | <br>Generación de burbujas y cultivos biológicos           |
|                   | <u>Water electrolysis</u>    |                                                           |
|                   | <u>Technology validation</u> |                                                          |
|                   | <u>Dissemination</u>         |  <small>CENTRO TECNOLÓGICO<br/>DE LA ACUICULTURA</small> |

## Action leaders

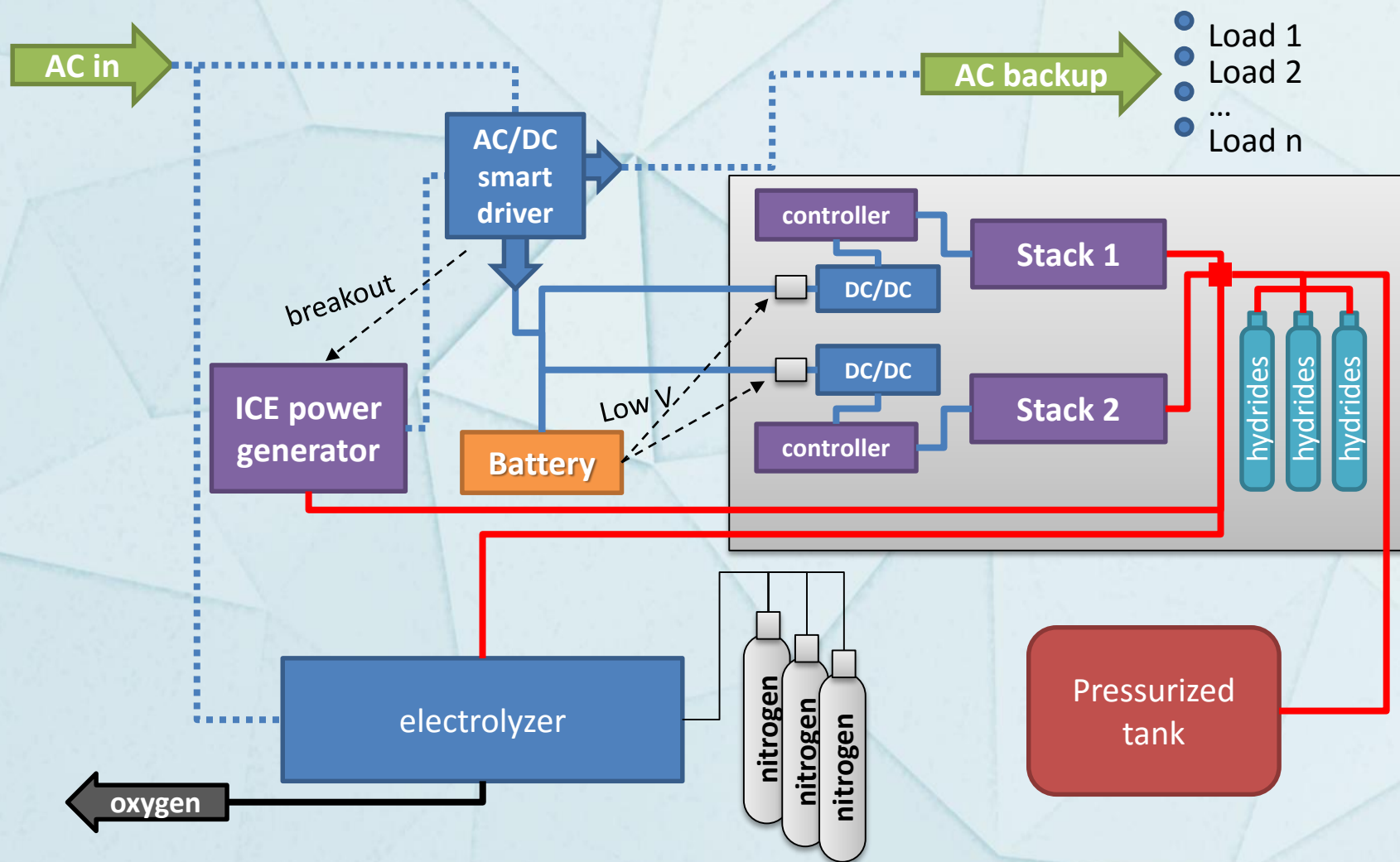


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## HYDROGEN VALORIZATION



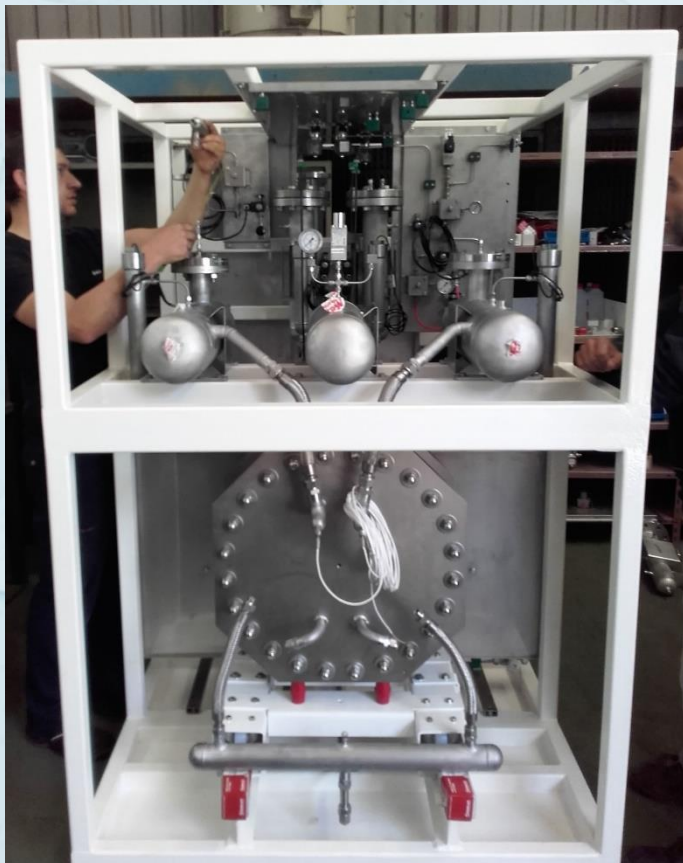


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## WATER ELECTROLYSIS



|                 |                       |        |
|-----------------|-----------------------|--------|
| Oxygen prod.    | 0,5Nm <sup>3</sup> /h | 715g/h |
| Hydrogen prod.  | 1Nm <sup>3</sup> /h   | 90g/h  |
| Power (max)     | Aprox. 5kW (3Ph)      |        |
| Technology      | Liquid alkaline (KOH) |        |
| Output pressure | 15bar                 |        |

The prototype must:

- Bear marine conditions
- Remove KOH traces from O<sub>2</sub>

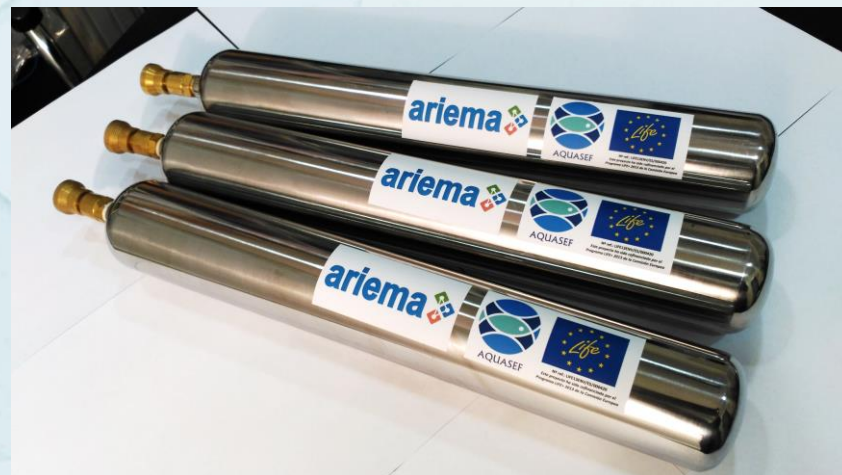


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## HYDROGEN STORAGE



### Hydrogen storage

- Metal hydrides:  $2,1\text{Nm}^3$
- SS tank:  $15\text{Nm}^3$





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Two technologies and  
applications:

- Fuel cell: 1,6kW UPS
- Hydrogen adapted ICE generator: portable and heat cogeneration



HYDROGEN VALORIZATION

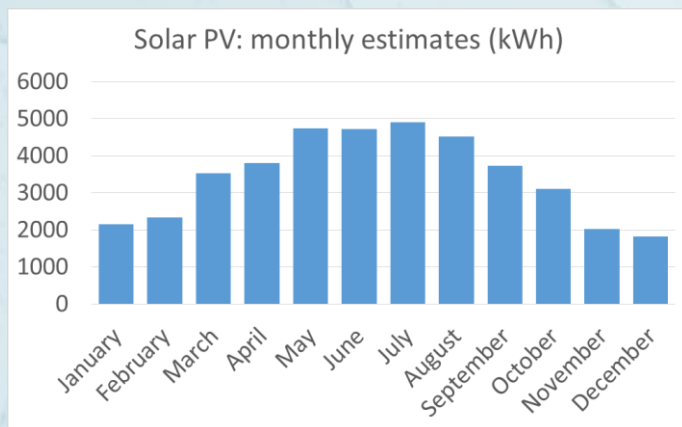


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## RENEWABLE ENERGY



Micro island  
PV systems  
5 x 200W units



Small wind power  
5,5 kW



Photo-voltaic array  
30 kW



Solar thermal 25kW



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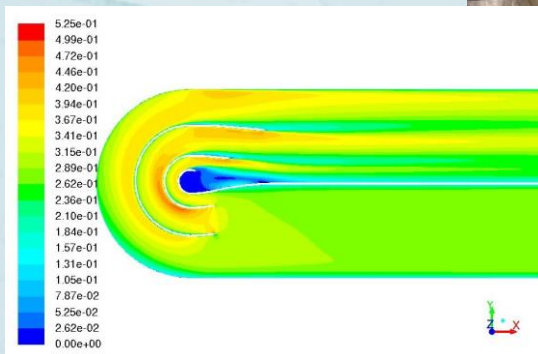
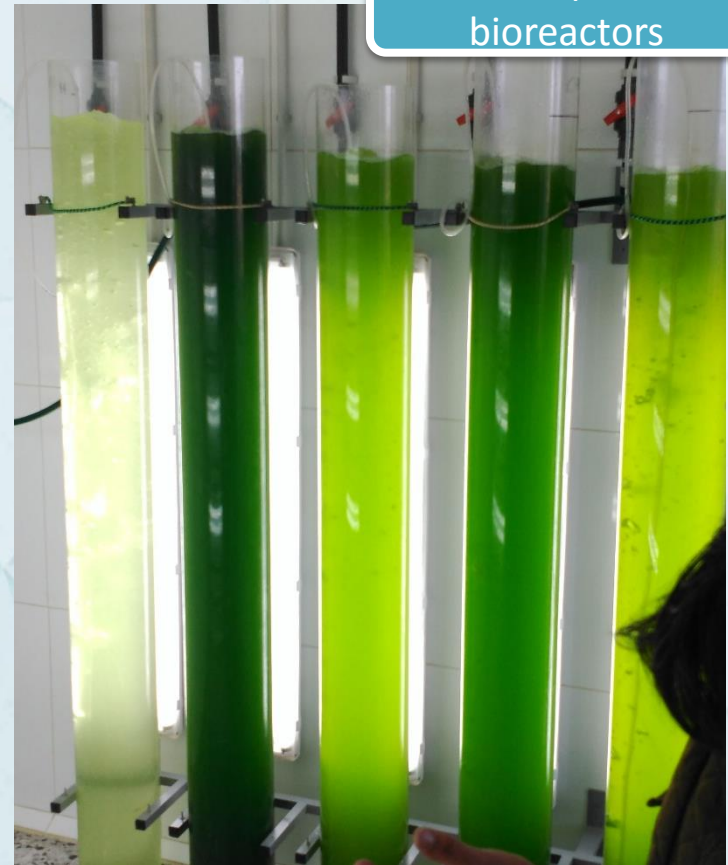
## MICROALGAE

Indoor and  
outdoor  
microalgae  
production

Outdoor algae  
production



Indoor photo-  
bioreactors



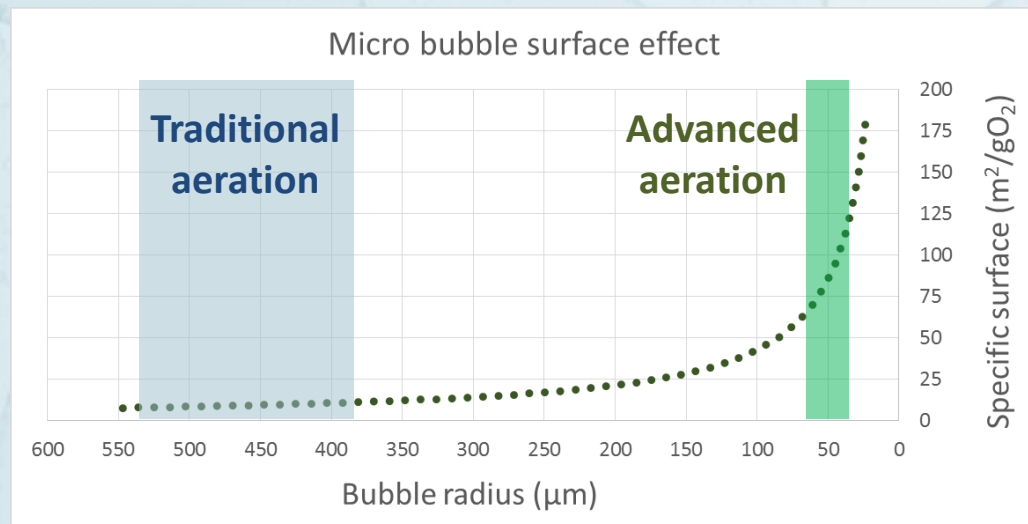


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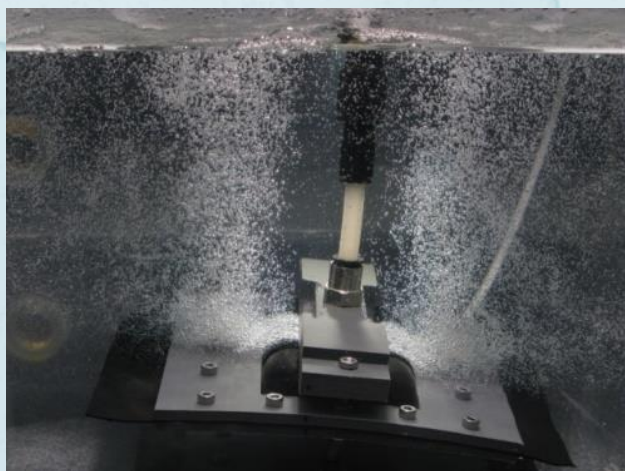
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ADVANCED AERATION



Energy and oxygen efficiency  
is dramatically increased



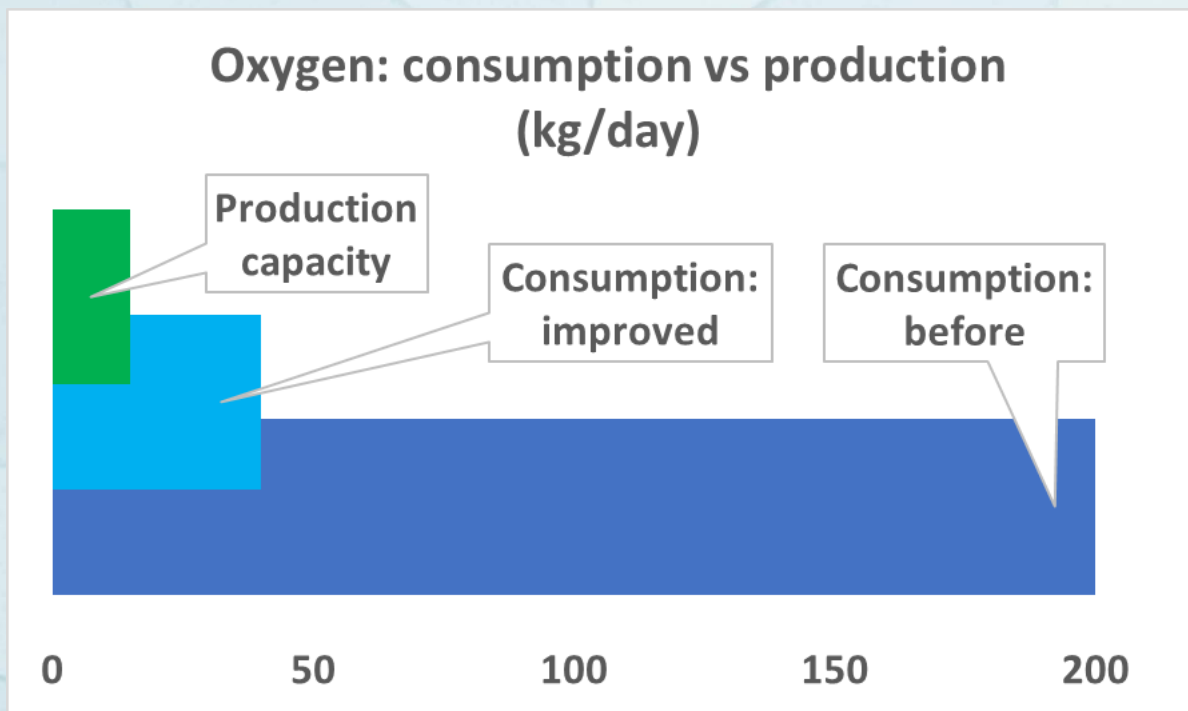


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## OXYGEN NEEDS



Advanced aeration advantages:

- Change from pure oxygen to air injection
- When necessary, improved dilution will save oxygen



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RESULTS EXPECTED





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## RESULTS EXPECTED

**FEED  
dependence**



**+ 3 ton/year** of high valuable fresh microalgae feed (dry)

**ENERGY  
dependence**



**+ 65 MWh/year** from local renewable sources  
**- 10 MWh/year** through efficiency and new technology  
**+ 7 MWh/year** from hydrogen technology

**CO<sub>2</sub> footprint**



**- 21 tCO<sub>2</sub>/year** through renewable energy  
**- 3,5 tCO<sub>2</sub>/year** through efficiency and new technology  
**- 3 tCO<sub>2</sub>/year** through microalgae fixation

**OXYGEN  
dependence**



**+ 5,5 ton/year** of 15bar pure oxygen

**EFFLUENT  
treatment**



**Quality improvement** through microalgae culture



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## Thanks for your attention

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