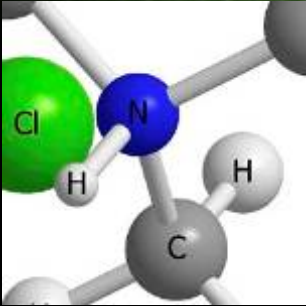




Algae @ Proviron.

Proviron



Specialty chemicals

Building blocks to plastics, cosmetics, drugs, colours, coatings and many other

Recently feed/food ingredients

Sold in medium volume niche markets

Innovating chemicals from renewable raw materials



Biodiesel

Manufacturing chemical products out of renewable raw materials



Contract manufacturing

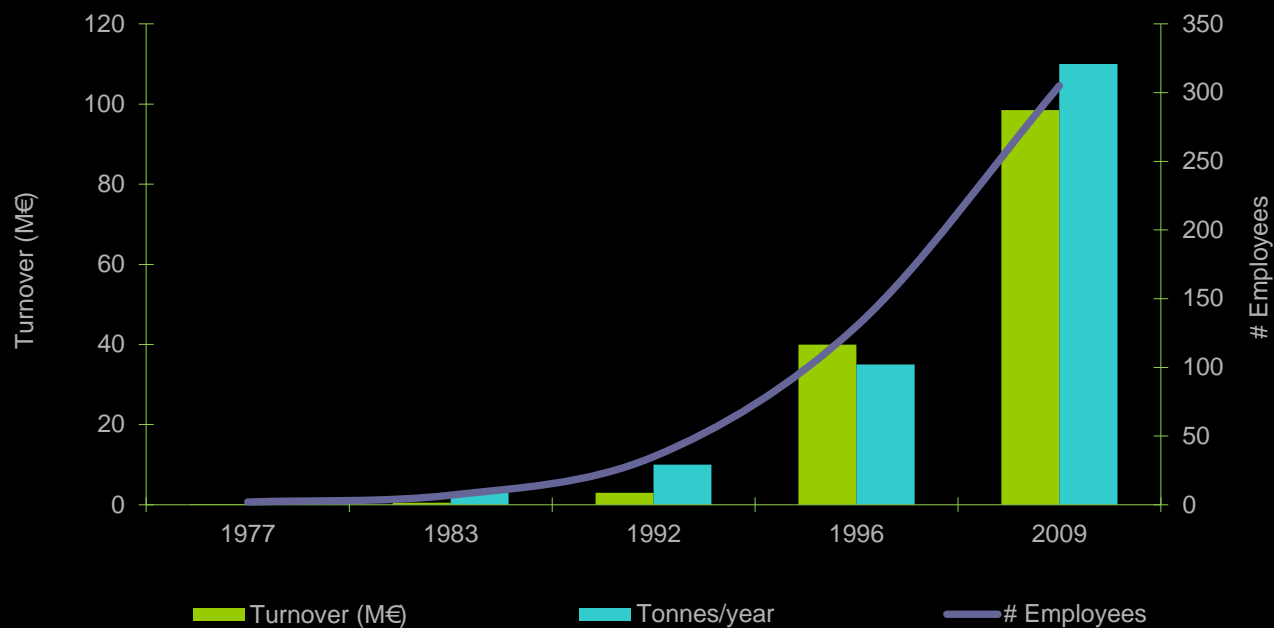
Scientific and technological know-how for a full solution package

Innovating for and with the customer

Proviron

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Proviron in figures



Site Hemiksem



Proviron Industries
Proviron Innovations

Site Oostende



Proviron Functional Chemicals
Proviron Basic Chemicals

Site Friendly



Proviron America, Inc

Site Hangzhou



Proviron China, Inc

Algae?

1977

Process & Environment = **Proviron**[®]



=



Focus on chemicals from renewable raw material →
feedstock limitation → algae the solution?

Cost!



	Units	Raceway pond	Flat panel	Horizontal tubular reactor
Biomass Production	ton /year	2071	6363	4141
Photosynthetic Efficiency	%	1.5	5	3
Light path	m	0.2	0.03	0.034
Daily dilution rate	%	10	30	30
Culture volume	m ³	180180	57692	29671
Investment	K€ /ha	647	938	341
Biomass production cost	€ / kg DW	5.70	4.03	4.02
Main contributor to biomass production cost	Description and total %	Centrifuge 15 %	Air blowers 24%	Circulation pump 46%
	% due to equipment cost	12	7	4
	% for power consumption	3	17	42
Energy balance (produced-consumed)	GJ /year	4496	-325294	-486442

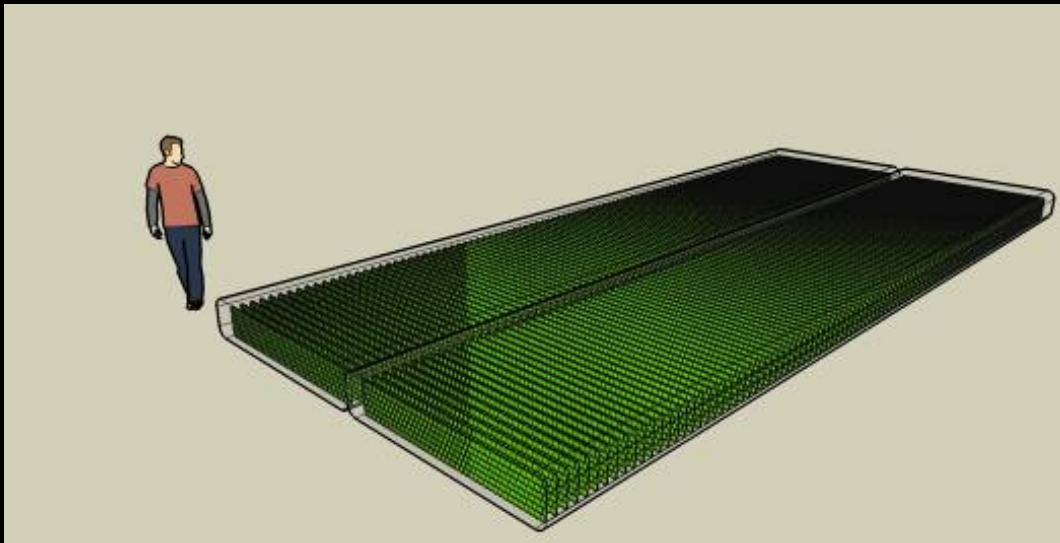
From Delta survey (by WUR) for 100 Ha plant

- Algae cost > 4 €/kg
- Target for bulk = 0.25 to 0.5 €/kg

The ProviAPT concept

Proviron Advanced Photobioreactor Technology

A self supported water filled bag incorporating multiple flat panel photobioreactors with thin plates of reduced height with all connections integrated entirely made out of a polymeric foil that can be produced on a fully automated production line.



Proviron

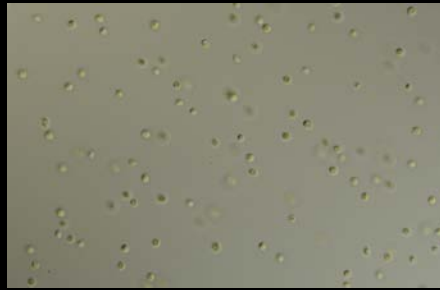
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Status



2011 Autumn

Status



Chaetoceros muelleri

Phaeodactylum tricornutum

Nannochloropsis oculata

Isochrysis galbana

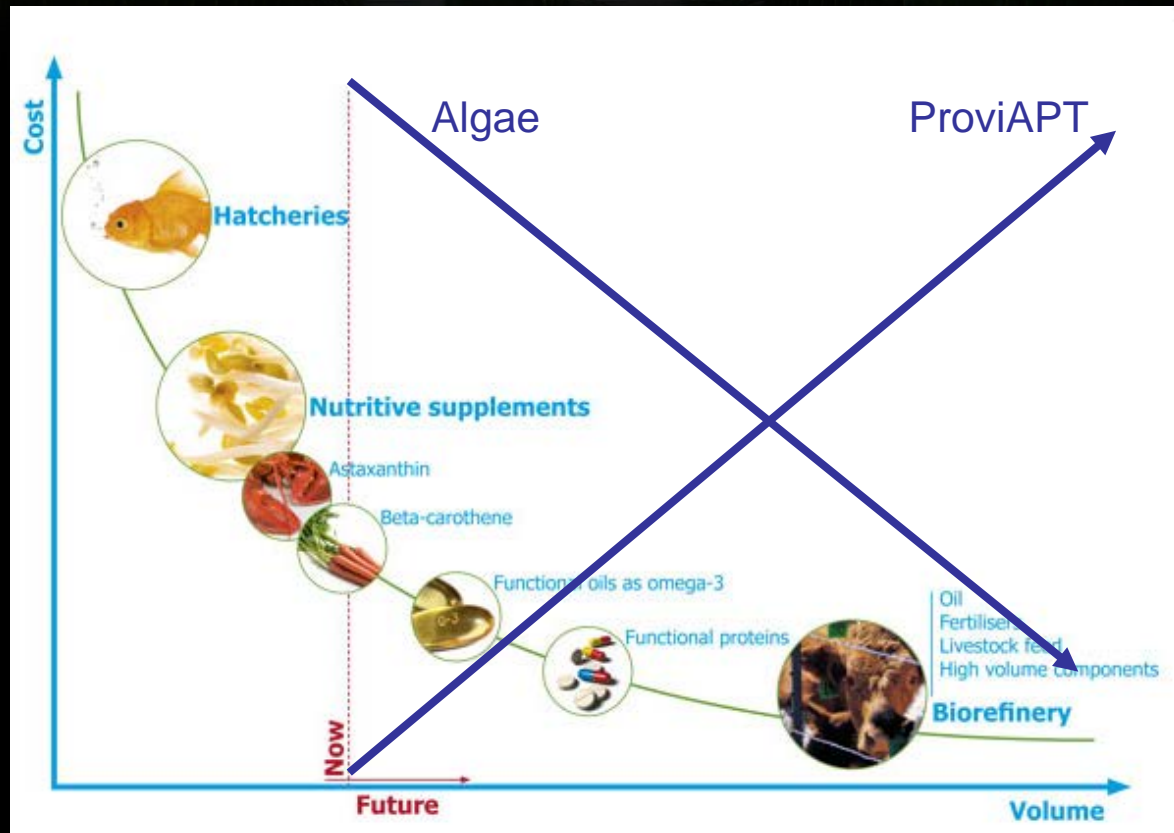
Prospects



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Prospects



Marine Biotech in current research

- AlgaePARC - Wageningen, NL
 - Process optimization
 - Benchmarking
- AIChEmis @ Hooge Maey (MIP2):
 - Cultivation of microalgae on waste streams (waste heat, flue gasses, ...)
 - Recycling
- Omega-OIL (Flanders' Food):
 - (Microalgal) PUFA's as food additives
- Omega-EI (Flanders' Food):
 - Microalgae as feed ingredient for poultry (laying hens)
- BiCycle (TeTra – IWT)
- Sunlight (SBO – IWT)

Marine Biotech Infrastructure

- Harvesting/dewatering
- Refining
- Analytical capacity

Marine Biotech Contribution

- Applications:
 - Compound screening
 - Strain selection/improvement
 - Metabolomics
 - Aquaculture
- Process optimization (productivity):
 - Fouling
 - Autoinhibition
 - Culture integrity

Marine Biotech Expertise needed

- Algae biology (biology, physiology, genomics, proteomics, metabolomics, ...)
- Process technology (harvesting, refining, ...)
- Water treatment (recycling), water chemistry (nutrient availability, mineral deposits, ...)
- ...

Marine Biotech Adoption in research

- Ongoing
 - 'Core business' of algae group within Proviron
 - Active participation in research projects
 - Internships
 - User committees
 - Service provider (biomass, (technology))



algae@proviron.com
<http://www.proviron.com/algae>

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