

# Growing microalgae in disposable bioreactors the way from pilot-scale to large-scale

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Omega Green B.V. is the successor of Algaecom

# Content

Algae business

Culturing system

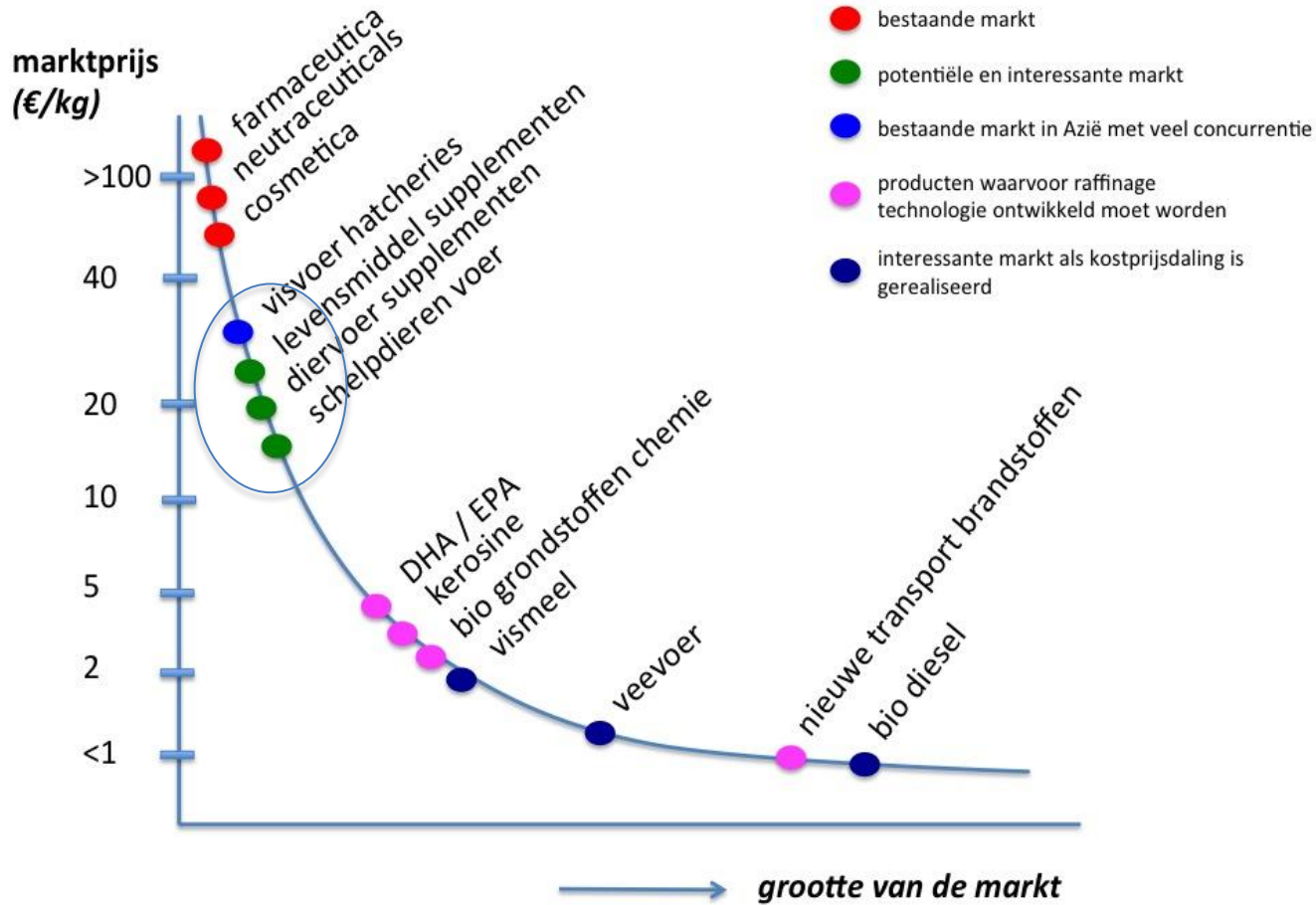
Developments



# Algae based products



# The market for algae



# Omega Green

## Mission and Ambition

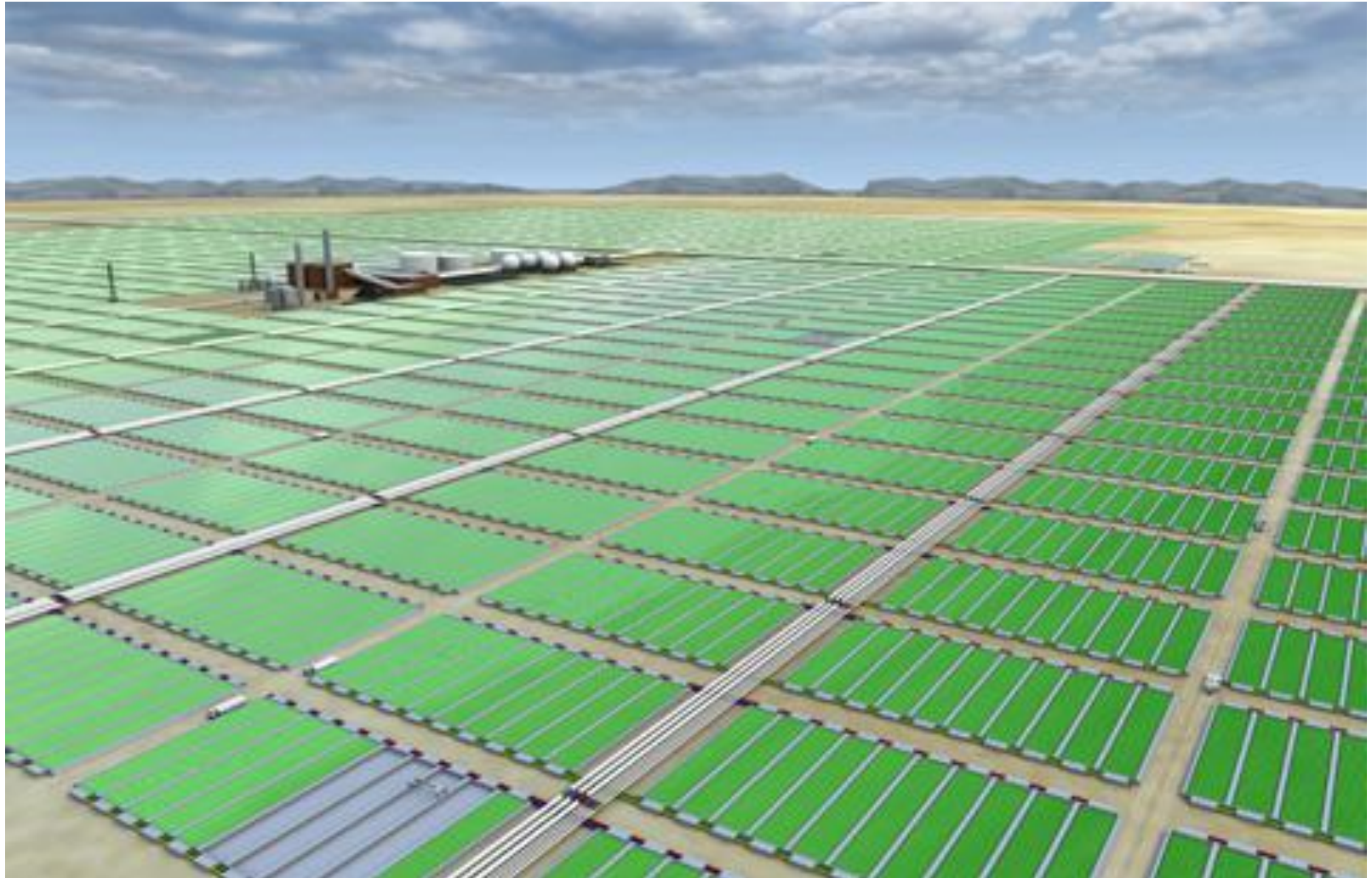
Omega Green is convinced that algae will significantly contribute to healthy and sustainable food, feed and basic feedstock.

Prerequisite is that the algae need to be mass produced in a sustainable manner.

With the unique growth system that Algaecom has developed, this economy of scale is now within reach.



# Foresight



(shared view with Solix Biofuels)



# Track record – pilot plants

Hoogkerk/Groningen



Leeuwarden

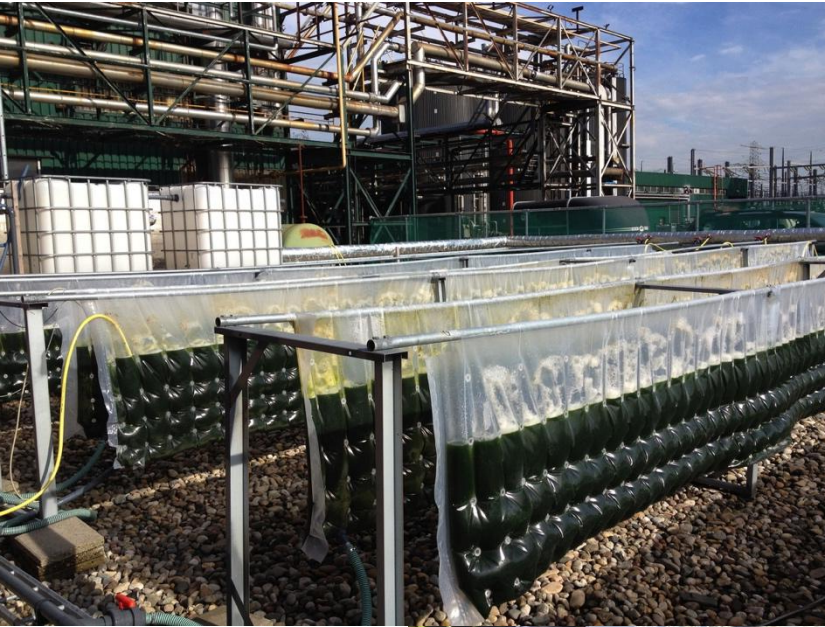


Gasselternijveen



Delfzijl

# Scaling up to 200 m<sup>2</sup>





# Scaling up to 2500 m<sup>2</sup>



Algen productie-unit Delfzijl

# Development heating system



# Best practice sustainable and economically robust



# ALGAE GROW SYSTEM

# PRODUCTS

INPUT



sun light



flue gas as CO<sub>2</sub> source



nutrients



waste heat



mono culture algae



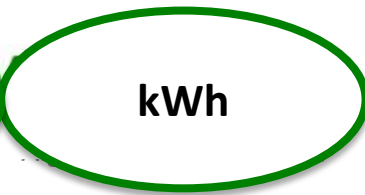
dry algae



algae paste

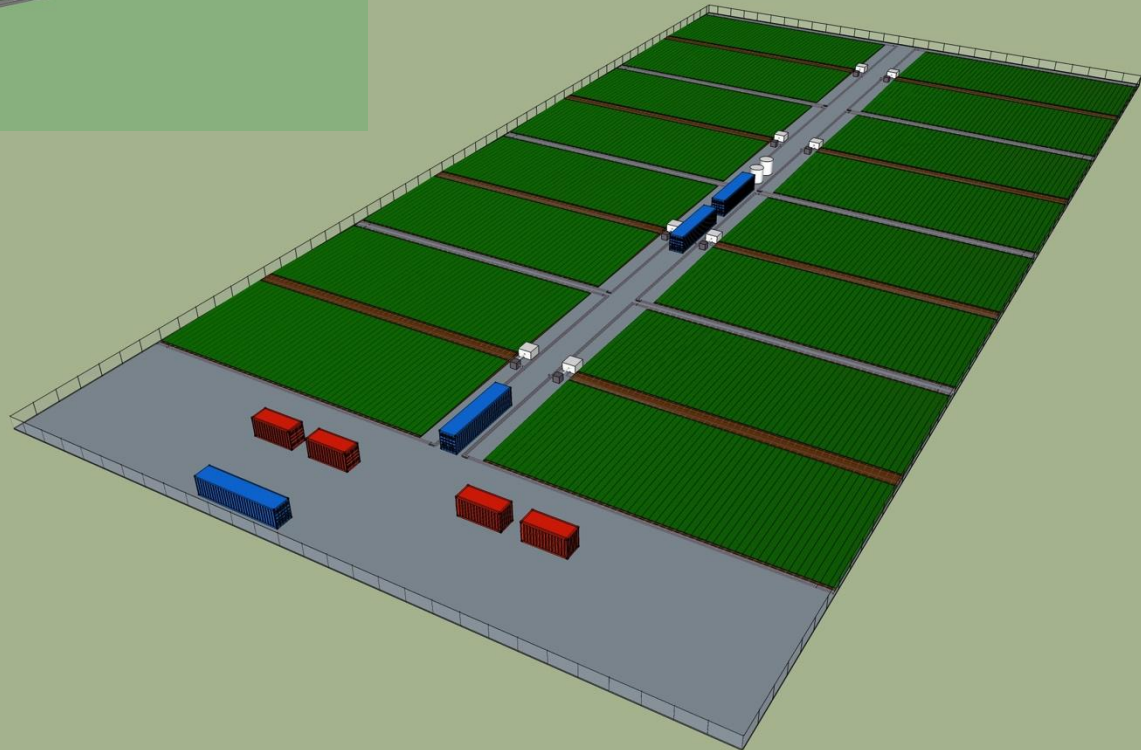
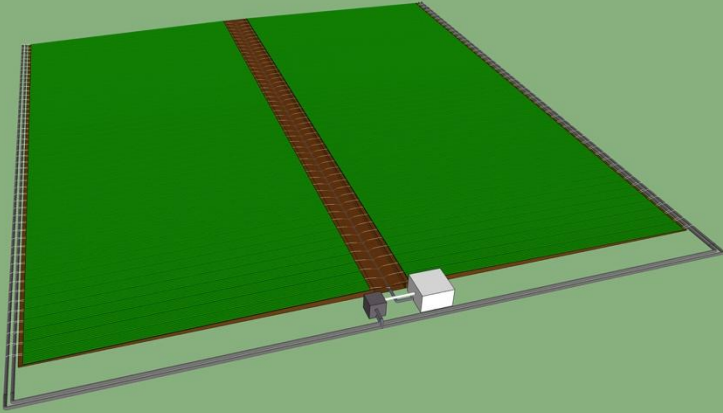


water



kWh

# Modular and scalable system



# Other algae grow systems

Open systems



“ Raceway ponds “



Closed systems



# Advantages of the Omega Green system

- Low algae cost price
- A closed production system enabling a controllable process
- GMP<sup>+</sup> and HACCP certified production of algae paste.
- The patented disposable plastic foil bioreactors avoid expensive cleaning procedures. The reactors can be discarded if necessary and recycled through regular waste collection schemes.
- The growth system is flexible. It is suitable for production of several varying algal species in both fresh and saline medium.
- The growth technique is driven by sunlight and is very sustainable because flue gasses (as a CO<sub>2</sub> source) and waste heat (growth promotor) can be applied.

# The new algae producers, our clients

- Green house gardeners and farmers looking for profitable business
- Owners of waste streams, for example owners of digesters, companies with gasification and combustion installations
- Producers of waste heat, in particular data centers
- Aquaculture, shellfish growers



# Example : Farmer & Digester

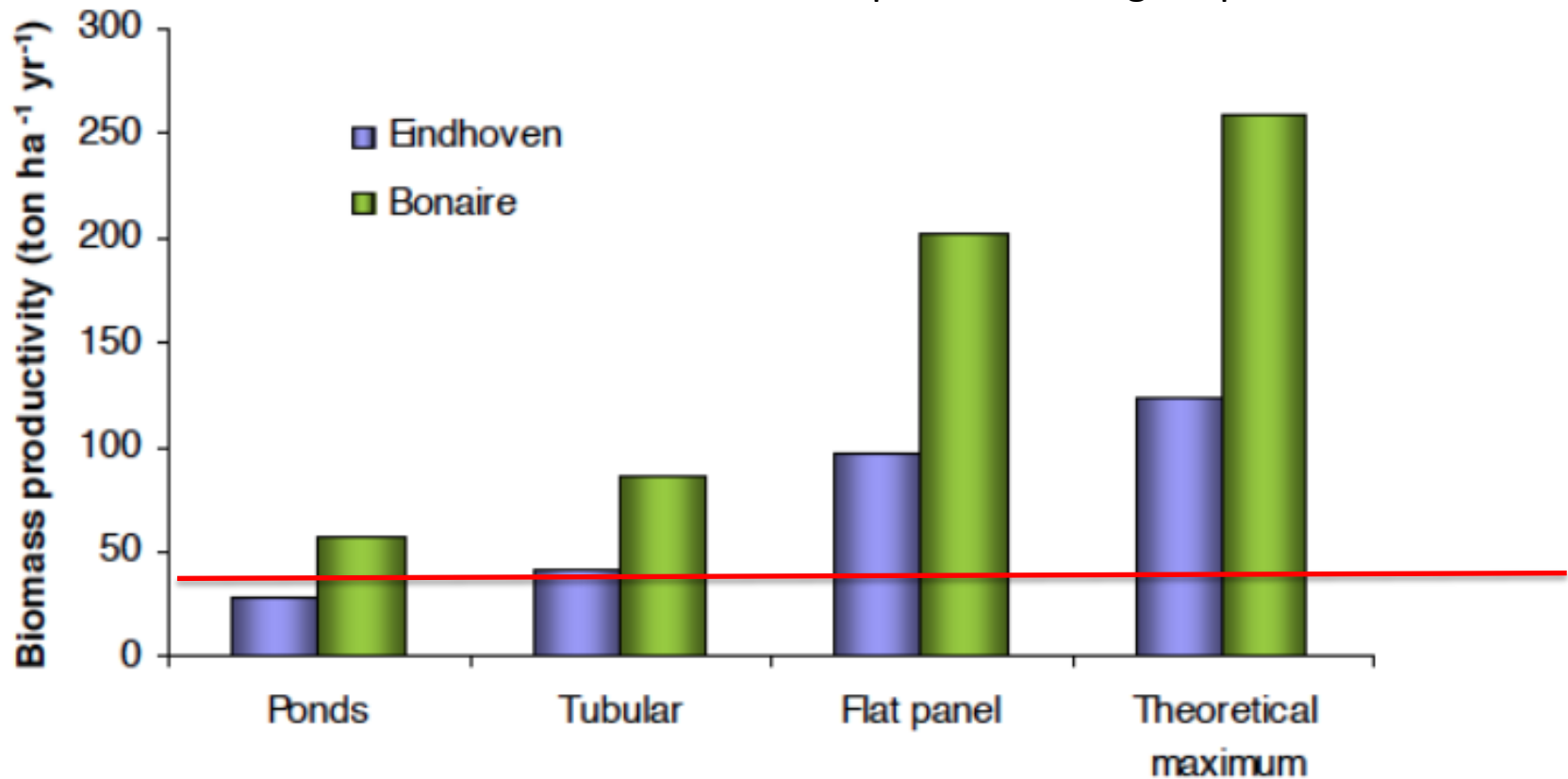


# Business case

(€/kg)	2016	2020	2025
cost price	3-10	2-8	0,5 -6
market value	10-30	2-15	1- 10
gross profit	2-10	1-8	0,5-4

# Production, figures from literature

also dependend of algae specie



# Approved claims for ingredients in the EU

REGULATION-LED OPPORTUNITIES AND SCIENTIFIC ADVANCES

EC: Article 13.1 224 approved claims for ingredients

								Zinc	Water	Vitamin D	
	Vitamin C	Vitamin B6	Vitamin B12	Vitamin A	Thiamine	Selenium	Riboflavin (B2)	Resistant Starch	Protein	Potassium	
	<u>Folate</u>	Iodine	Iron	Magnesium	Manganese	Molybdenum	Olive Oil Polyphenols	Niacin	Pantothenic acid	Phosphorus	
<b>General Wellbeing</b>	Biotin	Calcium	Choline	Chromium	HPMC	<u>Arabinoxylans</u>	Beta-glucans from oats and barley	Sugar replacers	<u>Pectins</u>	Copper	
					Vitamin K	Vitamin C	Vitamin B6	Vitamin B12	Walnuts	Thiamine	
	HPMC	Linoleic Acid	<u>Monascus purpureus</u>	Oleic Acid	<u>Pectins</u>	Plant sterols/stanols	Potassium	Reduced content of SFA	Reduced content of sodium	MUFA/PUFA	
<b>Cardio-vascular health</b>	<u>ALA</u>	<u>Beta-glucans</u>	<u>Betaine</u>	Calcium	Chitosan	Choline	<u>EPA/DHA</u>	<u>Folate</u>	<u>Glucosamine</u>	Guargum	
				Zinc	Vitamin B12	Riboflavin (B2)	Vitamin B6	Vitamin C	Vitamin D	Thiamine	Selenium
<b>Other prime positioning</b>	Biotin	Calcium	Copper	<u>Folate</u>	Iodine	Magnesium	Meat or Fish	Melatonin	Niacin	Potassium	
<b>Beauty from within</b>	Selenium	Vitamin B2 (riboflavin)	Vitamin C	Zinc	Vitamin E	Copper	Iodine	Beta-carotene	Biotin	Niacin	Manganese
						Calcium	Vitamin B6	Vitamin C	Water	Zinc	
<b>Brain health</b>	Biotin	<u>DHA</u>	<u>Folate</u>	Iodine	Iron	Magnesium	Niacin	Pantothenic acid	Thiamine	Vitamin B12	

# Approved claims EU (2)

REGULATION-LED OPPORTUNITIES AND SCIENTIFIC ADVANCES

## EC: Article 13.1 approved claims for ingredients continued

Oral Health	Calcium	Sugar Replacers	Fluoride	Magnesium	Phosphorus	Sugarfree Chewing Gum (with and without carbamide)	Vitamin C	Vitamin D		
Immune Support	Copper	Folate	Iron	Selenium	Vitamin A	Vitamin B12	Vitamin B6	Vitamin C	Vitamin D	Zinc
Digestive Health	Activated Charcoal	Barley Grain Fibre	Biotin	Calcium	Chloride	Lactulose	Oat Grain Fibre	Rye Fibre	Wheat Bran Fibre	
Energy Boosting	Creatine	Folate	Iron	Magnesium	Niacin	Pantothenic Acid	Riboflavin (B2)	Vitamin B12	Vitamin B6	Vitamin C
Bone Health	Calcium	Magnesium	Phosphorus	Vitamin C	Vitamin D	Vitamin K	Zinc	Manganese	Protein	
Vision Health	DHA	Riboflavin (B2)	Vitamin A	Zinc						
Weight Management	Glucosamin (Konic Acid)	Meal Replacement for Weight Control								
Food Intolerance	Lactase Enzyme	Live Yoghurt Cultures								
Endurance	Carbohydrate Electrolyte Solutions									



# Perspective, healthy food



**Omegaella Mozzarella Cheese**

A product of Famiglia Chiari.



**Vaalia Yoghurt for Toddlers**

A product of Parmalat.



**Gold Circle Farms Eggs**

A product of Hidden Villa.



**Organic Fruit on the Bottom Super Yogurt**

A product of Wegmans.



**Apple Bran Muffin**

A product of Starbucks.



**ActiLean Chocolate Peanut Butter Bar**

A product of Weight.com Michael Myers, M.D. Inc..



**Via Biona ORAC ChocBloc**

A product of Vitamin Shop Direct.



**Challenge Spreadable Butter**

A product of Challenge Dairy.



**Extra Virgin Olive Oil**

A product of Star Fine Foods.



**Wellness Hamburger**

A product of Dalco Food.



**Omega Orange**

A product of Genesis Today.



**Active Lifestyle Premium OJ**

A product of Kroger.



**To Be Healthy Pasta Sauce**

A product of Francesco Rinaldi.



**Purely Bulk Gluten-free Baking Mixes**

A product of Prosource.



# Sustainability Algae versus ?

## Algae versus fish oil / krill

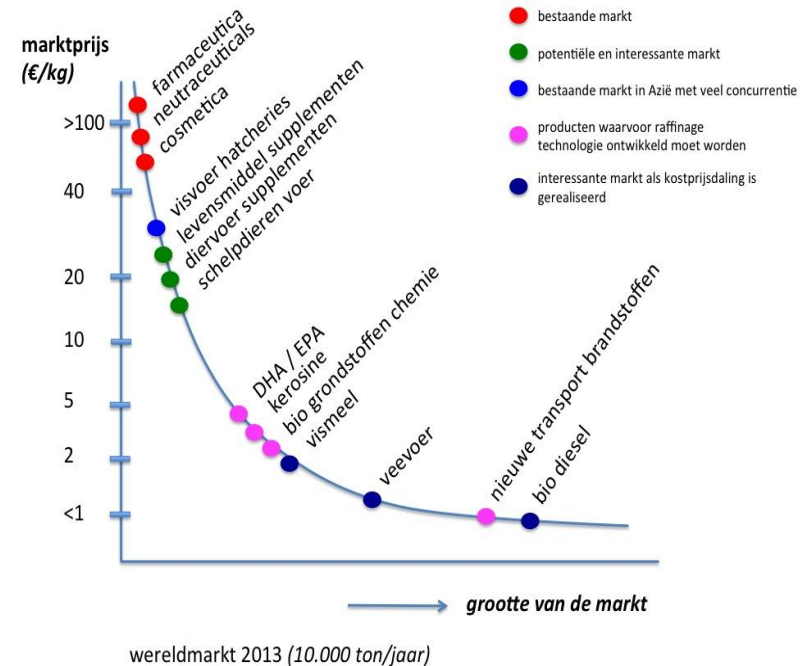
less pressure on the oceans

## Algae oil substituting palm oil (partially)

no world wide transport of minerals  
local production means less transport  
saving remaining tropical forests

## Algae versus soy

no world wide transport of minerals  
local production means less transport  
less need for clean water in tropical areas



## Algae versus fossil fuels

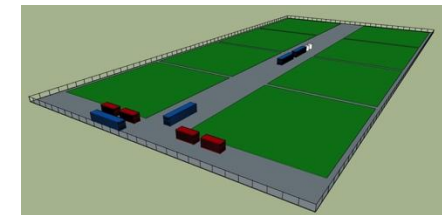
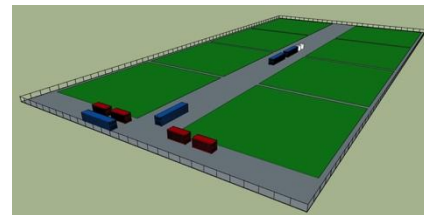
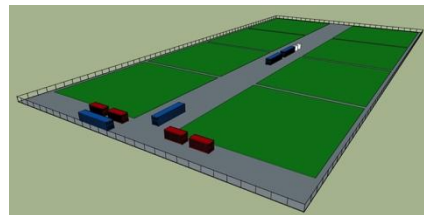
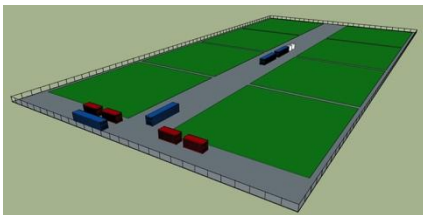
short cyclic CO<sub>2</sub>



# Ambition Omega Green

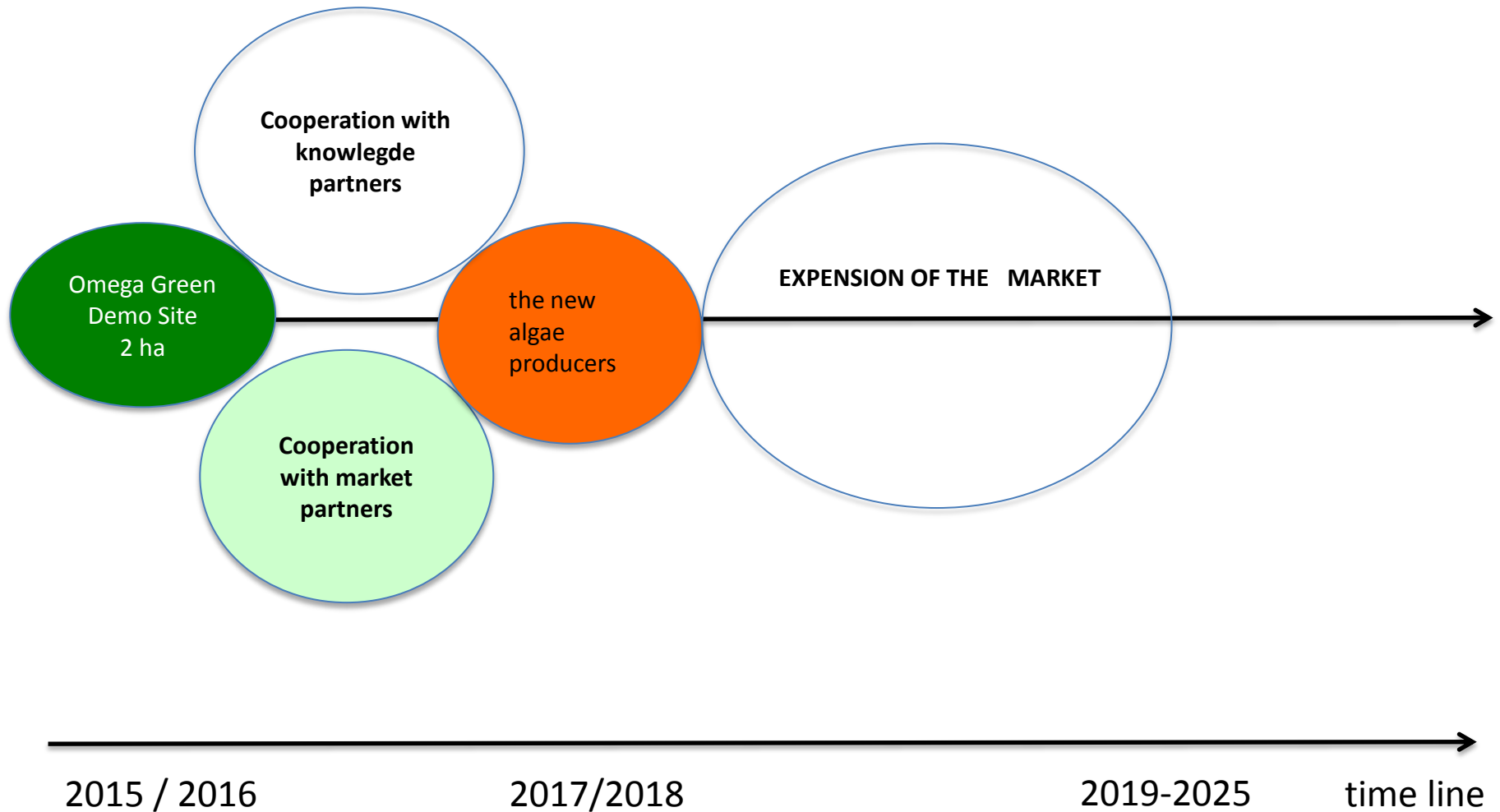


- Selling and building algae production sites
- Selling patented disposable algae grow reactors
- Providing consultancy and training





# Development



# Company

Managing partners Omega Green

Bert Knol

Monique Schoondorp

Frank Fliek

Team      2 marine biologists  
              environmental engineer  
              technical assistant



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