# Algae Growing Systems

# for large scale applications



### Kansen voor CO<sub>2</sub> als grondstof Kans om in Rotterdam te blijven Deltalings 30 March 2017



www.omegagreen.nl dr. Monique A Schoondorp Managing partner



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## Algae contribute to a sustainable world

Sequestering  $CO_2$  (1 kg algae sequesters 2 kg  $CO_2$ )

Algae can grow directly on flue gas

Algae produce essential nutrients (omega - fatty acids & proteins)

Algae produce 20 to 80 ton dry matter per hectare (EU-climate)

No competition with the current agriculture

Algae fit in a circular economy with a positive business case

Algae business offers innovation challenges

Algae business creates new jobs

**Biotechnology is the base** 

Micro algae are only visible with a microscope Macro algae visible with your eyes (wieren) Different in composition



Crops	ton/ha/yr (dry matter)
Algae	20-100
Palmoil	10
Rape seed	3
Soy	1 – 3
Jathropha	7-10
Sun flower	3-5



## State of the art



Algae culturing is not in a laboratory phase anymore Pilot- and demo plants have been build at several places Scaling up has been executed by Omega Green A commercial unit now available

### Unique system developed for large scale production

- Closed production system resulting in a GMP and HACCP proof production process
- The patented disposable plastic foil bioreactors avoid expensive cleaning procedures and loss of production time.
- Yield of 30 to 50 tons dry matter per year
- Scalable process, suitable for different algae species
- Culturing process is suitable to use waste streams
- System can be operated by non specialized personnel
- System is suitable to operate in windy conditions
- Positive business case

Low cost algae compared to indoor and/or high capex systems









## **Business case 4 ha algenteelt**

<b>BUSINESS CASE 4 HA ALGAE PRODU</b>	JCTION										
all costs and revenues for algae powder											
(x € 1.000)	2017	2018	2019	2020	2021	2022	2023	<b>202</b> 4	2025	2026	
Investment											
Total Investment	2800										
Production capacity											
Net production total	54,0	125,8	136,8	152,0	159,6	171,0	182,4	200,0	200,0	200,0	
Selling price	10,00	9,50	9,03	8,57	8,15	7,74	7,35	6,98	6,63	6,30	
Total revenues	540	1.195	1.235	1.303	1.300	1.323	1.341	1.397	1.327	1.260	
Total production costs	292	497	545	541	532	530	510	508	503	503	
Total production costs per tonnes	5,41	<i>3,95</i>	3,99	3,56	3,33	3,10	2,79	2,54	2,52	2,52	
Total costs per tonnes including depreciation	r 8,18	5,73	5,62	5,03	4,74	4,41	4,02	3,66	3,64	3,64	
Result before tax	98	474	465	538	544	569	607	665	600	533	5.094

### **Cooperation and LOI's**

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### betreffende de afname van algen en toepassing in PET-food

Vabta 5.x. is gelietenseased in toepaooing van algen in haar producten en verklaart daarom het inigende:

- · We also perspectief to de tospecelog nan algen in once productors.
- Mot some noar de tarkonst oal meit als bouastere stenik schaarser en daunter worden. Aarloopitosten in ontwikkeling din legisch. Pripreductle is neg wel nonduskelijk voor multitlische concurrente etet andere functionele exeiten.
- Volra heaft interesse in deze innovatieve grandstof en ciet naset de subritionele aspecten. sick organateptische (onzak en Meur) en functionetie utplagnagen (etant). Met name Mindlegseigenschuppen en vet enwägening.
- Vedra wil samerwerken met Draga Green kin, ein deur torpassing te multieren en daurbij. gebruik te maken van de door Omega Grean geproduceerde algee.
- · Net superpression period segment kent dankij het eend in aanserking i v.n. torgevoegde waarde producteet. Het superpremium segment is voor toters de hoofdate ee deniate privargely dat all feld tot direct ever terpacoleg waar in alwaree van alger uflightfrukt in tennen pesender is Lp.r. te denken in klingrammen (azhanigrootte-is assure (g)
- · Any "incrubing contorner" Vetex 6.v. in het PETbod segment wordt leitiked een abseneprijk sen 6 28 per vilo sig op de voorgesteld. De signet voldoes das aan GMP+ ware waarke het gehein produktingrisces han worden geseigel. Belangrijk aspeet is in deze is het wij sje van potentiele ophopingen van overe matalen en vrij zijn van off taste augesten. Product woer, augen waar een opname petitiaad verketening, dit is een kande veorwaarde.
- Zohlte de productieikanten dit magelijk maken, biedt Otrega Green k.v. Kaar faunsting container? Valina low una cerate beshiff in het PICTopol segment zon levengarantie voor oan lagere prije. Binnen erkele jaren servacht Greege Eineer de productiekonten met 20% te helden verlaget.

Gatakend to Vighel namero libbra bur.

Datum Light mare Bul Sto-Hicked Timber Margare Voicetve

Consortium OBR Special Petfoods LAMBERS - SEGHERS Ewolitet door masheers neovia by invivo. Ome **BioAtlantis** Hortimare WAGENINGEN UNIVERSITY & RESEARCH Hemke



## **Protein sources**



# 80 % of all agricultural land world wide is used for feed production

Most important source for proteins Soja

Imported from Brazil, Argentina and USA

### Algae is a real substitute Comparable amino-acid pattern

De omvang van de wereldbevolking van 1800 tot 2100 1960 1974 1987 1999 2025 2043 1927 16 Annichevolkin 14 toe varian 12 oge varian Mijlpalen 2000 2050 1850 2100 Jaar Bron: Verenigde Naties

## Aqua culture



Figure 2.1: World and EU-28 seafood production (capture and aquaculture): 1990-2012.

Source: FAO, 2014

No grow in Europa due to a shortage of fish feed

FAO prediction- shortage around 30 million tonnes of fish to meet the world demand in 2030

Algae are a real option For example DSM & EVONIK announced an investment of € 200 million in algae based fish feed in 2017

### **IMPACT & VISION**

- Sustainable Feed
- Saves energy and water
- More sustainable jungle and oceans



Large scale developments

• Natural carbon sink in the ocean, start of the food chain

The production of

algae for energy

use.

# OCAP line & planning new CO<sub>2</sub> infra structure



Possibility to use existing infra structure and non-used land

Cooperation of all companies who want to stay in Rotterdam

Investment fund to set up the first commercial algae plant in NL/ Europe.

For example a certain amount per tonnes CO<sub>2</sub> emmission

Shared risk for a new concept

### Offer

- Sustainable return on investment without subsidies.
- Contribution to a circular economy and CCU
- No worries, work will be done.

## CCU already available in 2017



The route to sustainable biomass for energy use