Algae Growing Systems

for large scale applications

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Managing partner

Kansen voor CO_2 als grondstof
Kans om in Rotterdam te blijven

Deltalinqs 30 March 2017

23 maart 2017 NRC

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

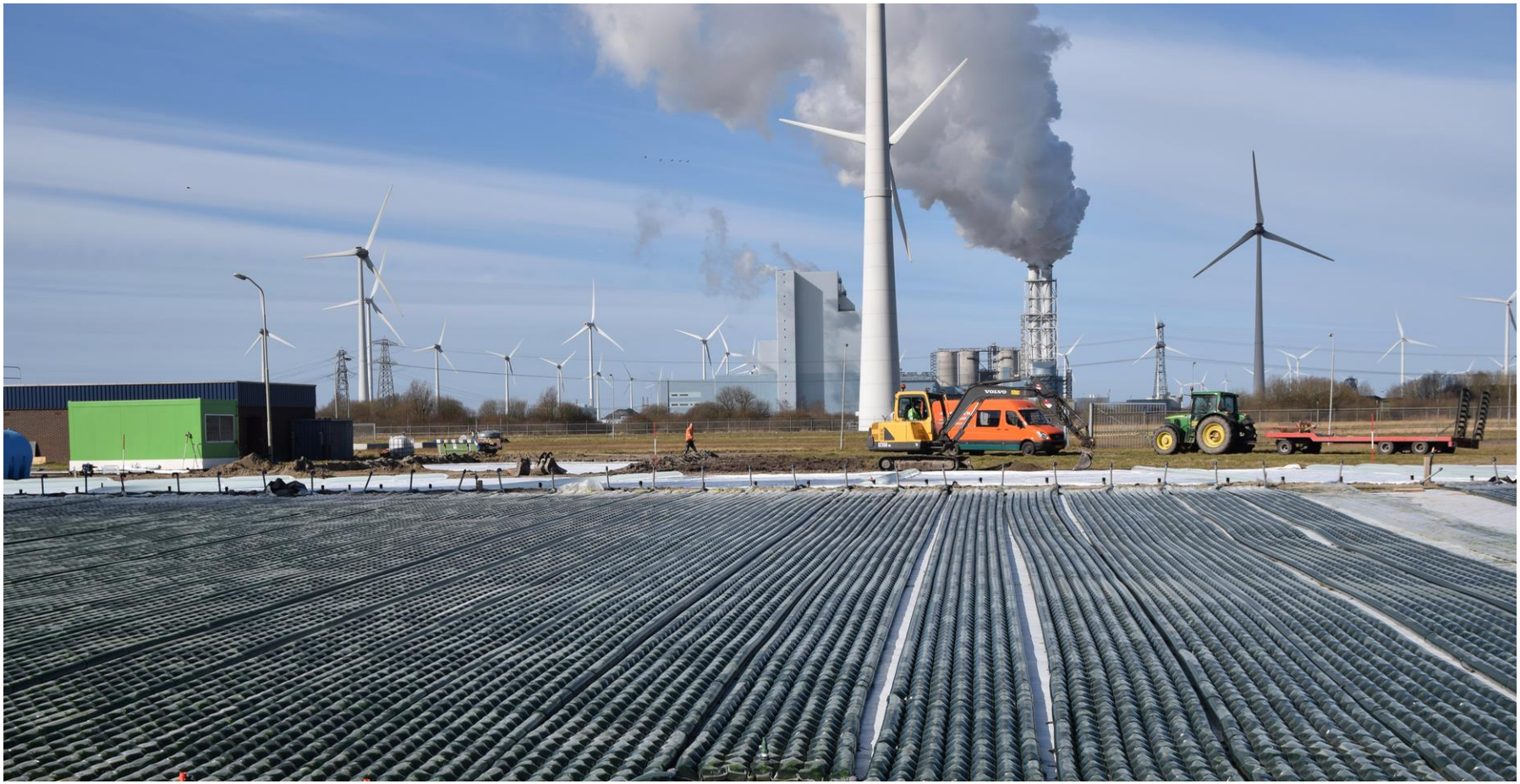
Biotechnology is the base

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

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

Omega Green

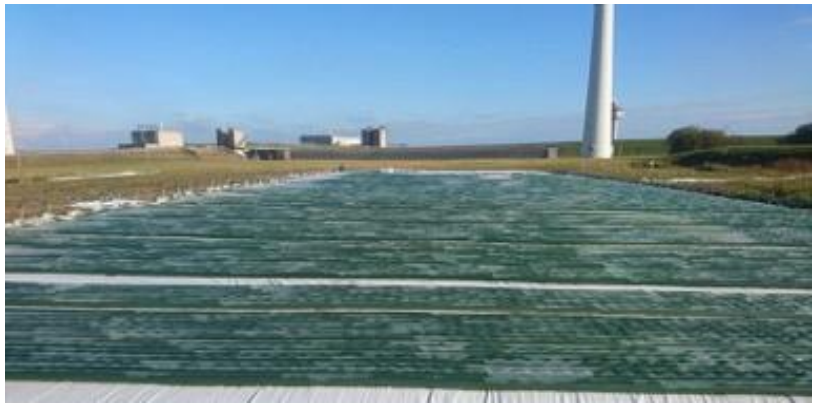
State of the art



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

BUSINESS CASE 4 HA ALGAE PRODUCTION											
all costs and revenues for algae powder											
(x € 1.000)	2017	2018	2019	2020	2021	2022	2023	2024	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***	***3,95***	***3,99***	***3,56***	***3,33***	***3,10***	***2,79***	***2,54***	***2,52***	***2,52***	
Total costs per tonnes including depreciation	***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

Intentieverklaring
Over de afname van algen en toepassing in diervoeder

Intentieverklaring

betreffende de afname van algen en toepassing in PET-food

Consortium

LAMBERS - SEGHERS
Kwaliteit door maatwerk

VOBRA
Special Petfoods

neovia
by INVIVO

Omega Green

Hortimare

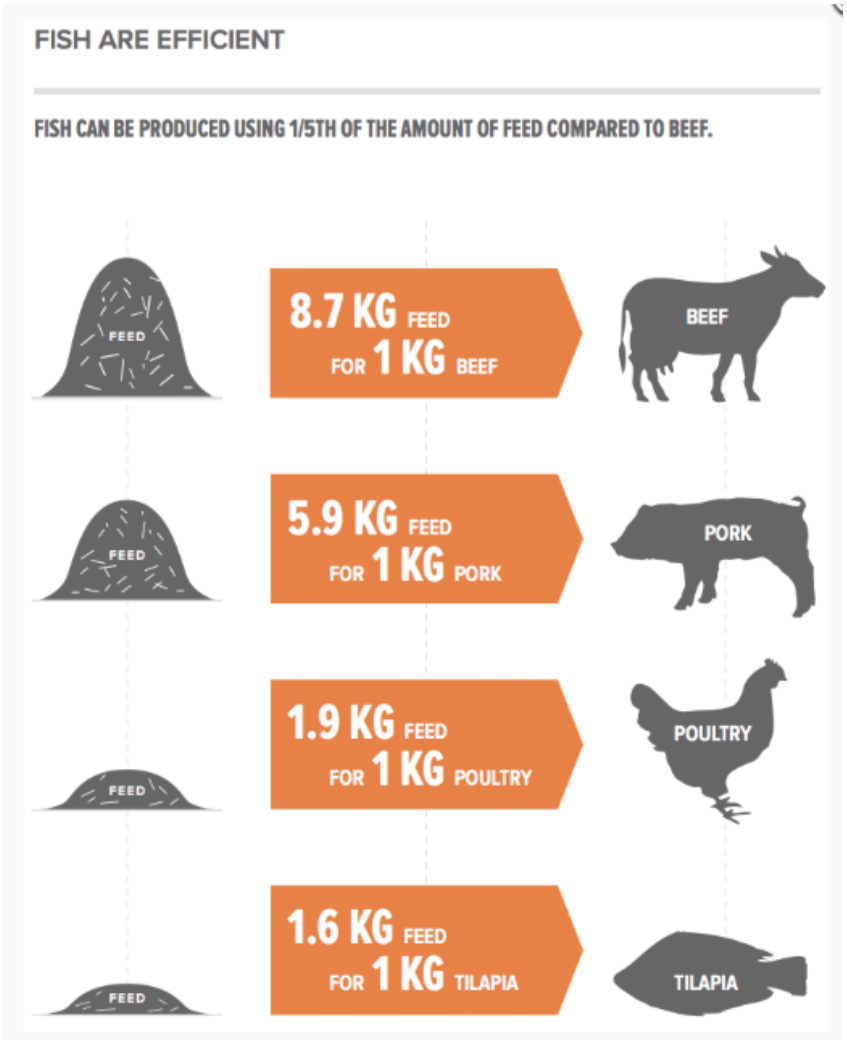
BioAtlantis

WAGENINGEN
UNIVERSITY & RESEARCH

Hemke

← Consortium in algae for feed additives

Protein sources

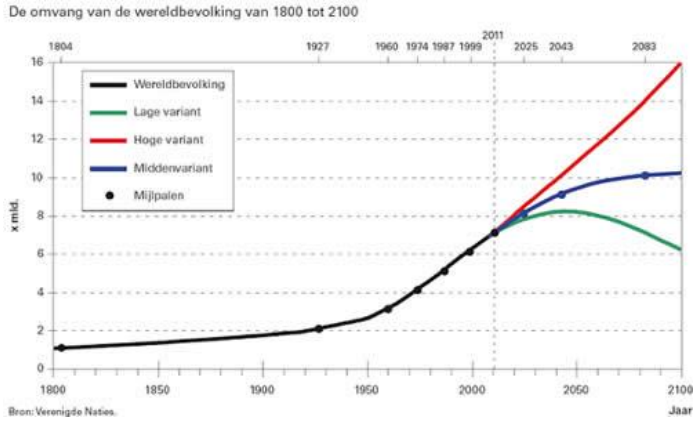


80 % of all agricultural land world wide is used for feed production

Most important source for proteins
Soja

Imported from Brazil, Argentina and USA

Algae is a real substitute
Comparable amino-acid pattern



Aqua culture

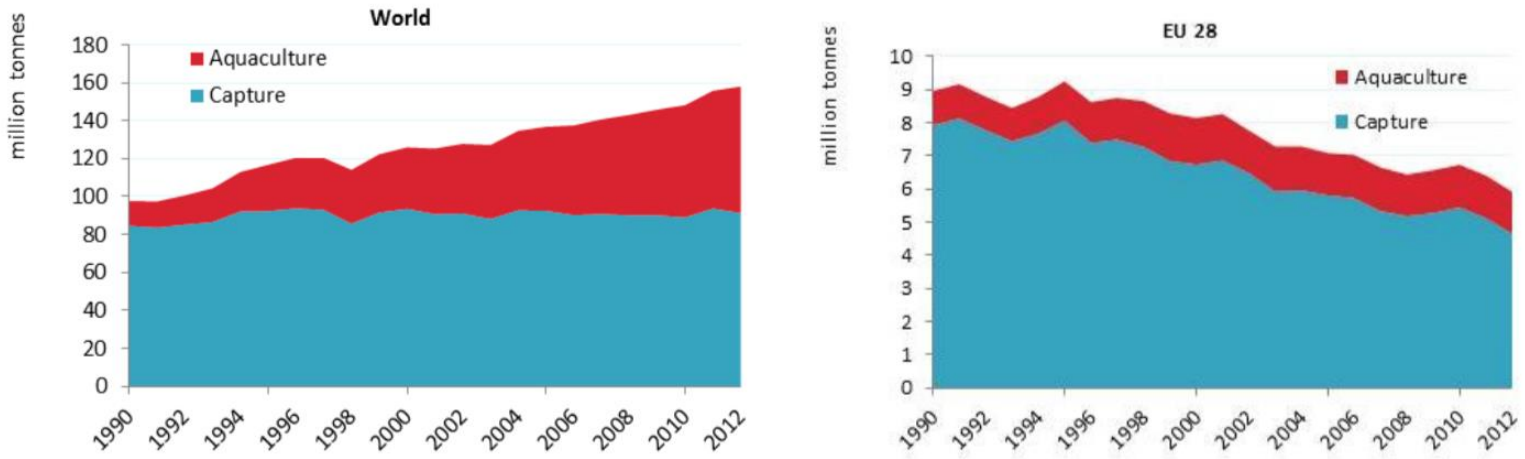


Figure 2.1: World and EU-28 seafood production (capture and aquaculture): 1990-2012.

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

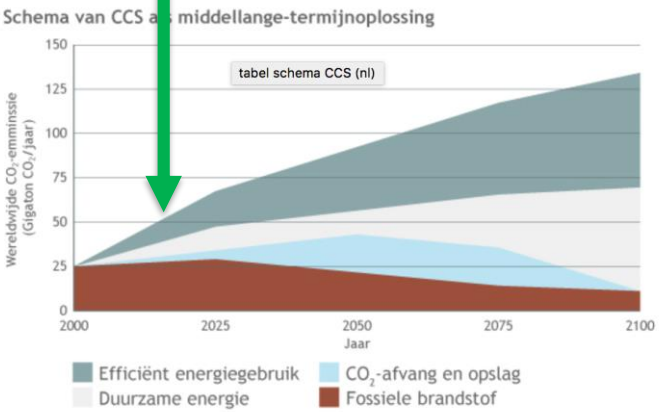
Algae are a real option
For example DSM & EVONIK announced an investment of € 200 million in algae based fish feed in 2017

IMPACT & VISION

1 hectare
100 ton CO_2 / yr

2017/2018

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



2018- 2022

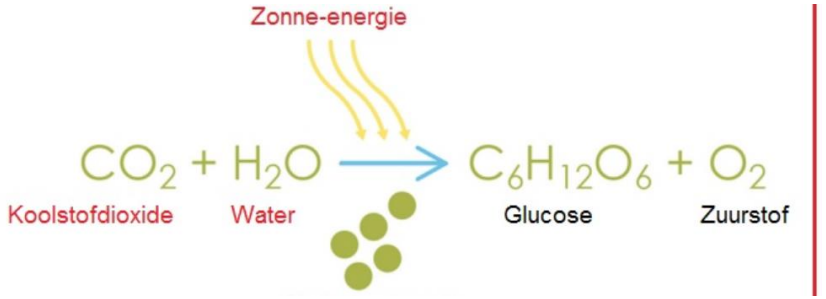
Large scale developments

- Prices drop
- New markets appear
- Serious circular CO_2 by algae technology.
- New jobs

2022- 2030

The production of algae for energy use.

2030- 2050



- **Algae are the most efficient photosynthetic organism**
- **Responsible for 50% of our oxygen supply**
- **Natural carbon sink in the ocean, start of the food chain**

Rotterdam: unique position to start

OCAP line & planning new CO_2 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_2 emmission

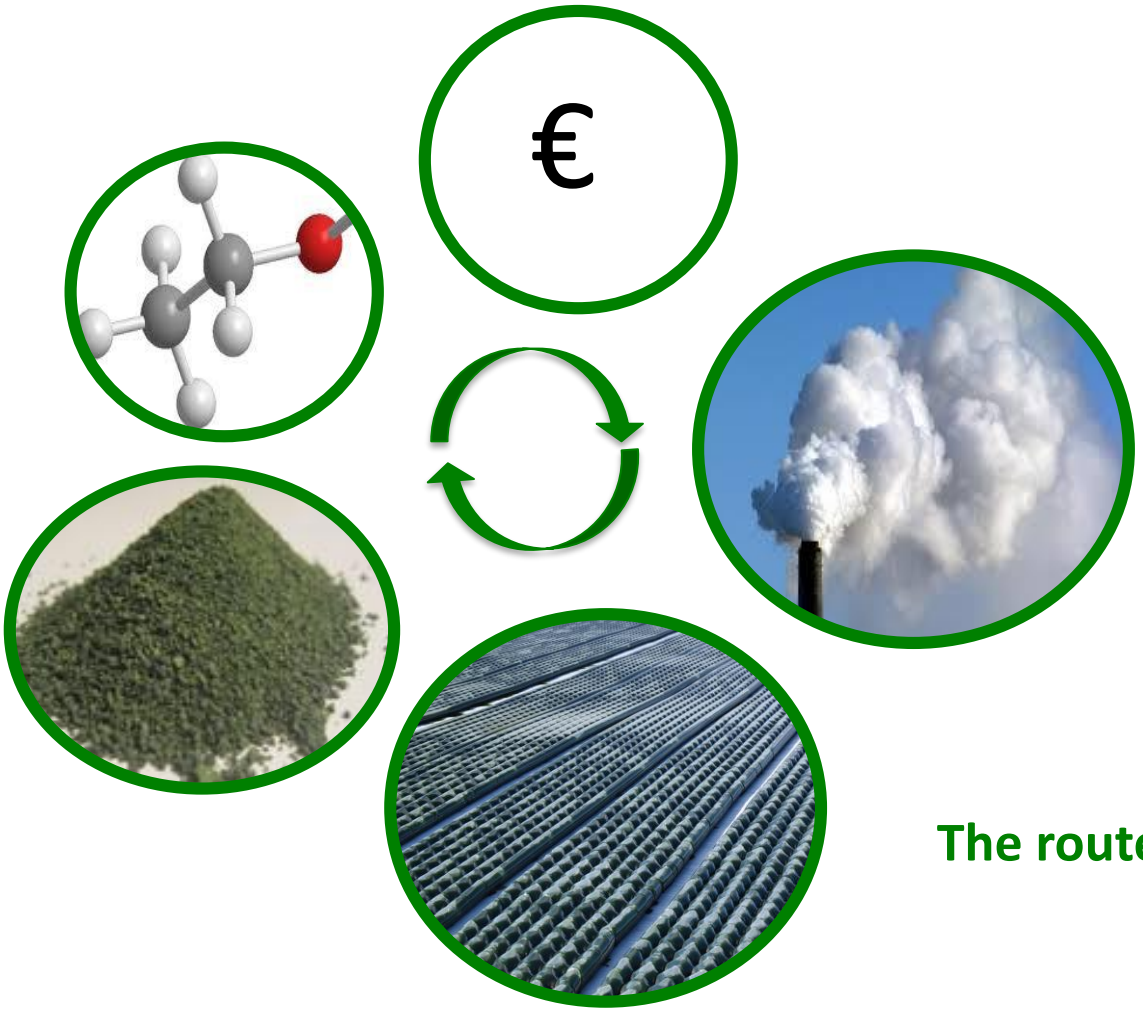
Shared risk for a new concept

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

circular algae business



The route to sustainable biomass for energy use