
Seaweedland
feeding the world sustainably
© Seaweedland

Why Seaweed

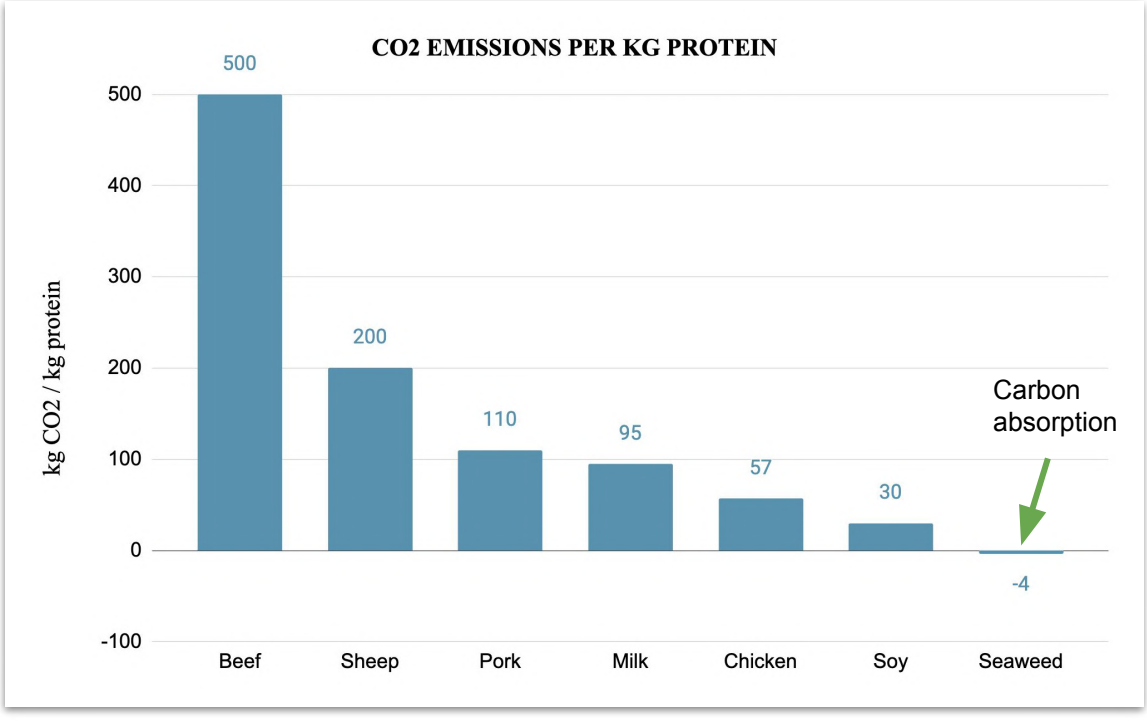
The challenge

- World population is expected to grow from 8 billion to 10 billion by 2057
- Demand for sustainable food and protein will grow
- Animal based protein relate to climate change and loss of biodiversity
- Soy protein lead to deforestation

The solution

- Seaweed is one of the greatest untapped resources on the planet
- Seaweed offers the most sustainable source of protein

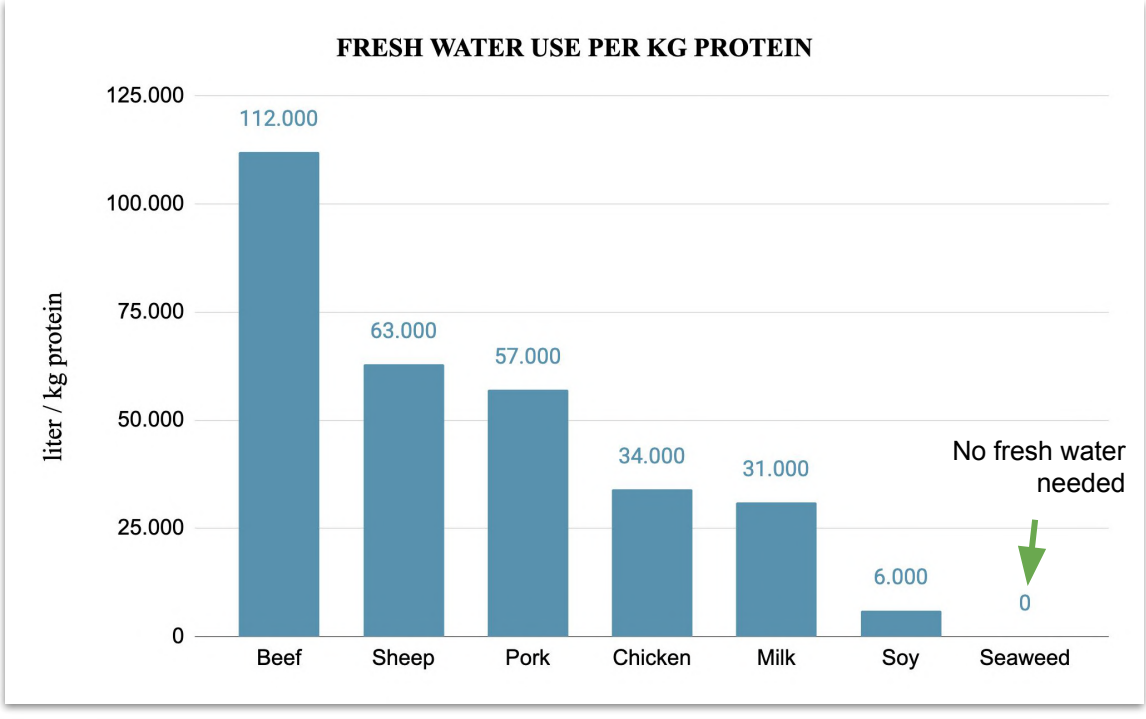
Why Seaweed



Source: Source: Joseph Poore and Thomas Nemecek (2018)

Seaweedland

Why Seaweed



Source: Source: Joseph Poore and Thomas Nemecek (2018)

Why Seaweed

Seaweed is healthy
Contains vitamins, minerals, fibers, omega 3 and proteins
Antibacterial, antiviral, anti-inflammatory, antioxidant, anti-ageing

Seaweed is sustainable
Generates oxygen, absorbs carbon dioxide
Reduces acidification of oceans

Seaweed grows fast
Doesn’t need fresh water

Our mission

Accelerate the transition towards sustainable food, feed and cosmetics

How

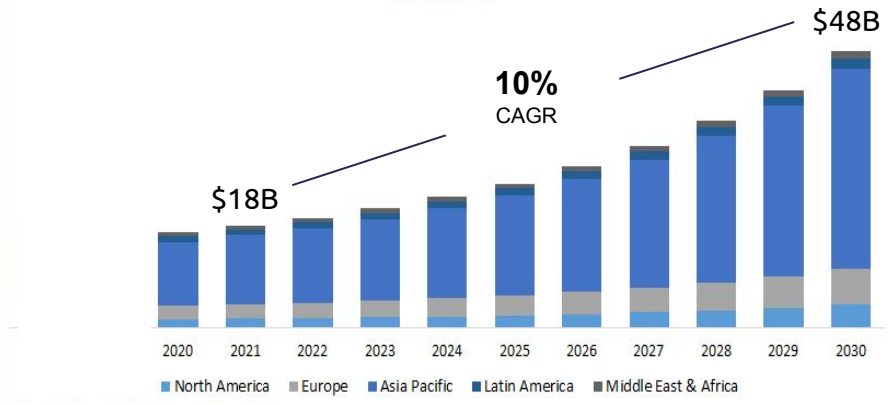
By creating the best in class, most efficient seaweed farm, on-land

photo of AlgaSpring - microalgae production

Our vision

Large scale, land based seaweed farms

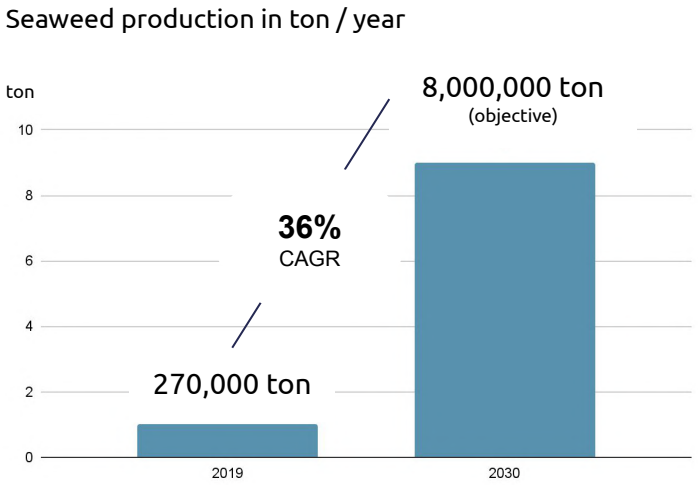
Global seaweed market



- 10% growth per year expected
- 40 mio ton per year in 2020
- 95% of production from Asia
- 97% through cultivation
- 77% for human consumption

Source: Polaris market research analysis

European seaweed market



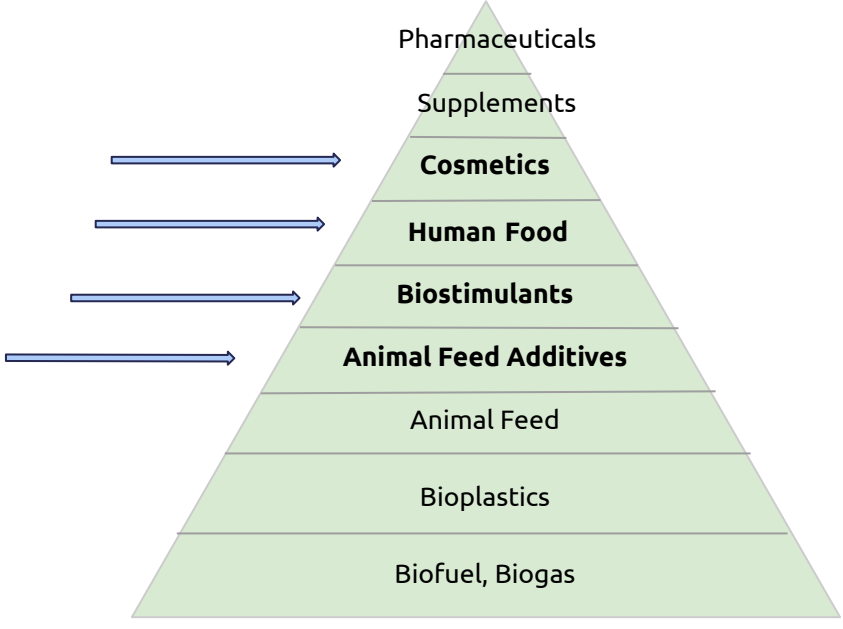
- Europe currently produces less than 1% of the global production of seaweed
- Growth through increasing demand for:
  - plant-based protein
  - sustainable food
  - natural ingredients
- The EU supports the seaweed sector as part of the EU Green Deal programs:
  "*Towards a Strong and Sustainable EU Algae Sector*"

EUROPEAN COMMISSION

Seaweedland

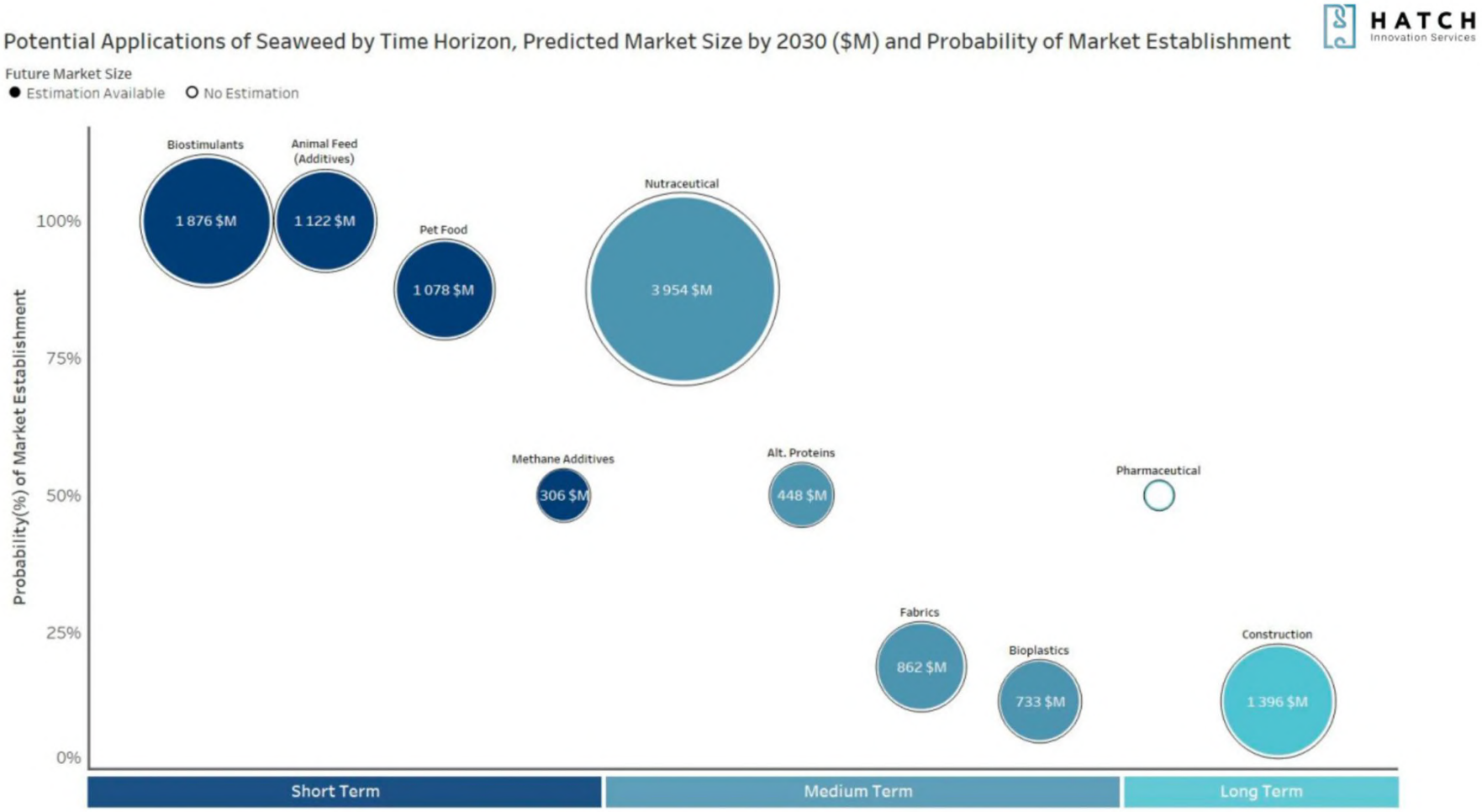
Source: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12780-Blauwe-bio-economie-naar-een-sterke-en-duurzame-algensector-in-de-EU_nl

Our target markets



Source: Day et al. 2016

Novel seaweed applications



Problems in seaweed cultivation at sea

- Inconsistent quality
- Seasonal supply
- Contamination by shellfish, plastics and sand
- Contamination by heavy metals
- Damage from storms and waves
- Unknown impact on marine ecosystems
- Shortage of suitable space at sea, especially in Europe

That's why we grow seaweed

ON LAND

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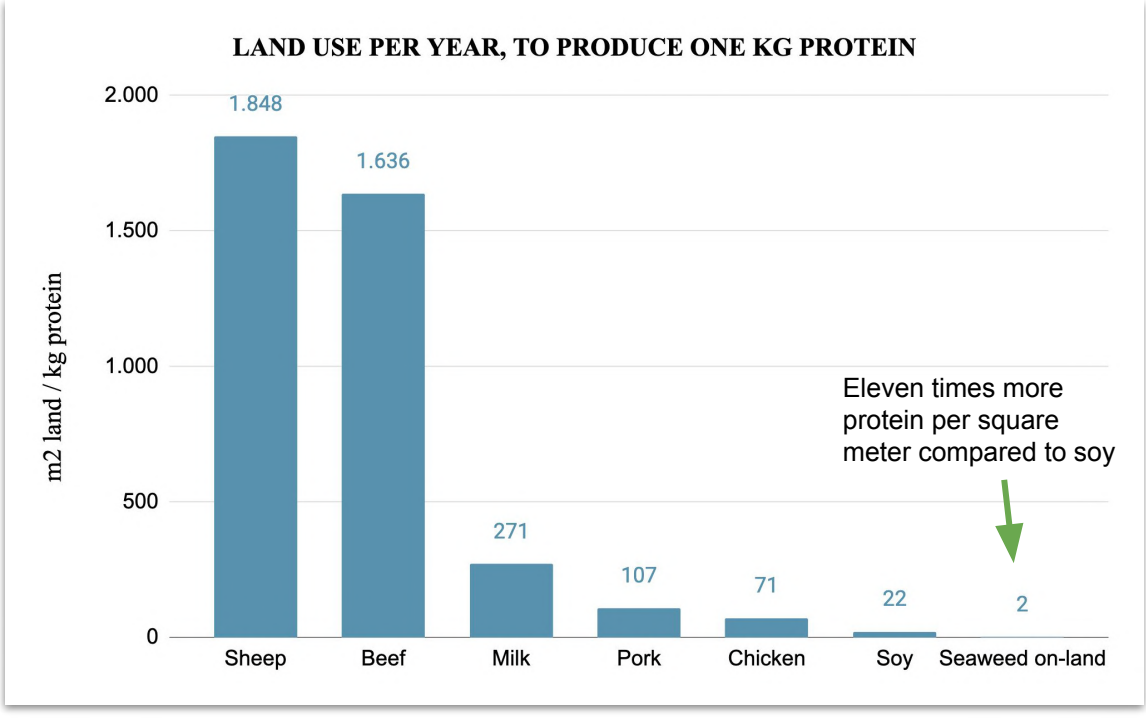
Seaweed on land

photo of microalgae production

Seaweed on land

Seaweed on land

… to create the most land-efficient protein production process



Source: Source: Joseph Poore and Thomas Nemecek (2018)

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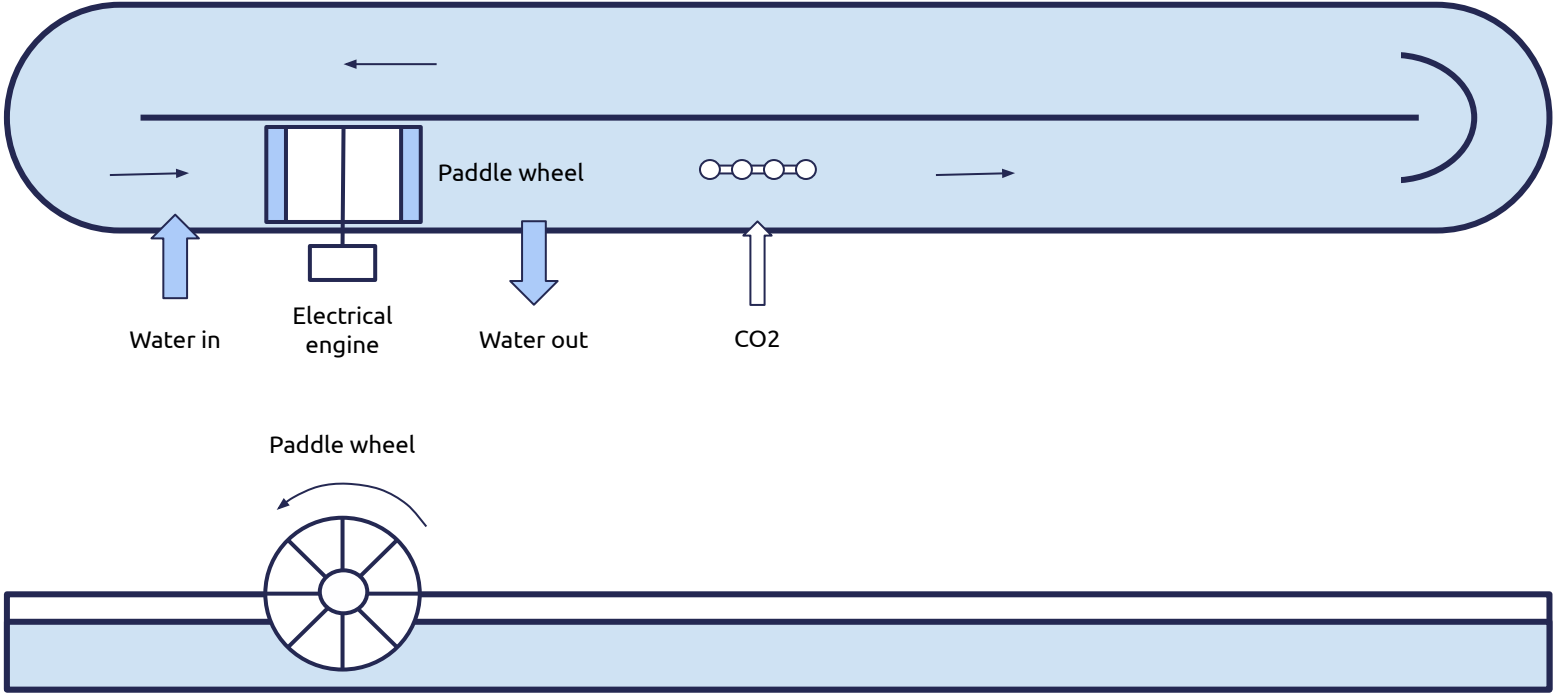
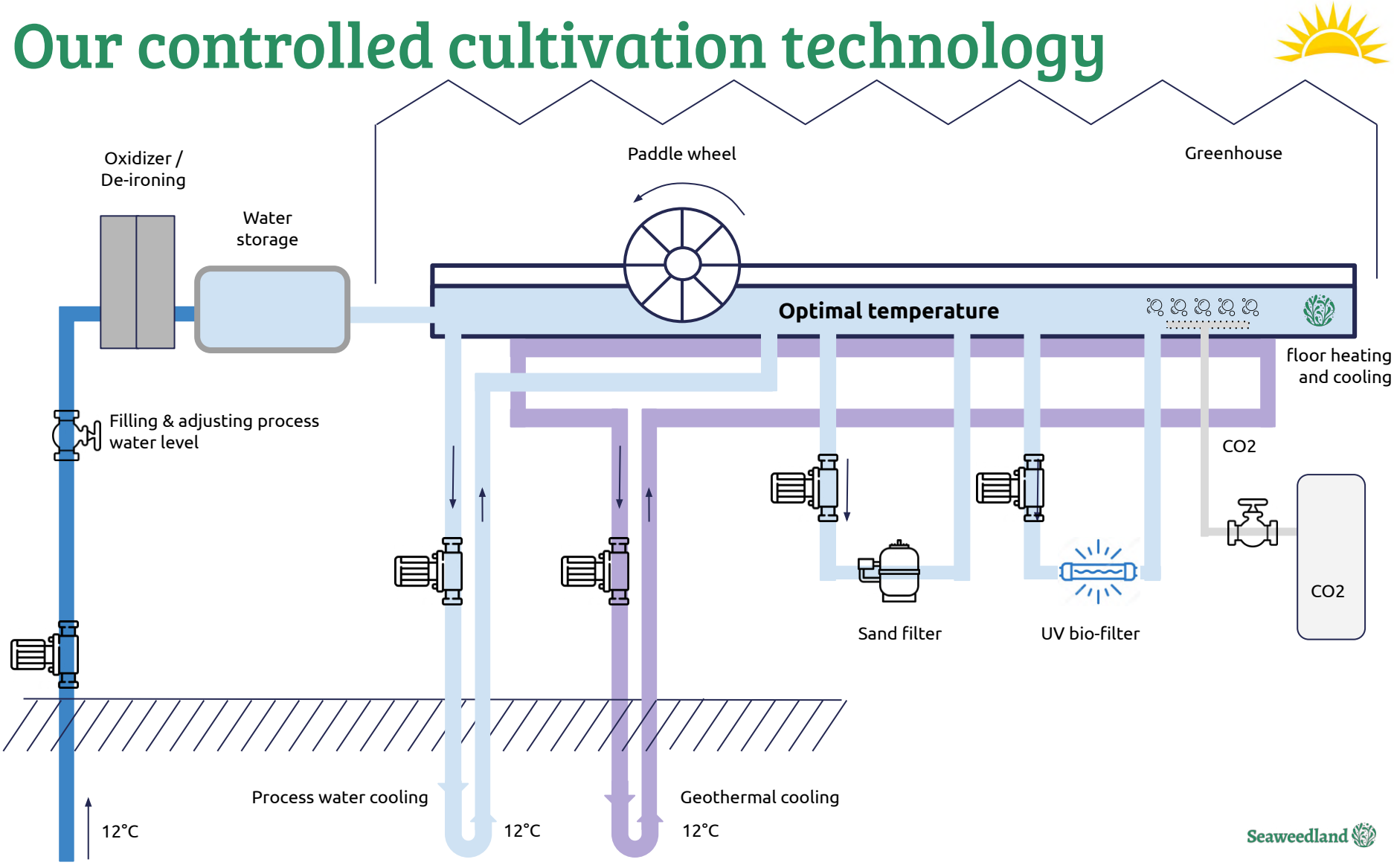
Benefits of seaweed on land

- Consistent quality
- Consistent supply
- Traceability
- Food safety
- High growth rate

Our raceway technology



Our controlled cultivation technology



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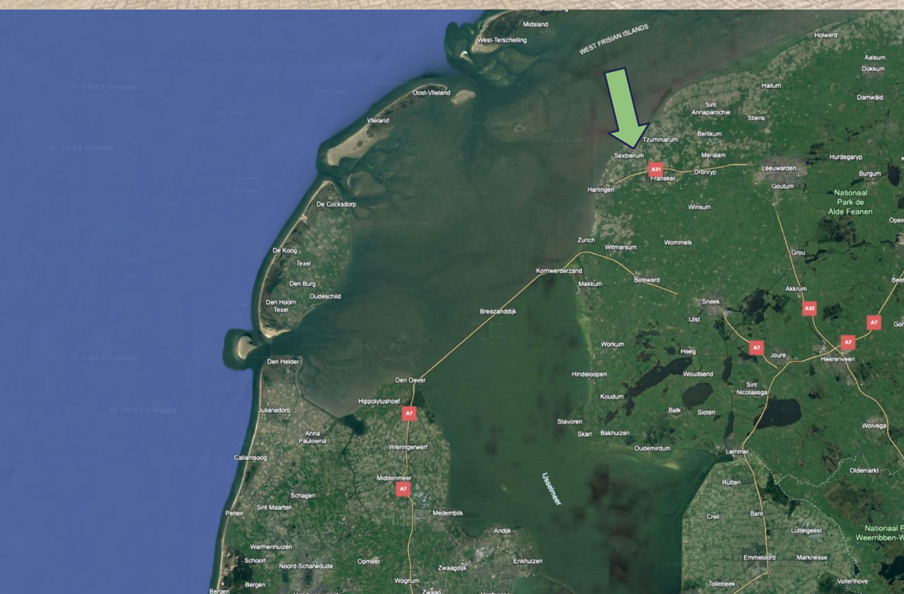
Benefits of our technology

- Controlled process
- Low tech
- Low investments
- Low operating cost
- Low energy consumption
- High growth rate
- Proven technology for microalgae cultivation

Our location

Sexbierum, Friesland

- pristine salt ground water available


Midsland
West-Terschelling
WEST FRISIAN ISLANDS
Holwerd
Aalsum
Dokkum
Oost-Vlieland
Vlieland
Hallum
Damwâld
Sint Annaparochie
Stiens
Berlikum
Tzummarum
Menaam
Hurdegaryp
Sexbierum
Dronryp
Leeuwarden
Burgum
Franeker
Harlingen
Goutum
Nationaal Park de Alde Feanen
De Cocksdorp
Winsum
Zurich
Wommels
Witmarsum
Grou
De Koog
Texel
Kornwerderzand
Makkum
Bolsward
Den Burg
Oudeschild
Akkrum
Sneek
Den Hoorn Texel
Breezanddijk
IJlst
Workum
Heeg
Joure
Den Helder
Heerenveen
Hindeloopen
Woudsend
Den Oever
Sint Nicolaasga
Koudum
Hippolytushoef
Balk
Sloten
Julianadorp
Stavoren
Anna Paulowna
Bakhuizen
Skarl
Wolvega
Wieringerwerf
Oudemirdum
Callantsoog
Lemmer
Middenmeer
Oldemarkt
IJsselmeer
Rutten
Schagen
Sint Maarten
Medemblik
Creil
Bant
Petten
Andijk
Lutteglest
Nationaal Park Weerribben-Wieden
Warmenhuizen
Schoorl
Noord-Scharwoude
Opmeer
Enkhuizen
Emmeloord
Marknesse
Zwaagdijk
Vollenhove
Bergen aan Zee
Bergen
Heerhugowaard
Wognum
Zwaag
Venhuizen
Tollebeek
Urk
Kraggenburg
A31
A32
A7

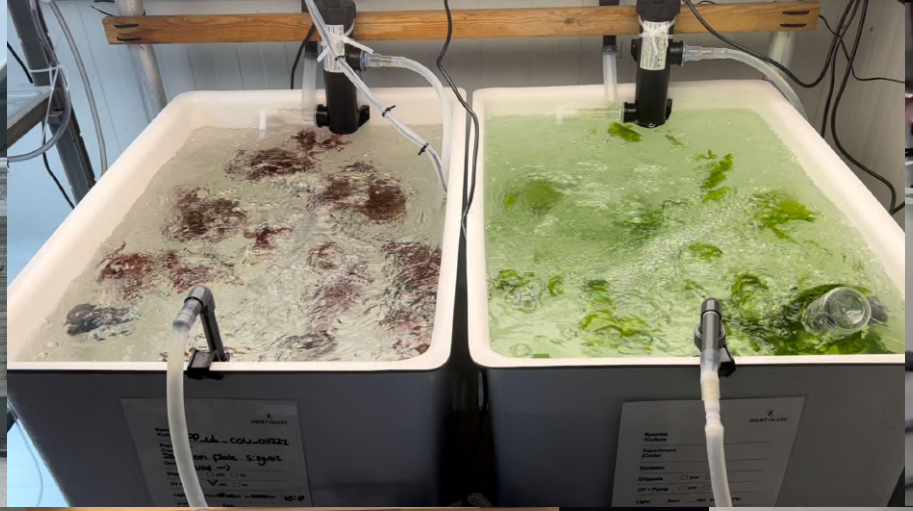

Dijksdaart
stichting molen de Korenaar CA
IKC De Skeakel
Sexbierum
Huisartsenpraktijk Bijlmenstate
Pietersbierum
Ropta State
Opvaart

Why Sexbierum

Favorable eco-system for on-land seaweed cultivation

- Salt ground water available
- Affordable greenhouses, currently empty, available
- Affordable offices available
- Affordable warehouses for post-processing, e.g. drying and packaging, available
- Relevant companies and customers in the region
  - Seaweed Food Solutions / Royal Smilde - Heerenveen
- Leading water and raceway technology partners in the region
  - Hubert Stavoren - paddle wheels - Friesland
  - DL Plastics - liners - Friesland
  - Remon - water technology - Friesland
- Financial institutions in the region
  - NOM - convertible loans provider and investor
  - Waddenfonds - grants provider
  - SNN - grants provider
- Knowledge institutes and young talent
  - Van Hall Larenstein University of Applied Sciences
  - Hanze University of Applied Sciences
  - RUG
  - CEW, Wetsus, Water campus
- Aquaculture and fisheries knowledge in the region
  - Lenger Seafoods - Harlingen

Our laboratory and pilot plant set-up


Our seaweeds

Our seaweeds

Palmaria Palmata

Dulse

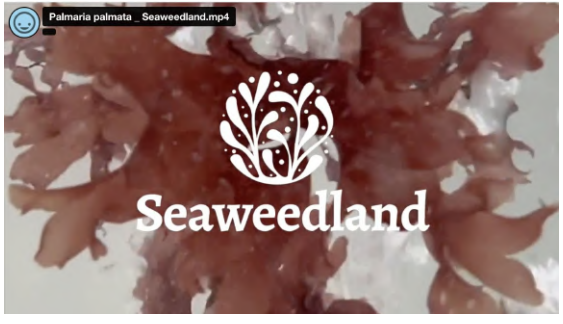
Ulva Lactuca

Sea lettuce

Asparagopsis Armata

Harpoon weed

Palmaria Palmata

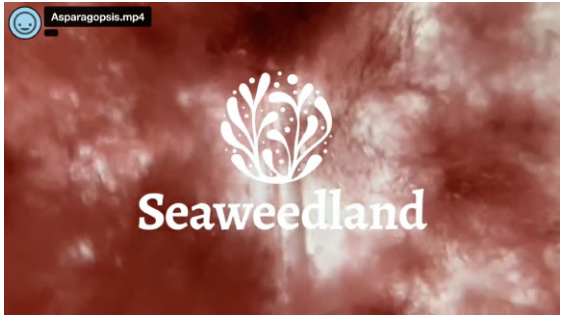


https://vimeo.com/844154513/dcc8178f7e

Ulva Lactuca

https://vimeo.com/845206295/450047f321

Asparagopsis



https://vimeo.com/824090930/0455488df4

Palmaria Palmata

Dulse

- 30% protein, dietary fiber, vitamins and minerals
- Optimal growth at 12 °C
- Vegetarian bacon - Bacon flavor and texture, salty, smoky, nutty flavor, umami

Food

- Snacks, egg dishes, mayonnaise, vinaigrettes, vegetables, grain and pasta salads
- Added to soup, miso, risotto, pasta sauces or stewed vegetables
- Salt substitute and spices
- Added to bread, crackers, cakes and brownies for a special touch

Food supplements

- Bone supporting minerals, magnesium and calcium, iron and sodium and potassium

Cosmetics

- Strong and healthy skin, activates blood microcirculation and moisturizes

Seaweedland


BURLAP & BARREL
SINGLE ORIGIN SPICES
PURPLE DULSE
Seaweed Flakes
GULF OF MAINE
WWW.BURLAPANDBARREL.COM

Ulva Lactuca

Sea lettuce

- 20% protein, dietary fiber, vitamins and minerals
- Optimal growth at 20 °C

Cosmetics

- Skin care and cosmetic products
- Anti-wrinkle, anti-aging, antioxidant, anti-inflammatory and antibacterial
- Wound healing

Food

- Flavor enhancer, salt substitute
- Salads, soups, crackers, snacks, fries, bread, alternative meat, proteins

Food supplements

- Iodine, Omega 3, Prebiotics, Fiber, antioxidant, improves bone health

Biostimulant

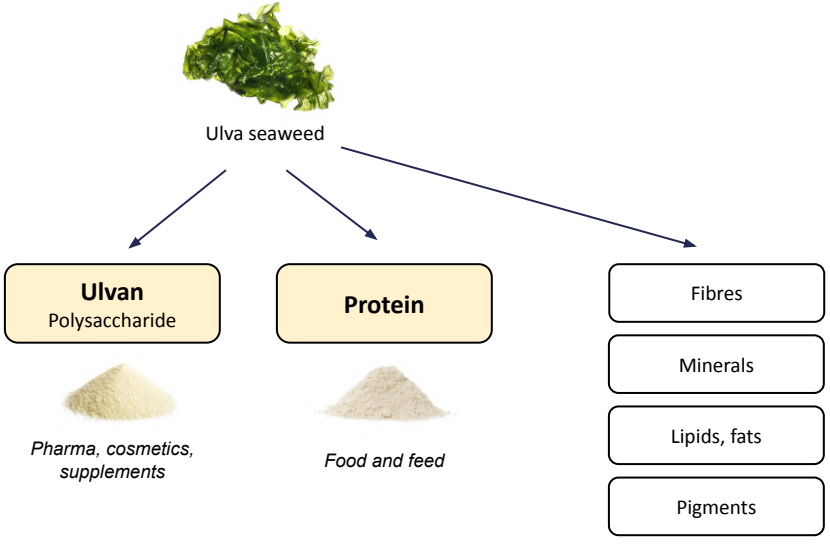
- Increase of vegetative growth, leaf chlorophyll content, stomata density and photosynthetic rate
- Increase of fruit production
- Increased levels of plant defense enzymes

Seaweedland

'Hybride-vlees'

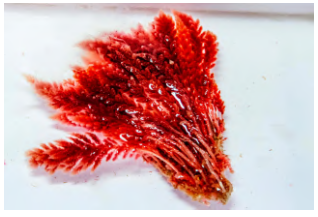
Minder vlees op menu: KLM denkt na over hamburger met zeewier

Extraction: Ulvan



- Bio active ingredient
- **Sulphated polysaccharide** located in the cell walls of green algae
- Variety of **biological activities** for cosmetic and pharmaceutical applications:
  - antibacterial, antiviral
  - antioxidant, anti-aging
  - anticoagulant
  - anti hyperlipidemic
  - anticancer
  - immunomodulating
- Skin care
- Wound healing

Asparagopsis Armata



Harpoon weed

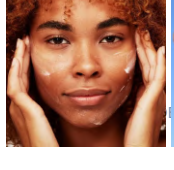
- Optimal growth at 20 °C

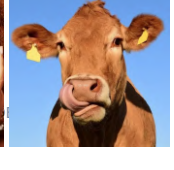
Feed additive

- Bromoform, as active component for methane reduction
- Methane reduction of ruminant

Cosmetics

- Extracts
- Antioxidant, anti-ageing
- Hydration, uniformity of complexion, firmness, density and elasticity, fat reduction, anti-wrinkle





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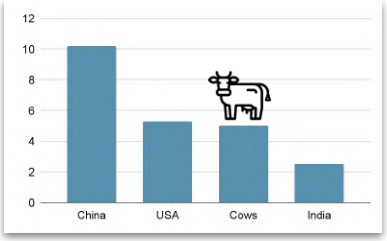
If cattle were a country, it would rank third in greenhouse gas emissions.

Bill Gates

CO2e emissions per year [Gigatons]



Cattle that consumed 80 grams of Asparagopsis seaweed per day burped out 82% less methane into the atmosphere.

University of California March 17, 2021

With greater control over the operating environment including water quality, temperature and harvesting frequency, on-land aquaculture systems could become the dominant production system for Asparagopsis.

Commonwealth Bank Australia, Beef Central, 04/10/2022

Investments in Asparagopsis

Bill Gates just invested in a startup that's trying to stop cows from burping and farting so much

Huileng Tan Jan 25, 2023, 6:00 AM

Bill Gates' Breakthrough Energy Ventures has backed Australian climate tech firm Rumin8. Dimitrios Kambouris/Getty Images

- Bill Gates-founded Breakthrough Energy Ventures led a $12 million seed funding round into Rumin8.
- The Perth-based startup is developing a seaweed-based feed aiming to cut methane from livestock emissions — like the burps and farts of cows.
- A byproduct of the digestion process, methane, is the most common greenhouse gas after carbon dioxide.

Rumin8

1 September 2023, at 1:00pm

CH4 Global raises $29 million to expand operations

The climate technology company, which aims to use seaweed to cut methane emissions associated with animal agriculture, has announced the funds will be used to grow the scale of seaweed production.

Asparagopsis, a red seaweed, can be added to animal feeds to reduce methane emissions by up to 90 percent © CH4 Global

Investments in Asparagopsis

Fonterra expands seaweed trial

By Jim Cornall
03-May-2022 - Last updated on 03-May-2022 at 09:01 GMT

Asparagopsis is a common seaweed native to the waters of Tasmania and New Zealand. Pic: Fonterra

RELATED TAGS Fonterra Dairy Seaweed Methane Csiro

In partnership with Australian company Sea Forest, Fonterra is looking at the potential Asparagopsis seaweed has in reducing methane in a grass-fed farming system.

Danone ventures arm invests in seaweed-based methane busting feed additive

By Jane Byrne
27-Jun-2022 - Last updated on 27-Jun-2022 at 15:27 GMT

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© GettyImages/Duncan_Andison

RELATED TAGS Seaweed Beef Cattle Dairy Methane Emissions

Danone Manifesto Ventures, the corporate venture arm of food and beverage company Danone, led a US$7m Series A funding round in Symbrosia, a Hawai'i-based startup that has developed a feed additive made from red seaweed.

The company claims that the Asparagopsis taxiformis-derived product, SeaGraze, reduces livestock methane emissions by over 80%.

Pilot customers

Pilot customers

Food

Seaweed Food Solutions

Royal Smilde Foods

MA menken van den assem fresh & frozen food

What's Cooking?

Cosmetics

Lubrizol

Agrimer Algues Marines

LESSONIA cosmetics + ingredients

Biotechnologies GREENSEA Marine Bioactives

EXSYMOL Monaco

Gelyma

Feed additives

ADISSEO A Bluestar Company

SKRETTING a Nutreco company

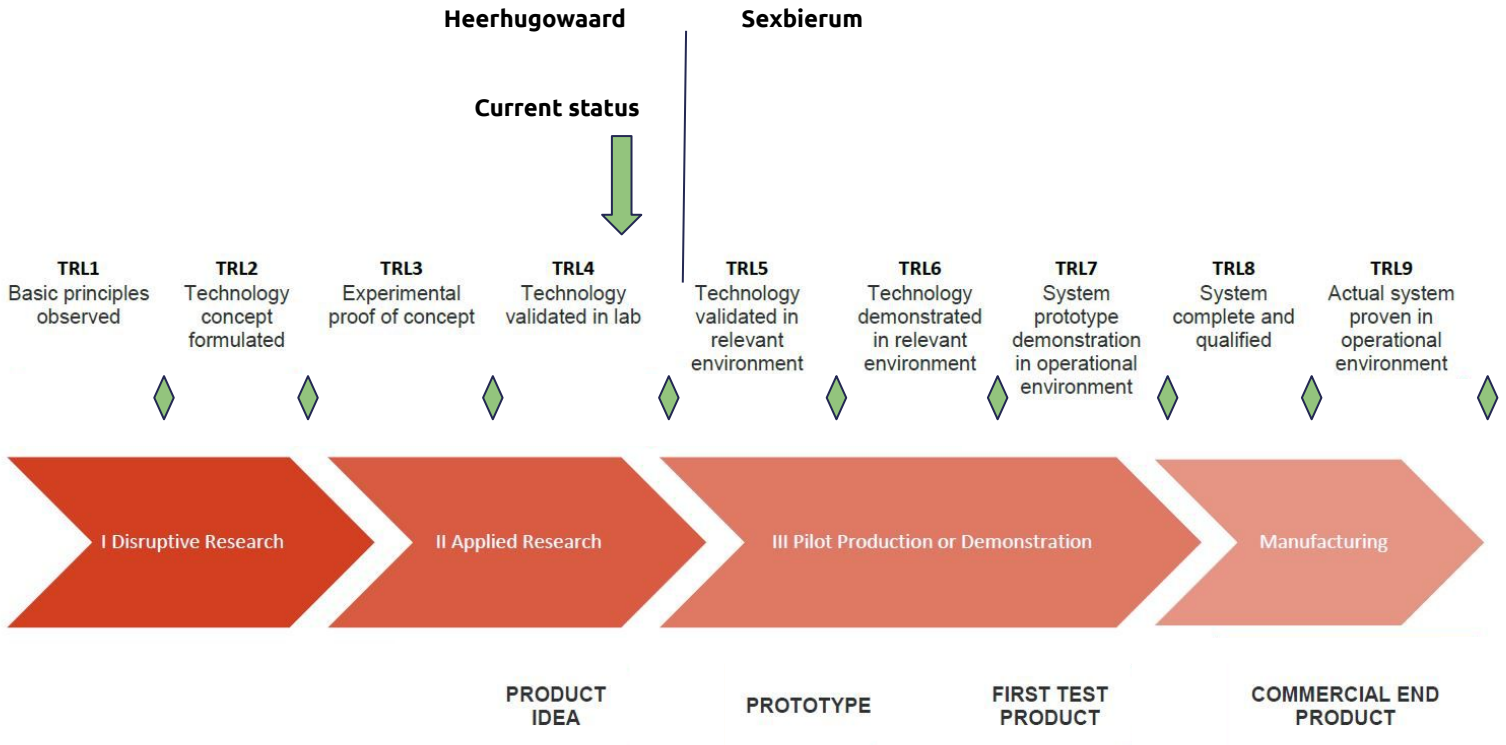
Alltech COPPENS

Biostimulants

ABUNDIGRO nurturing soil biology

Status

Technology Readiness Levels



Technology Readiness Levels

				Scope	Seaweed	Location	Status
Research	TRL 1	Basic principles observed	Principles postulated and observed	Concept & growth model		Seaweedland	Done
	TRL 2	Technology concept formulated	Concept and application formulated	R&D proposal, R&D budget		Seaweedland	Done
	TRL 3	Proof of concept	First lab test completed; proof of concept	10 liter tank	Ulva, Palmaria	Hortimare lab & hatchery	Done
				200 liter tank	Ulva, Palmaria	Hortimare lab & hatchery	Done
	TRL 4	Small scale prototype	Technology validated in lab	1,000 liter tank (ø1.5 m / 2 m2)	Ulva, Palmaria	Hortimare greenhouse, Heerhugowaard	Done
				1,000 liter raceway (5 x 1 m)	Ulva, Palmaria	Hortimare greenhouse, Heerhugowaard	Current
Development	TRL 5	Large scale prototype	Technology validated in relevant environment	30,000 liter raceway (25 x 3 m)	Ulva, Palmaria	Greenhouse Sexbierum	
	TRL 6	Prototype system	Tested demonstrated in relevant environment	400,000 liter raceway (100 x 4 m)	Ulva, Palmaria	Greenhouse Sexbierum	
	TRL 7	System prototype demonstration	Pre-commercial scale	2x400,000 liter raceway (100x10m)	Ulva, Palmaria	Greenhouse Sexbierum	
Deployment	TRL 8	System complete and qualified	Manufacturing issues solved	8x400,000 liter raceway (100x10m)	Ulva, Palmaria	Greenhouse Sexbierum	
	TRL 9	Actual system proven in operational environment	Technology and product available for consumers	8x400,000 liter raceway (100x10m)	Ulva, Palmaria	Greenhouse Sexbierum	

Growth rate experiments

Palmaria Palmata

- 12 °C
- Optimal temperature

Daily growth rate

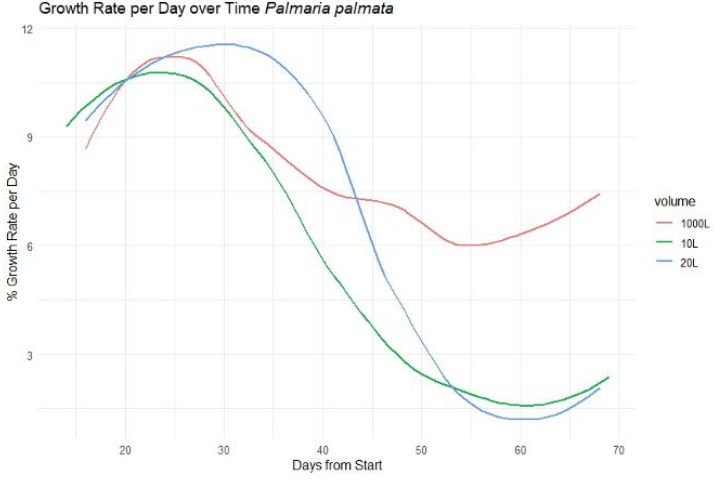
- 1,000 liter tanks
- 6% - 11% DGR

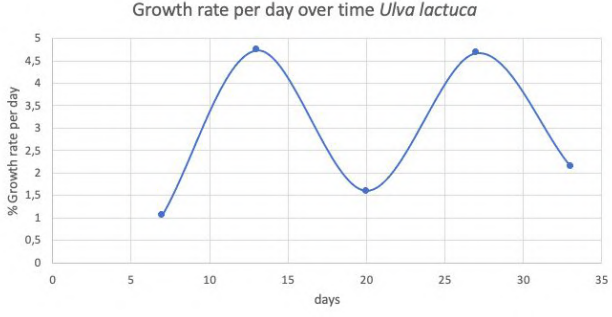
Ulva Lactuca

- 12 °C
- Non-optimal temperature

Daily growth rate

- 200 liter tanks
- 1% - 5% DGR





Seaweedland

Support Letters

DocuSign Envelope ID: 7C5086F6-0741-43E4-8F10-CB1F24906A53

SKRETTING
a Nutreco company

Seaweedland
Attn. Mr. S.J. Rusticus
Oudegracht 313
3511 PB Utrecht
The Netherlands

Sept 02.2022

Subject: Letter of Support for project: On-land Seaweed Cultivation

Dear Mr Rusticus,

With great interest I have taken notice of your On-land Seaweed Cultivation project, which you will deploy within Seaweedland, in cooperation with partner companies.

Skretting is part of Nutreco and is a global leader in the production of animal and fish feed.

We are continuously looking for new ingredients that improve our products, lower the cost price of our products and improve sustainability.

We support the development of new cultivation methods of seaweed that can be used as a source of sustainable proteins.

By implementing new technologies, a breakthrough can be created in seaweed quality, in protein quality derived from seaweed, in reliability and in cost price.

Therefore we support your project very much and we would appreciate it to be kept informed of further progress of this project.

Sincerely,

Robert van den Breemer
DocuSigned by:
Robert van den Breemer
Nutreco Mexico Procurement Director
02-09-22

INDUSTRIAS ROKO, S.A.

Seaweedland
Attn. Mr. S.J. Rusticus
Oudegracht 313
3511 PB Utrecht
The Netherlands

September 7, 2022

Subject: Letter of Support for project: On-land Seaweed Cultivation

Dear Mr Rusticus,

With great interest I have read and taken notice of your On-land Seaweed Cultivation project, which you intend to deploy within Seaweedland, in cooperation with partner companies.We support the development of new cultivation methods of seaweed in order to improve the quality, the reliability and the cost price of seaweed.

We believe that by implementing new technologies, like segmented cultivation tanks in combination with artificial light, a breakthrough can be created in seaweed cultivation.

Our company INDUSTRIAS ROKO is a leading producer of hydrocolloids from seaweeds in Europe. Our products are used in the food, cosmetics and pharmaceutical industry.

We are a large processor of seaweed and the largest Agar (hydrocolloid) producer in Europe. Therefore we understand the many challenges that exist in the seaweed supply chain, which is currently characterized by volatility in both supply, price and quality.

Therefore we support the development of new technologies that ensure a stable supply of seaweed at the desired quality and the right cost price.

For this I consider Seaweedland very well capable of tackling this challenge and implementing it successfully.

I would like to be kept informed of the further progress of this project.

Sincerely,

INDUSTRIAS ROKO, S.A.
Polígono de Silvota
Llanera
Teléfono 26 11 71. — OVIEDO

Jorge Aler Lanz
Managing Director

Registro Mercantil de La Coruña, Tomo 168, Libro 56, Folio 9, Hoja 485, Inscripción 2ª - N.I.F. A-33016155

Fábrica:
Polígono de Silvota
C/ Peña Brava, 25
33192 LLANERA (Asturias)

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compras@rokoagar.com
laboratorio@rokoagar.com

Tfnos.: 985 261 171
985 260 864
985 263 132
Fax: 985 269 184

Seaweed
FOOD SOLUTIONS

Seaweedland
Attn. Mr. S.J. Rusticus
Oudegracht 313
3511 PB Utrecht
The Netherlands

September 11, 2023

Subject: Letter of Support for Seaweedland

Dear Mr Rusticus,

With great interest we have taken notice of your seaweed cultivation developments in the north of the Netherlands, which you will deploy within Seaweedland.

Seaweed Food Solutions is a participation of Royal Smilde, a European leader in food solutions and ingredients.

We are continuously looking for new sources and applications for seaweed that improve our products, lower cost price and improve sustainability.

We support the development of new cultivation methods of seaweed that can be used as a source of sustainable food.

By implementing new technologies, a breakthrough can be created in seaweed quality, consistency in supply, food safety and cost price.

Therefore, we support Seaweedland in its mission to develop new technologies and applications for seaweed that will accelerate the transition towards sustainable food.

Sincerely,

Berend Tillema
Seaweed scientist & quality control

Royal Smilde Foods

Seaweedland

Commitment and trials

Food industry

- Trials are being done
- Seaweed Food Solutions is testing our freshly frozen seaweeds
- “For 5 euro per kg fresh seaweed, Seaweed Food Solutions is interested to buy tonnes of seaweed.”

Cosmetics

- Lubrizol is testing seaweed (in their lab in Texas) for extraction of polysaccharides.

Our team

Our team

Management team

Sven Rusticus
Co-Founder and CEO
Msc. Mechanical Engineering
Delft University
MBA RSM Erasmus University
Founder GreenTown Curaçao
Gemini Consulting
AkzoNobel

Anko Kuil
Co-Founder and CQO
MSc. Pharmacy
Utrecht University
MBA IESE Barcelona
Pharmacist and Pharma entrepreneur
Novartis

R&D partner: breeding & propagating seaweed

Haik van Exel
CEO Hortimare
Seaweed breeding & propagating

Ligia Ayres
Scientist Hortimare
Seaweed breeding & propagating

Gianluca Bizarro
Scientist Hortimare
Seaweed breeding & propagating

Josh Mantel
Technical Manager
Seaweed breeding & propagating

Suzan Vellekoop
Project manager
Seaweed breeding & propagating

Mabel Horst
Scientist
Seaweed breeding & propagating

Academic support

Rob van Haren
Professor Bio Based Economy
Hanzehogeschool Groningen

Antoinette Kazbar
Bio Process Engineering
Wageningen University & Research

René Wijffels
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Our network

HORTIMARE BREEDING & PROPAGATING SEAWEED	Hanzehogeschool Groningen University of Applied Sciences	WAGENINGEN UNIVERSITY & RESEARCH	cew centre of expertise water technology
van hall larenstein university of applied sciences	KC GROUP subsidieadvies	LANDING AQUACULTURE	GOA VENTURES
signify Our global brands are PHILIPS interact	BUCON industries	Murre Technologies Total solutions for food processing	NOM
PORT OF HARLINGEN	Lubrizol	SKRETTING a Nutreco company	ROKO

Future potential locations


Seaweed cultivation locations in
Europe
Oostzee
Riga
Edinburgh
Noordzee
Vilnius
Minsk
Минск
Denemarken
Verenigd Koninkrijk
Wit-Rusland
Dublin
Manchester
Hamburg
Kiev
Київ
Polen
Berlijn
Birmingham
Amsterdam
Warschau
Londen
Nederland
Oekraïne
Duitsland
Praag
België
Moldavië
Luxemburg
Slowakije
Parijs
Wenen
Boedapest
München
Chişinău
Zwitserland
Slovenië
Milaan
Sarajevo
Servië
Sofia
София
Podgorica
Подгорица
Kosovo
Monaco
Noord-Macedonië
Rome
Albanië
Andorra
Porto
Barcelona
Madrid
Athene
Αθήνα
Tyrreense Zee
Lissabon
Spanje
Valencia
Alicante
Sevilla
Granada
Tunis
تونس
Algiers
مدينة الجزائر
Malta
Gibraltar
Middellandse Zee
Rabat

Bonaire

municipality of the Netherlands & part of the EU

Why Bonaire

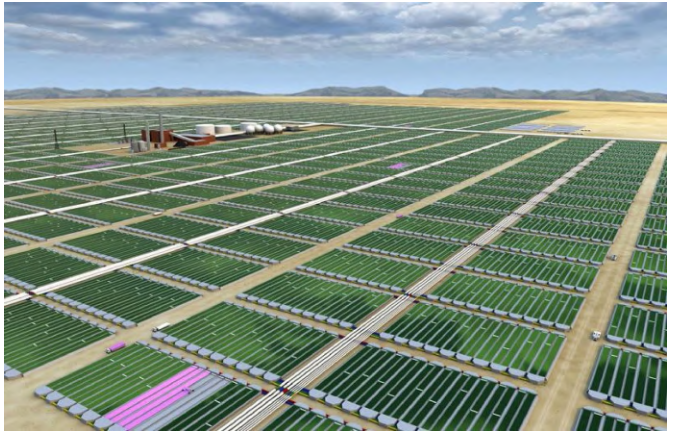
- Possible location at the former tank terminal
- Stable water temperature
- All year round cultivation
- Affordable land available
- Cooperative government
- Municipality of the Netherlands
- Dutch Universities are active on Bonaire
- Cooperation with AlgaeParc Bonaire

Meeting Government officials in Bonaire


Seaweed cultivation locations in
Africa
Ierland
Parijs
Berlijn
Polen
Warschau
Moldavië
Kazan
Казань
Tsjeljabinsk
Челябинск
Astana
Астана
Novosibirsk
Новосибирск
Alma-Ata
Алматы
Marseille
Kroatië
Servië
Barcelona
Rome
Madrid
Ankara
Georgië
Lissabon
Algiers
مدينة الجزائر
Tunis
تونس
Istanboel
Turkije
Athene
Αθήνα
Middellandse Zee
Teheran
تهران
Tasjkent
SINKIANG
Tunesië
Syrië
Irak
Noordelijke Atlantische Oceaan
Marokko
Jordanië
Iran
Afghanistan
Algerije
Libië
Cairo
القاهرة
Koeweit
Pakistan
Riyad
الرياض
Westelijke Sahara
Verenigde Arabische Emiraten
New Delhi
Djedda
جدة
Saudi-Arabië
Jaipur
Ahmedabad
Calcutta
Mauritanië
Rode Zee
Oman
Mumbai
Mali
Niger
Haiderabad
Sudan
Dakar
Senegal
Eritrea
Jemen
Bamako
Tsjaad
Madras
Djibouti
Burkina Faso
Bangalore
Coimbatore
Guinee
Benin
Nigeria
Sierra Leone
Ethiopië
Ghana
Centraal Afrikaanse Republiek
Liberia
Lagos
Kameroen
Abidjan
Accra
Golf van Guinee
Yaounde
Somalië
Gabon
Uganda
Kenia
MARANHÃO
Congo-Kinshasa
PARAIBA
ALAGOAS
SERGIPE
Tanzania
Dar es Salaam
Luanda
MINAS GERAIS
ESPIRITO SANTO
RIO DE JANEIRO
Angola
Zambia
Malawi
Lusaka
Mozambique
Port Louis
Indische Oceaan
Harare
Madagaskar
Namibië
Botswana
Zuidelijke Atlantische Oceaan
Pretoria
eSwatini
Lesotho
Durban
The Settlement
Kaapstad
Port Elizabeth
Alfred Faure

Social impact

- Coastal dry areas
- Local jobs and economic growth
- Local food and feed
- Sustainable local biostimulants and fertilisers
- Products for export
- Education and brain gain



Seaweedland

Conclusion

- Seaweed cultivation offers an attractive business model
- Seaweedland differentiates itself by offering high quality seaweed without contamination.
- Seaweedland offers consistent quality, a consistent supply and traceability of its seaweed production
- The global market for seaweed is growing at 10% per year
- There is a growing demand for natural ingredients for food, feed and cosmetics
- Seaweed offers unique properties to become a sustainable component for these industries
- Seaweed cultivation at sea has drawbacks: pollution, quality inconsistency, seasonality and limited space
- Seaweedland developed a technology that solves these problems via controlled on-land seaweed farming
- Seaweedland believes that on-land systems will become the dominant production systems for seaweed
- Seaweedland will be able to produce high quality seaweed at low cost
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We look forward to welcoming you as our partner.

Thank you!

Seaweedland

feeding the world sustainably