

AlgaeLinkages

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AlgaeLinkages

- Cultivation of microalgae for chicken feed on drainwater from greenhouses
- Collaboration between Dutch and Mexican companies and research institutes
- An AlgaePARC project

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An Outlook on...

Develop this process is a sustainable and economical way within the next 10 - 15 years

Review

Microalgae for the production of bulk chemicals and biofuels

To develop a more sustainable and economically feasible process, all biomass components should be used

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Techno-economic model

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Flat panel reactor south of Spain, 100 ha

INPUTS		Flat Panel	
Location	South of Spain	BIOMASS COST (€/kg)	2.95 €/kg
Cultivation system	Flat Panel	BIOMASS CAPACITY	7515 Tonne yr ⁻¹
Land	Rented land	ENERGY PRODUCTION COST	132 €/GJ
Photosynthetic efficiency	3.3 %	NER	1.48
% of facility to harvest	10 %	NER	1.48
Operation days per year	300 days	TOTAL COSTS	22.27 M€ yr ⁻¹
Mode of operation	Chemostat	CAPEX	4.89 M€ yr ⁻¹ (0.65 €/kg ² 32 %)
Daily dilution	27 %	OPEX	17.38 M€ yr ⁻¹ (2.30 €/kg ² 78 %)
Daily dilution in summer	27 %	Initial investment	70.2 M€
Maximum culture temperature	30 °C		
Minimum culture temperature	20 °C		
Nitrogen source	Urea		
Phosphorus recycling rate	0 %		
Nitrogen recycling rate	0 %		
Source of CO ₂	Commercial		
Flow velocity	0.32 m/min		
Flow velocity (night)	0.32 m/min		
Photoculture energy	No		

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TOTAL COSTS

Component	Percentage
Operational costs	27%
Capital cost: Building	38%
Capital cost: Major equipment	4%
Capital cost: Minor equipment	31%

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Conclusions techno-economic analysis

- Experimental results from AlgaePARC Pilot Facility
- Projections to 100 Ha facility for south of Spain
- Included biorefinery costs for different market scenarios

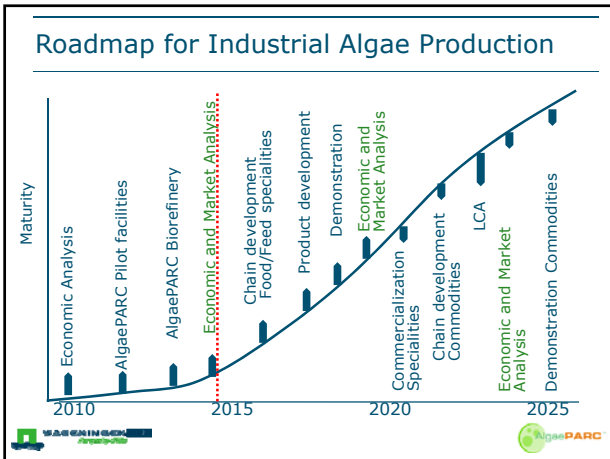
+ Biorefinery cost ~1 €/Kg

Market	Value (€/kg)
Biofuel	0.16
Commodities	< 2
Specialties	> 8

- Short term: high value
- Medium term: commodities

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Objectives and mission AlgaePARC

- Bridging the gap towards commercialisation of commodity products from microalgae
- Challenges
 - Reduction of production costs
 - Development of production chain
 - Market development

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AlgaePARC Pilot Facilities objectives (2011-2015)

- Comparison of different production systems
- Photosynthetic efficiency on sunlight of 5%
- Develop an improved reactor concept and/or process strategy in which the production costs and energy requirements are lowered
- Background information to design a large-scale production facility
- PPP with 19 companies
 - BASF, Bio Oils, Cellulac, Drie Wilgen, DSM, ExxonMobil, GEA Westfalia, Heliac, Neste Oil, Nijhuis Water Technology, Paques, Proviron, Roquettes, Sabc, Simris Alg, Suriname Staatsolie, Synthetic Genomics, Total, Unilever

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AlgaePARC biorefinery

- Fractionate all components
- Maintain their functionality
- At low energy input
- PPP with 12 companies
 - BASF, BODEC, Cellulac, DSM, Dyadic, Eskens, Evodos, EWOS, Gea Westfalia, POS Biosciences, Total, WAB

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European projects

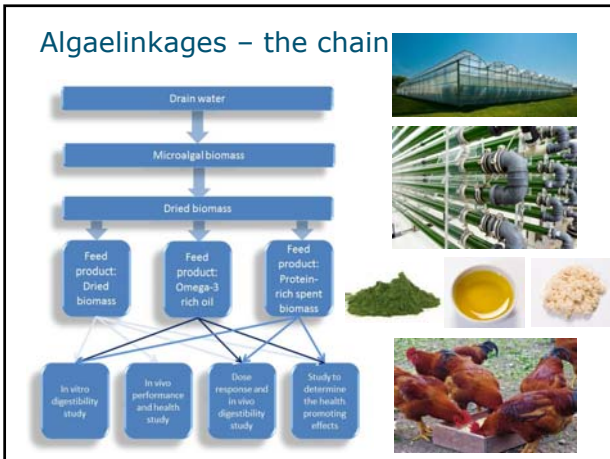
- INTESUSAL: demonstration project Portugal
- ALGADISK: biofilmreactor; pilot Spain
- FUEL4ME: biofuel project with pilots in Israël, Italy, Spain and Netherlands
- SPLASH: biomaterials project with pilots in Spain and Netherlands
- MIRACLES: biorefinery project for food and feed applications with pilots in Norway, Chile, Netherlands and Spain

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Algae linkages

- Problems in horticulture Mexico
 - Lack of water
 - High concentrations of nutrients in drainwater
 - Recirculation of drainwater limited because of salinity
- Why microalgae?
 - Microalgae efficient in uptake of nitrate and phosphate under saline conditions
 - Microalgae interesting for feed
 - Protein
 - ω-3-fatty acids
 - Pigments

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Project granted by TKI Agrifood en CBBE

- TKI AGRIFOOD International: Goal to promote the development of new business internationally
- CBBE (Centre for Biobased Economy): Goal to implement Biobased economy in the education of students from Wageningen UR and 7 universities of applied sciences

Total budget: 1.8 MC
Contribution TKI and CBBE: 0.9 MC

Benefits AlgaePARC for stakeholders

- Wageningen UR
 - Research and education organization in the algae field
- Industry
 - Expand business in new markets
 - Synergy in investments resulting from collaboration
- Government
 - New jobs in R&D and commercial activities
- Europe
 - Independency in feedstock supply

AlgaePARC
Production & Research Centre

AlgaePARC
Biorefinery

European
Projects

Dutch Research
Council

Industrial partners

Arke, Avantium, BAM, BASF, BAS, Biogas Fuel Cell, BioOils, Biotopic, Bodec, Caglar Dogal Ununler, Cellulac, Cripeye, Desah, Drie Wilgen, DSM, Dyadic, Eco Treasures, Evodos, EWOS, ExxonMobil, Feyecon, Fitoplankton Marino, Fotosintetica & Microbiologica, GEA-Westfalia, Heliae, IDConsortium, Imenz, Infors, Lankhorst, LifeGlimmer, MFKK, NATAC, Neste Oil, Molcim, Nijhuis, Omega Algae, ONVIDA, OTEC, OWS, Paques, POS Bioscience, PNO, Prominent, Proviron, Rhodia, Rodenburg Biopolymers, Roguette, Sabic, Simris Alg, SPAROS, Suriname Staatsolie, Synthetic Genomics, Total, Umwelt-Technie, Unilever, VET

Academic partners

Ben Gurion University of the Negev, Cambridge University, Centre for Research and Technology Hellas, Cranfield University, CSIC, ECN, Ege University, Fraunhofer, INRA, Joanneum Research, Qingdao Institute of BioEnergy and Bioprocess Technology, Rijksuniversiteit Groningen, Technical University Delft, Thomas Moore Kempen, Uni Research, Universität Bielefeld, Universidad de Antofagasta, University of Bergen, University of Huelva, University of Las Palmas de Gran Canaria, University of Nordland, University of Utrecht, VITO, VU Amsterdam, Westfälische Wilhelms-Universität Münster

www.AlgaePARC.com