

GERM - ALGAE

Green Eco-efficient Renewable Materials



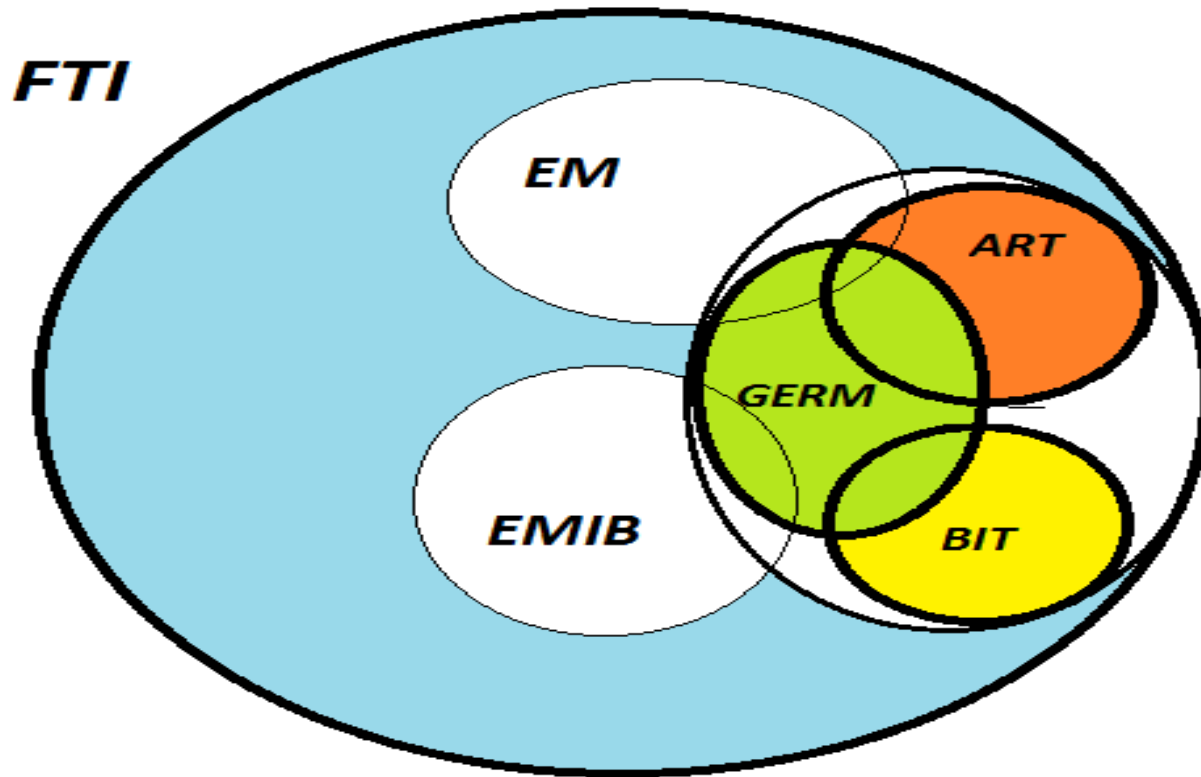
GERM

Green Eco-efficient Renewable Materials
University of Antwerp

S.M.F. Tavernier
15 oktober 2014



GERM-research group
FTI -research-cluster



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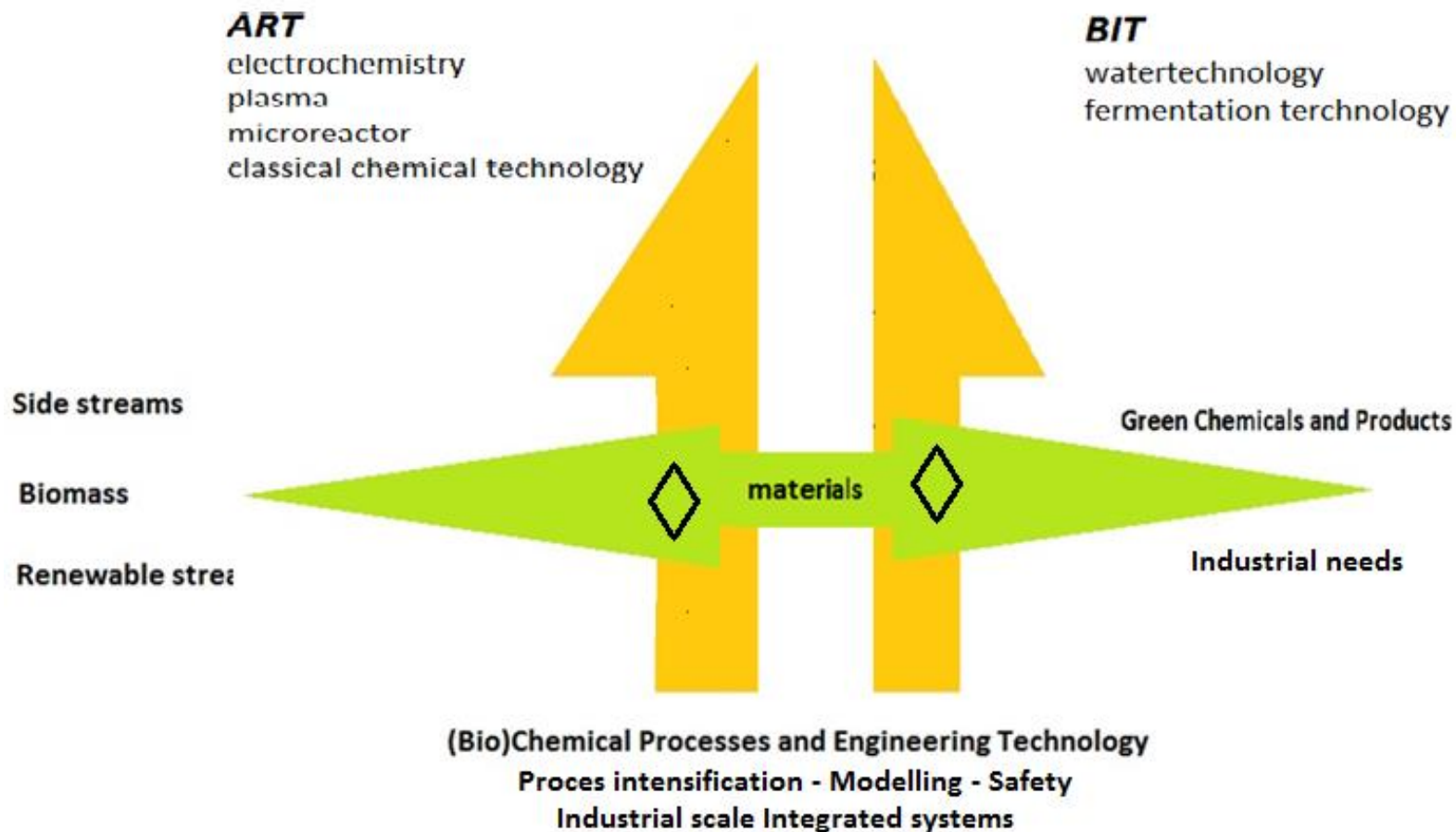


GERM-research

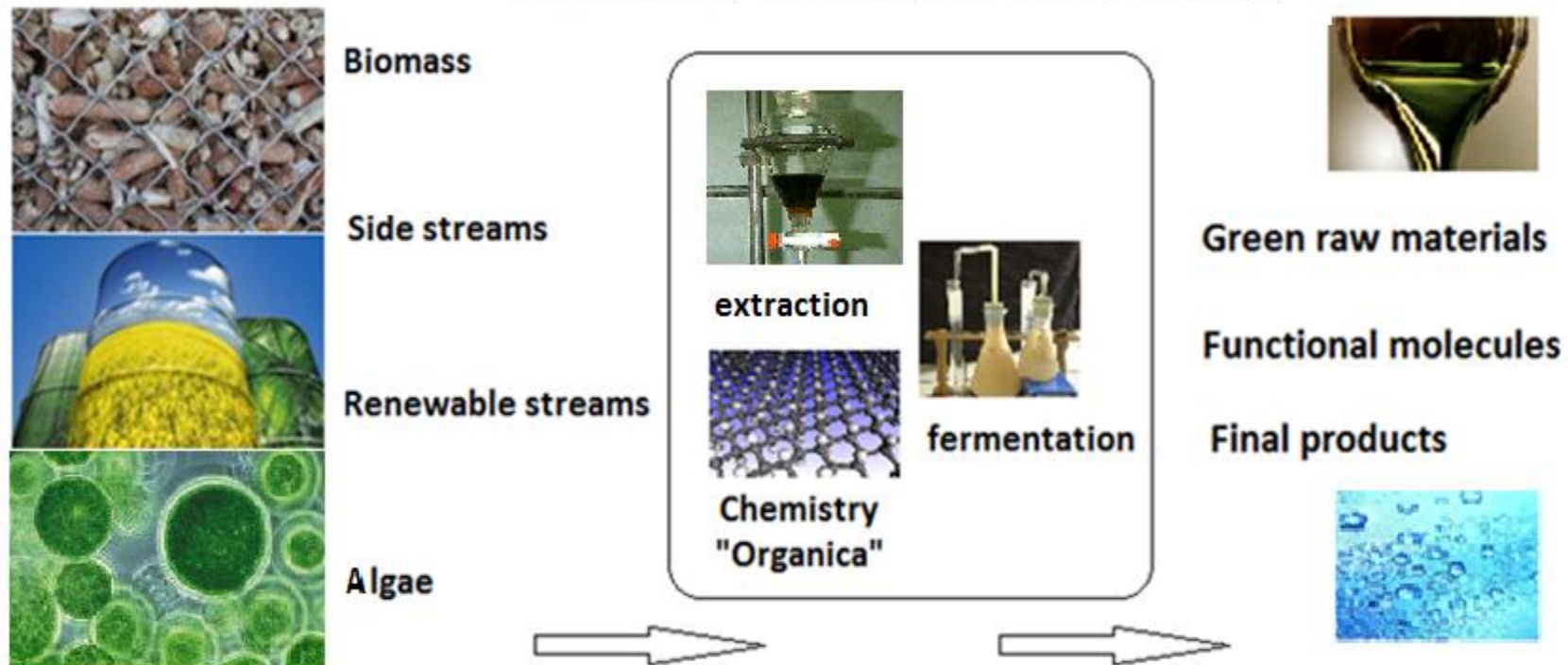
Mission

- Multidisciplinary, application oriented research in ...durable, renewable, (bio-based-degradable), molecular building blocks and derived products using optimized eco-efficient processes

(Bio)Chemistry



Oleochemistry - Fermentations - Bioma-Chemistry



Unique in Flanders

Netherlands: Wageningen UR Prof. dr. Sanders



Algae - Chemistry - Biochemistry

Renewable streams = algae



Low-temperature,
catalyzed processes

Mono- and diglycerides
(food and pharmacy)



X, Y, Z



Catalyst-free microwave-assisted processes

functional molecules
(biopolymers)



Alkylesters (biofuel, biosolvent,
cleaning agent ...)





Algae - Chemistry - Biochemistry

X, Y, Z

FOSS-CHEMISTRY

Euro/kg

X, Y, Z



Hi-value

Medium-value

Commodity-value

Lo-value

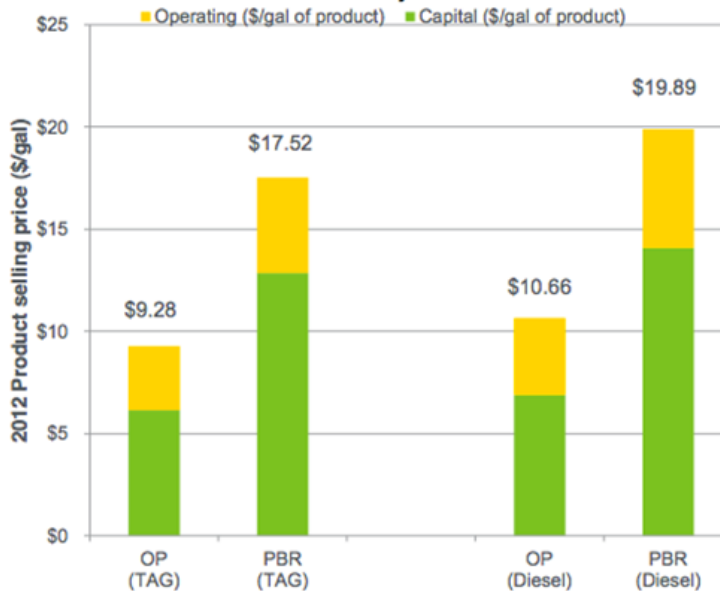


€/kg *Determining Factors* *Downstream processing*

FY11 Techno-economic Analysis: Algal Baseline Costs

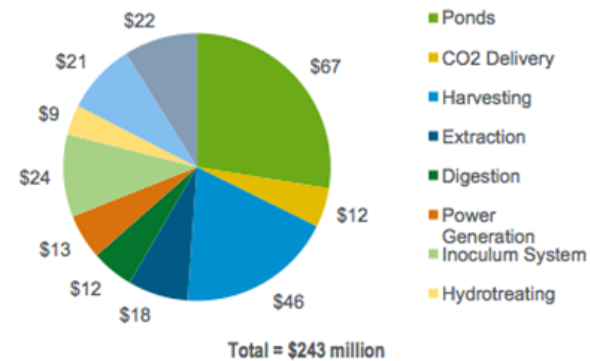
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TAG/Diesel Selling Prices (OP vs PBR)

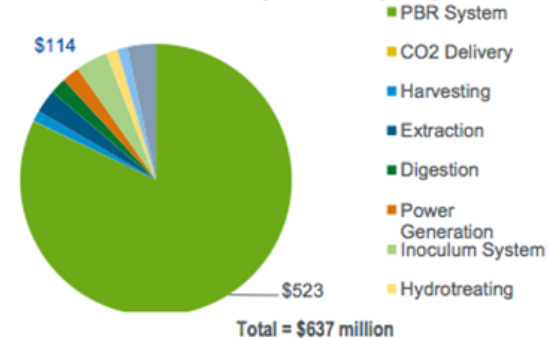


Source: Davis R et. al., "Techno-Economic Analysis of Autotrophic Microalgae for Fuel Production", Applied Energy 88 (2011) 3524 – 31.

Direct Installed Capital, \$MM (Ponds)



Direct Installed Capital, \$MM (PBR)

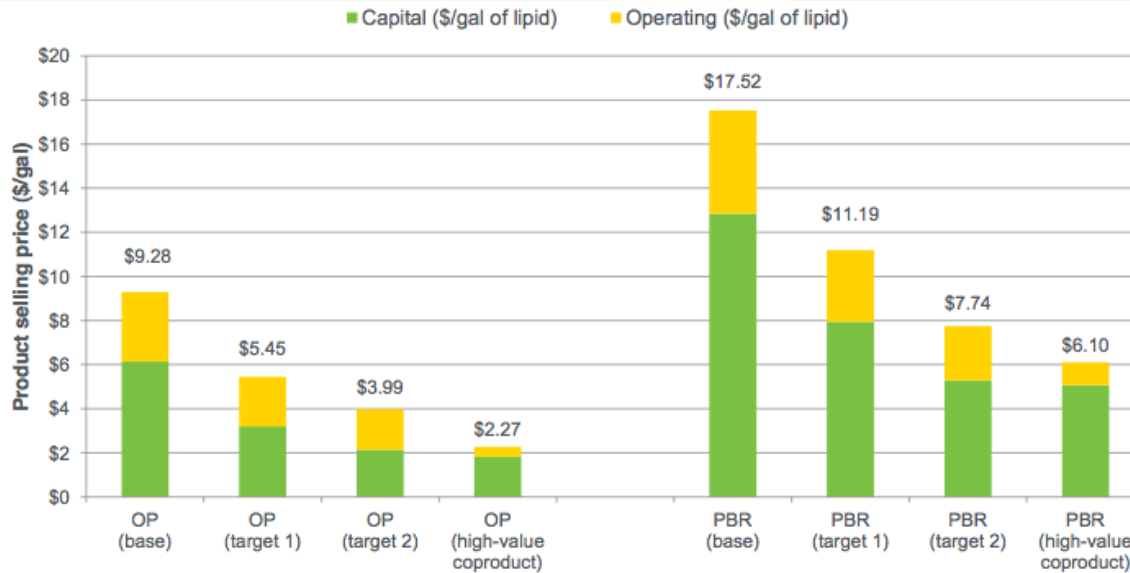




€/kg *Determining Factors* *Downstream processing*

Projecting Future Algal Costs – How Can We Get There?

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Growth rate	25 g/m ² /d	25 g/m ² /d	30 g/m ² /d	30 g/m ² /d		1.25 g/L/d	1.25 g/L/d	1.5 g/L/d	1.5 g/L/d
Lipid content	25%	40%	50%	50%		25%	40%	50%	50%
Harvesting cost	Base	Cut by 50%	Cut by 50%	Cut by 50%		Base	Cut by 50%	Cut by 50%	Cut by 50%
Extraction cost	Base	Base	Cut by 50%	Cut by 50%		Base	Base	Cut by 50%	Cut by 50%
Spent biomass utilization	AD	AD	AD	Sell @ \$500/ton		AD	AD	AD	Sell @ \$500/ton

9 | Office of the Biomass Program

eere.energy.gov



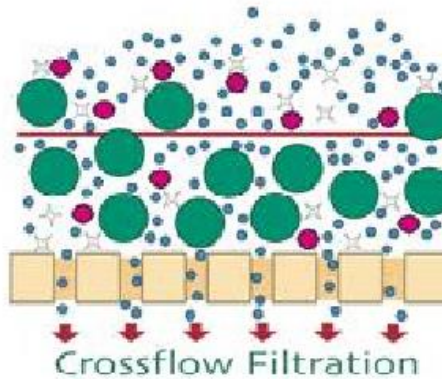
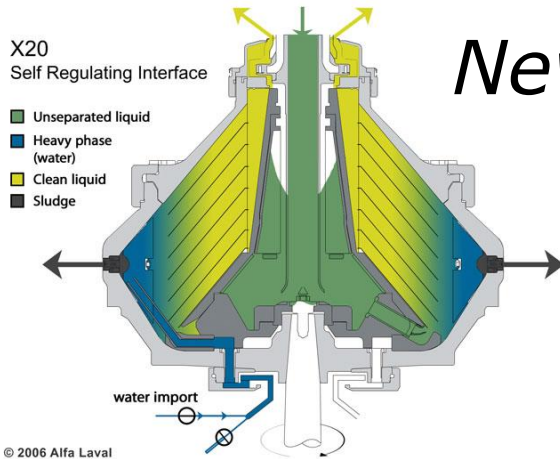
Bottlenecks re. Algae industry

- Biology factors... high activity worldwide
- Extraction/other downstream processing:
 - Bi-Cycle project -> Dewatering
 - Bi-Cycle project -> Disrupture⁺
 - Bi-Cycle project -> Extraction⁺
 - GERM = Step-in expertise for further work
- Harvesting ...
 - Major challenge
 - Multidisciplinary aspect -> FTI!!!
 - Hot priority!!

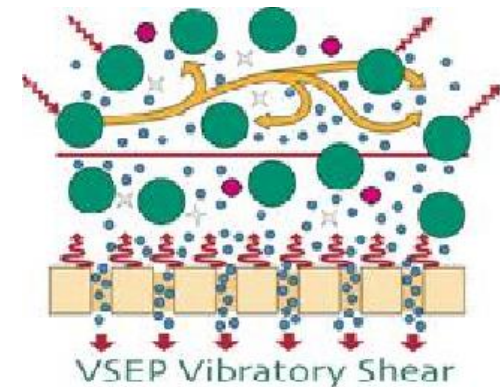
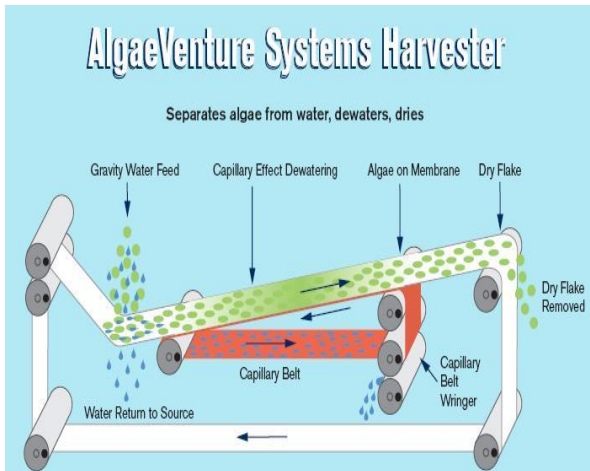


State of the art.....

New technologies...



Evodos lamellae





Specifications re. "HARVALG"

- Soft harvesting (integrity)
- Universal / Generic
- No addition of flocculant, co-organism, ... (purity)
- High efficiency
- Low energy
- Low capital cost
- Low labour cost
- Modular design

- Extension to rejuvenation of medium?
- Priority project FTI... internal enabler



Project flow

"HARVALG"

- *Concept*
- *Check re. physical principles*
- *Feasibility module and test (start-up)*
- Preprototype
- Prototype
-Fieldtest module
- Series 0
- Production
- Sales – Use by costumers



PARTNERS!!

 *Enablers and cooperations = important*



FISCH identificeert, stimuleert en katalyseert innovaties voor duurzame chemie in Vlaanderen door bedrijven te ondersteunen bij de initiatie en opzet van innovatie projecten

project opzet en uitwerking ondersteunen, samenwerking bevorderen tussen bedrijven, overheden en kennisinstellingen, partnerships stimuleren, kennisclustering, etc.



GERM framework - cooperations

- **UA-research focus:** Ecology, sustainable - technologies and materials
- **Actual UA-cooperations:** *Organica, EMAT, Sustainable Energy and Air purification, TEW (Engineering Management - Datamining)*
- **Cooperation with industry:** *Proviron, Oleon, Ecotreasures,*
- **Cooperation with institutes/organisations:** *VITO, BB, Vlaams Algen platform, FISCH, Essencia,....*
- **Cooperation international:** *Karlsruhe Institute of Technology (Technische Biologie, Algentechnologie), University of Pisa (Enzyme Technology),*



Thanks you ... Any Questions?



Marc Wijnants, Paul Vanderauwera, Dorine Wambeke, Serge Tavernier, Eliane Goossens, Lukasz Pazdur, Linda Beenaerts, Jorien Fret, Margeretha Peeters