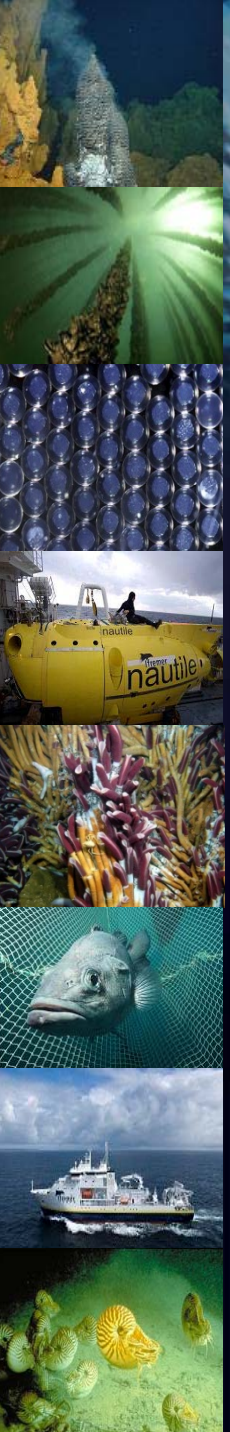
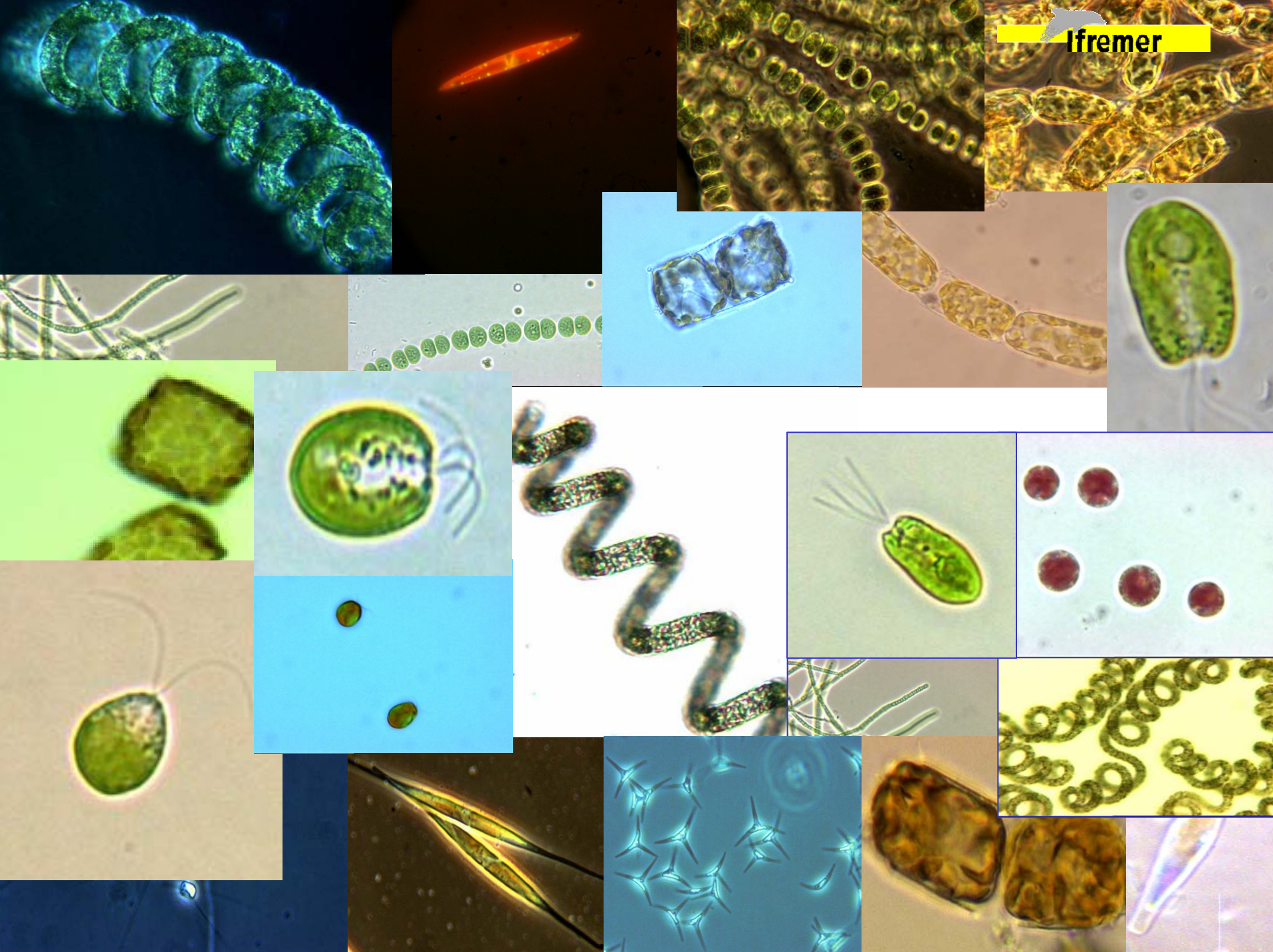


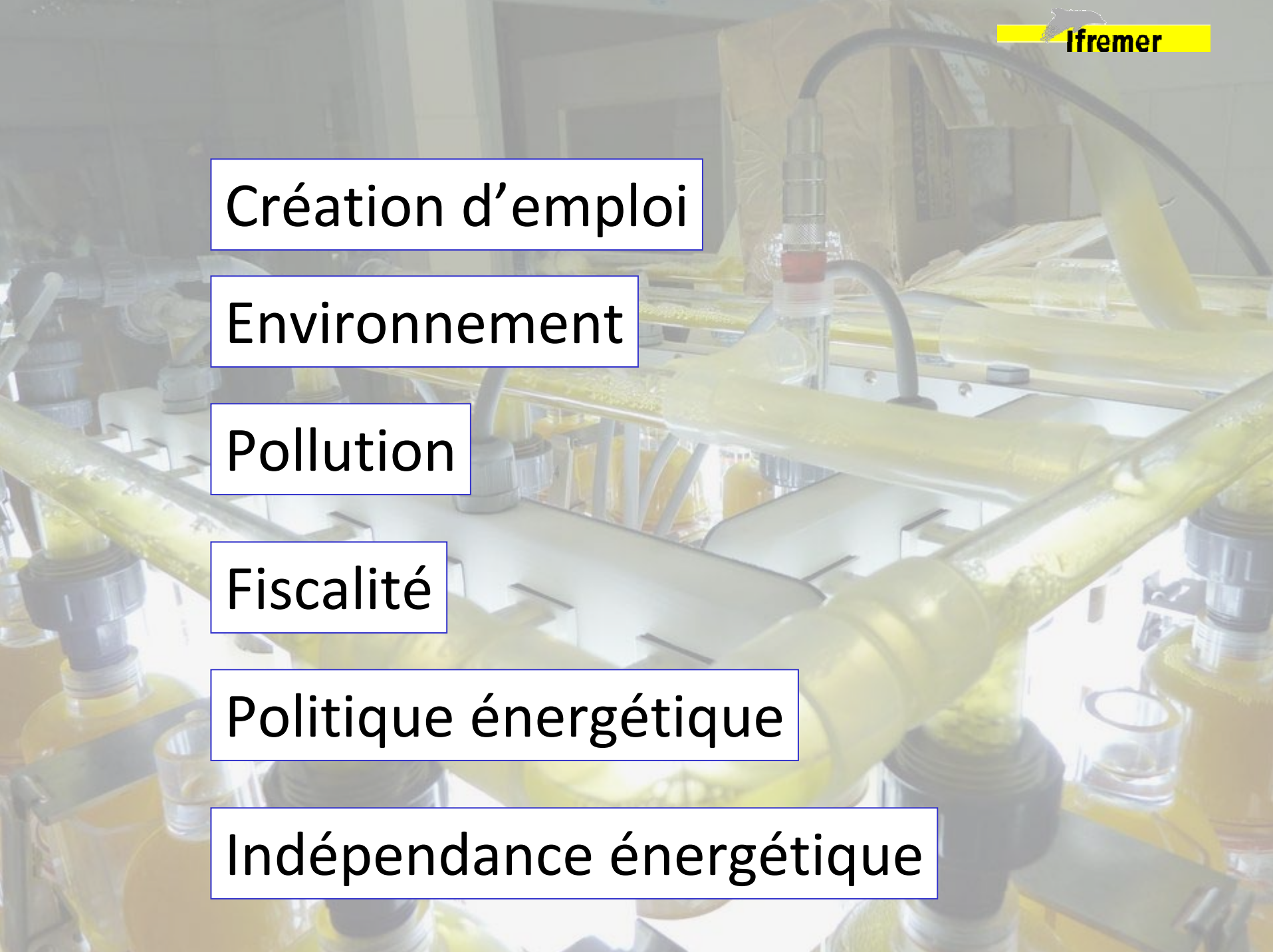
Rendez-Vous de Concarneau
Where Industry meets Science in Marine Biotechnology

European Landscape of the private sector in Microalgae Biotechnology

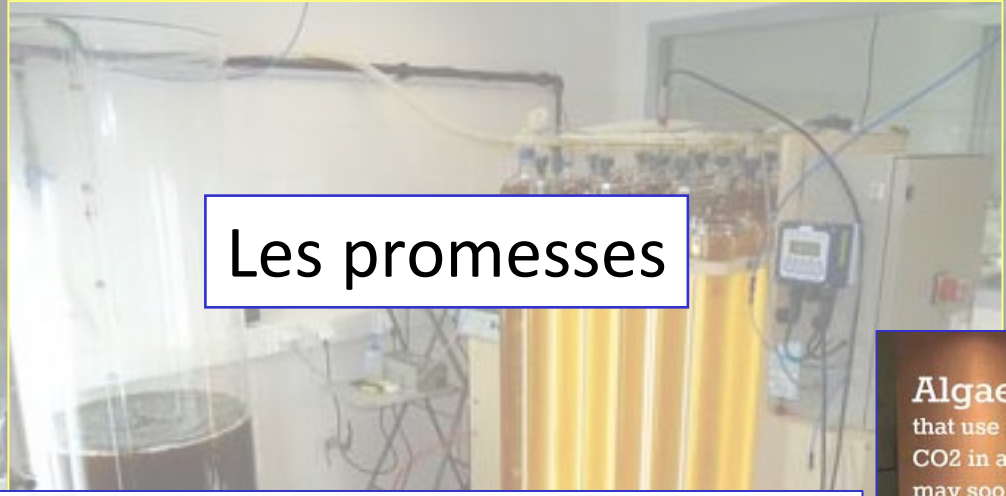
Jean-Paul CADORET
Laboratoire
Physiologie et Biotechnologie des Algues
PBA-Ifremer-Nantes
http://wwz.ifremer.fr/pba

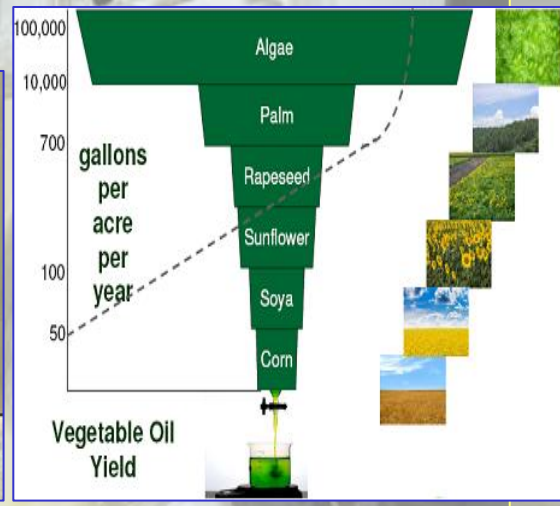
Station marine de Concarneau 3 et 4 octobre 2013

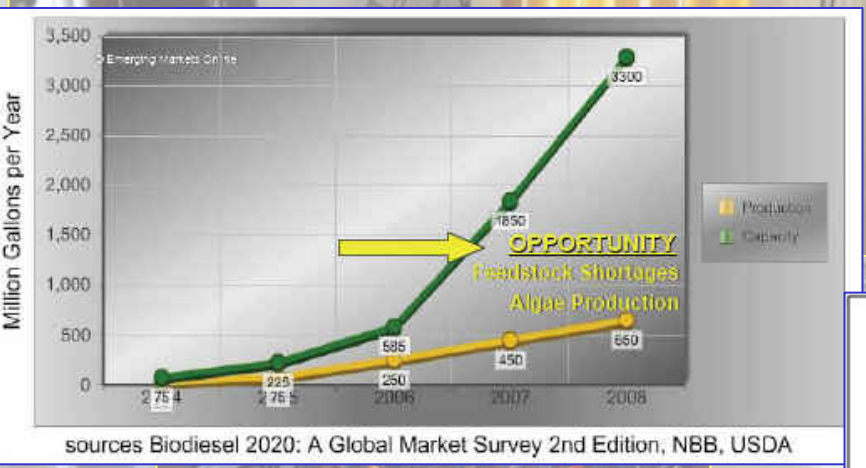

Ifremer


Ifremer
Création d’emploi
Environnement
Pollution
Fiscalité
Politique énergétique
Indépendance énergétique

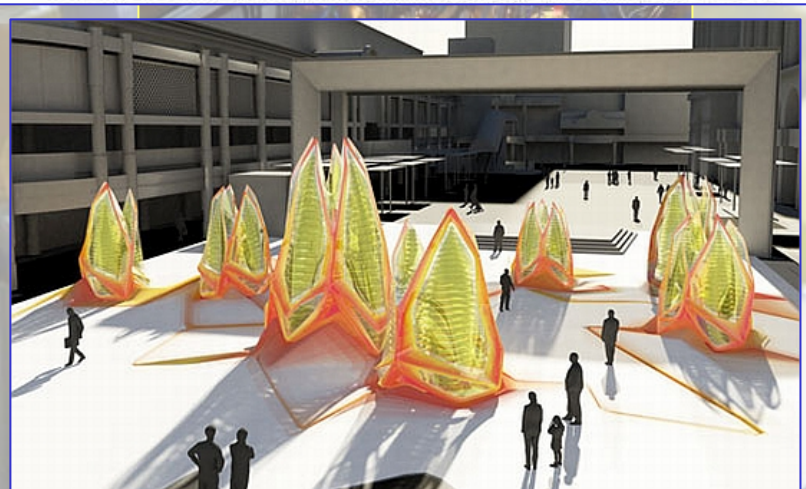
Les promesses

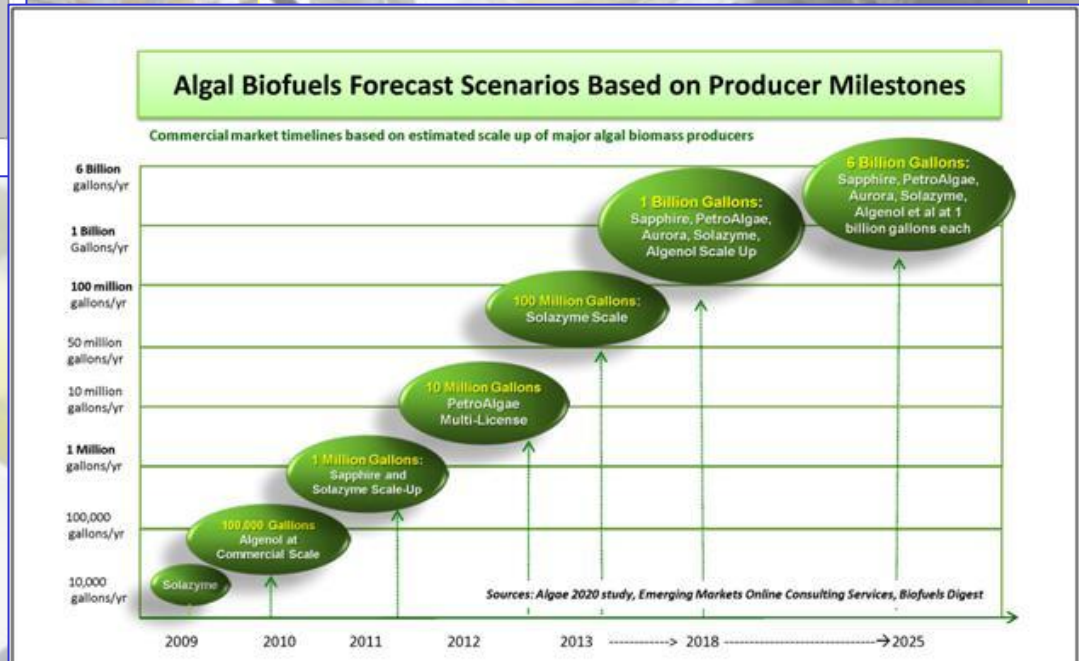






sources Biodiesel 2020: A Global Market Survey 2nd Edition, NBB, USDA



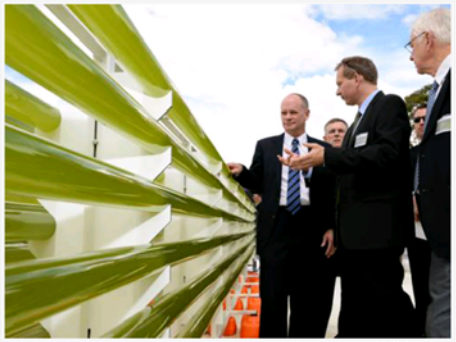


Algal biofuels pilot plant opens in Queensland

3,5 M$

April 10, 2013

AlgaeIndustryMagazine.com



Queensland Premier Campbell Newman (L) officially launched the solar biofuel pilot plant on April 9, 2013. (AAP)

Premier of Queensland, Australia, Campbell Newman, has cut the ribbon on an advanced solar biofuels pilot plant designed to develop microalgae-based systems as a source of clean fuel and animal feeds.

The $3.5 million project had the potential, said Mr. Newman, to benefit regional and rural communities

BioProcess Algae scaling-up to Phase Four

10-15 M$

March 31, 2013

AlgaeIndustryMagazine.com

BioProcess Algae. At "Ground Zero" for algae production, in Shenandoah, Iowa

Phase Four in the commercial development of BioProcess Algae has begun. Bidletting for this expansion is underway for the Shenandoah, Iowa-based algae cultivators, CEO Tim Burns said at the recent annual meeting of the Shenandoah Chamber and Industry Association.

The upcoming phase consists of a 10-to-25 acre expansion, costing between $10-15 million dollars. The

15 M$

Milton Sommerfeld, co-director of the Arizona Center for Algae Technology and Innovation (AzCATI) at Arizona State University in the lab with samples of algae biomass, algae oil, residuals and other products from algae biomass.

A.I.M. Interview: ASU's Dr. Milton Sommerfeld

October 28, 2012, by David Schwartz

AlgaeIndustryMagazine.com

Big algae news in the state of Arizona is the $15 million award by the Department of Energy to Arizona State University to establish a national algae science and technology testbed, dubbed the Algae

A.I.M. Interview: Sapphire Energy's CJ Warner and Tim Zenk

300 M$

October 21, 2012, by David Schwartz

AlgaeIndustryMagazine.com

Sapphire Energy's Green Crude Farm, in Columbus, New Mexico, is the biggest gamble on the table for commercial-scale algae to fuel. With over $300 million in investments and loan guarantees, Sapphire is on course to bring algae cultivation technology and processing to the American farmer—at some point not too far down the road.

Sapphire Energy CEO and Chairman, CJ Warner

So now that we've all seen pictures of their prototypical New Mexico open pond algae farm, what is the real story behind it? What's it like operating the place? Where is it going from here?

Sapphire Energy Vice President of Corporate Affairs, Tim Zenk

At the recent ABS in Denver we had a chance to sit down with Sapphire's Chairman and CEO, CJ Warner, and VP of Corporate Affairs, Tim Zenk, to assess the progress of this phase of the Sapphire business plan.

With CJ's background of over 20 years in the top ranks of Big Oil, and Tim's as a well-respected pundit of the algae industry to many Washington legislators, as well as a board member of the Algae Biomass Organization, this dynamic duo brings a large perspective to the conversation on

30 M$

October 14, 2012, by David Schwartz

AlgaeIndustryMagazine.com

Heliae is the 9th startup for CEO Dan Simon, and the company is finally at his favorite stage. "We are completing our charge through the Valley of Death," he says. Indeed. In 2012, Heliae grew their team to over 75 people, sold their first barrel of jet fuel, completed over $30 million in private placements—$18 million of which came from outside investors – and broke ground on their 20-acre production site in Gilbert, Arizona, on the outskirts of Phoenix.

Heliae CEO Dan Simon

Most people in the industry know that Heliae was founded by members of the Mars family, owners of Mars, Inc. "Mars is a hallmark private family business and they understand that new industries require a long vision," said Simon. "That said, we needed to diversify our ownership and, in May, we brought in our first outside investor, the Salim Group of companies. They are an exceptional investor for the same reasons as Mars, but with the added benefit of an immediate entry into Southeast Asia and Asia Pacific."

Heliae has now signed their first long-term off-take agreement, is in the final stages of signing a couple others worth multi-millions, and has expanded their IP portfolio from five to over 30 issued patents in the last nine months.

We spoke with Dan Simon, President and CEO of Heliae Technology Holdings, Inc., at the recent ABS about Heliae's progress and plans for the near future.

98,4 M$

Algae Energy to invest 75M€ in Serbian algae farm

March 12, 2013

AlgaeIndustryMagazine.com

Greek biomass-from-algae producer Algae Energy is ready to invest 75 million euro ($98.4 million) over the next two and a half years in an algae farm in the southern Serbian town of Leskovac, Belgrade-based media has reported.

John Sporidis-Antoniadis, the general manager of Algae Energy, has signed a memorandum of understandir with Leskovac's mayor Goran Cvetanovic, and said that his company will employ around 4,000, according to newspaper Blic (www.blic.rs).

The algae production will take place in the town's so-called green zone, formed last year on 100 hectares of land close to the old highway connecting the town with the southern city of Nis. The zone was planned to be production and distribution center of agricultural goods for southern Serbia.

Algae Energy is prepared to start the project as early as July this year.

Australia to build $10m seawater pipeline for algae industry

86 M$

February 25, 2013

AlgaeIndustryMagazine.com

Australia's State Development Minister Colin Barnett has announced a $10 million government sponsored project for construction of a seawater pipeline to support the expansion of an algae industry at Karratha, in Western Australia. The pipeline would initially support Aurora Algae, a US-based algae technology and cultivation company currently investing $86 million towards a Stage 1 production facility at Karratha.

Australia's State Development Minister Colin Barnett

Aurora Algae's pilot facility, close to Karratha airport, has already proved the technology to produce biodiesel, omega-3 oil, and protein-rich biomass for aquaculture and animal feed. As well as bringing jobs and economic diversification to the region, Aurora's production facility is intended to create new exports for the region, contribute to reducing the CO_2 emissions by the resource industry and support the local provision of diesel.

"This common user infrastructure will deliver benefits beyond encouraging the investment of Aurora Algae, with the seawater resource capable of supporting further investment by other industrial users," said Mr. Barnett. "It has already been recognized that the Pilbara region is ideally suited for the development of an algae industry. Aurora's proposed production facility is estimated to bring 170 jobs to the region."

Solazyme raises $125 million, closes offering

January 31, 2013

AlgaeIndustryMagazine.com

Solazyme, Inc. has announced the closing of its offering of 6% Convertible Senior Subordinated Notes due 2018 (the "Notes") in a private offering pursuant to Rule 144A under the Securities Act of 1933, as amended. The issuance of $125 million aggregate principal amount of Notes includes the exercise in full by Goldman Sachs & Co., sole book-running manager for the offering, of its option to purchase $10 million aggregate principal amount of Notes to cove over-allotments.

Solazyme has received aggregate net proceeds from the sale of the Notes of approximately $119.4 millio after deducting discounts to the initial purchaser and estimated offering expenses payable by Solazyme. Solazyme intends to use the net proceeds of the offering to fund project related costs and capital expend and for general corporate purposes.

Officials of ENN Biomass Energy Technology Center and EADS/Airbus sign the agreement to develop and test algae-based aviation fuels.

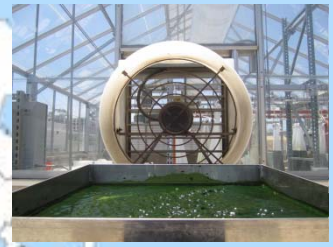
ENN, EADS/Airbus to Collaborate on Algae-based Aviation Fuels

November 17, 2012

AlgaeIndustryMagazine.com

China's ENN and Europe's EADS have signed a Memorandum of Understanding to co-develop microalgae-based aviation fuels. The agreement was made public at the China International Air Show in Zhuhai, Guangdong province.

Le Cluster CleanTech San Diego
la filière « algues »
cinq cent emplois Sapphire Energy, le SD-CAB,
la Scripps Institution of Oceanography et Synthetic Genomics
***US$ 1 Md** ! d'investissements sur les microalgues.*



SD-CAB - San Diego Center for Algal Biotechnology
objectif d'obtenir un gallon de biodiesel à 2 US$ d'ici 10 ans,
cultures en raceways (une quarantaine de raceways de 200-800 m3).
18 laboratoires de recherche du SD-CAB

San Diego se veut être la capitale mondiale de la recherche algale

Algae Fuel Could Help Solve The Navy's Oil Dependence
Thursday, January 17, 2013

Are Algae Biofuels a Realistic Alternative to Petroleum?
By Ian Branam | Scientific American – Wed, Mar 20, 2013

Senator Hueso Sees Hope in Algae
UC San Diego Visit Promotes Public-Private Collaborations for Energy, Economy, and Environment

De très vastes pans de recherche sur la production

Ifremer

1 Biologie

- choix de organismes suivant un cahier des charges
- sélection variétale
- génomes et mutants possibles
- OGMs
- comportement en phototrophie/hétérotrophie
- contrôle des prédateurs
- risques pathologiques
- risques de dissémination
- prise en compte des co-produits
- propriété industrielle

2 Gestion des intrants

2.1 Eau

- approvisionnement en eau
- complémentation en eau des systèmes ouverts
- recirculation de l'eau
- traitement des eaux usées

2.2 Substrats et nutriments

- approvisionnement en CO_2
- nutriments (optimisation des apports et des coûts)
- Bilan énergétique

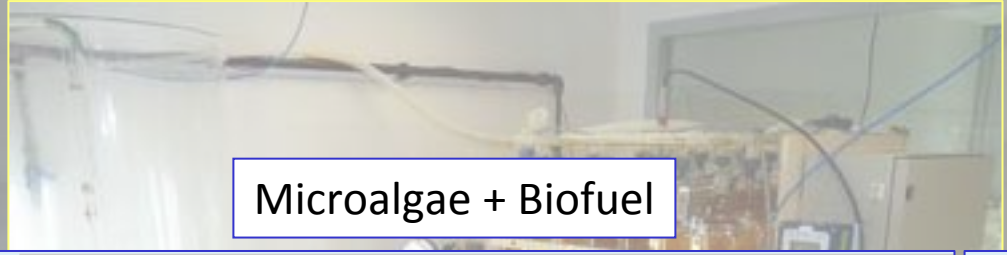
3 Bioréacteur et procédé

- sélection de photobioreacteurs (mode d'éclairement)
- expertise de nouveaux matériaux
- transfert du CO_2 et élimination de O_2
- optimisation du brassage
- contrôle et régulation des paramètres physico-chimiques
- définition des paramètres de conduite (temps de séjour…)
- automatisation du procédé
- modélisation

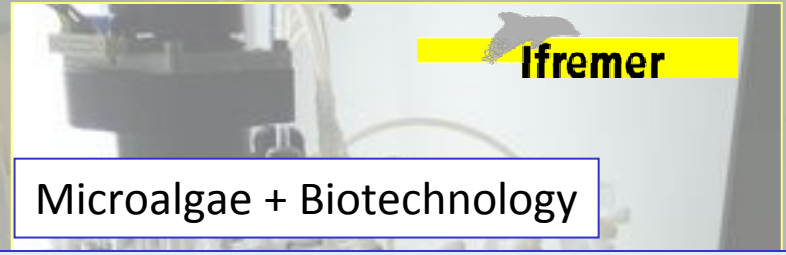
4 Bioraffinerie

- concentration de la biomasse algale
- extraction
- post traitements éventuels

5 ACV transversal



Microalgae + Biofuel



Microalgae + Biotechnology

Authors Refine Exclude Cancel

The first 100 Authors (by record count) are shown.

DAS KC	ZHOU WENGUANG	BARBOSA MJ	LU YH
SOMMERFELD M	BERNARD O	BENEMANN JR	MALCATA FX
CHEN PAUL	BERNET N	BHATNAGAR ASHISH	MARKOU G
CHINNASAMY S	BOROWITZKA MA	BRADLEY TH	MELIS A
BHATNAGAR A	CHINNASAMY SENTHIL	BUX F	MOROSINOTTO T
RUAN R	DARZINS A	CHEN L	NG KYS
RUAN ROGER	DEMIRBAS A	CHEN M	O'LEARY SJB
CHANG JO-SHU	GONZALEZ-FERNANDEZ C	CLARENS AF	PATE R
CHEN P	GRIMA EM	COLOSI LM	PEI ZJ
GOUVEIA L	HU QA	COOKSEY KE	POSEWITZ MATTHEW C
HU Q	LAURENS LML	DA SILVA TL	POSEWITZ MC
KAFAROV V	LI YG	DAS K C	POSTEN CLEMENS
DANQUAH MK	LI YT	DRAGONE G	QUINN JC
HU B	LIU YH	FERNANDEZ FGA	RADAKOVITS R
HU QIANG	MAYFIELD STEPHEN P	GEORGAKAKIS D	SALLEY SO
KRUSE O	MCGINN PJ	GREENWELL HC	STEYER JP
LI YECONG	MIN M	HAN DX	TANG HX
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CHISTI Y	SCHENK PM	HUNT RW	HEBNER RE
LAN CQ	SIALVE B	LAM MK	ITUEN EUU
LI YC	WANG B	LEE KT	LI DM
MIN MIN	ZHANG WEI	LI Y	WANG ZM
SOMMERFELD MILTON	ZHOU WG	LIU YUHUAN	ZHU SN

Authors Refine Exclude Cancel

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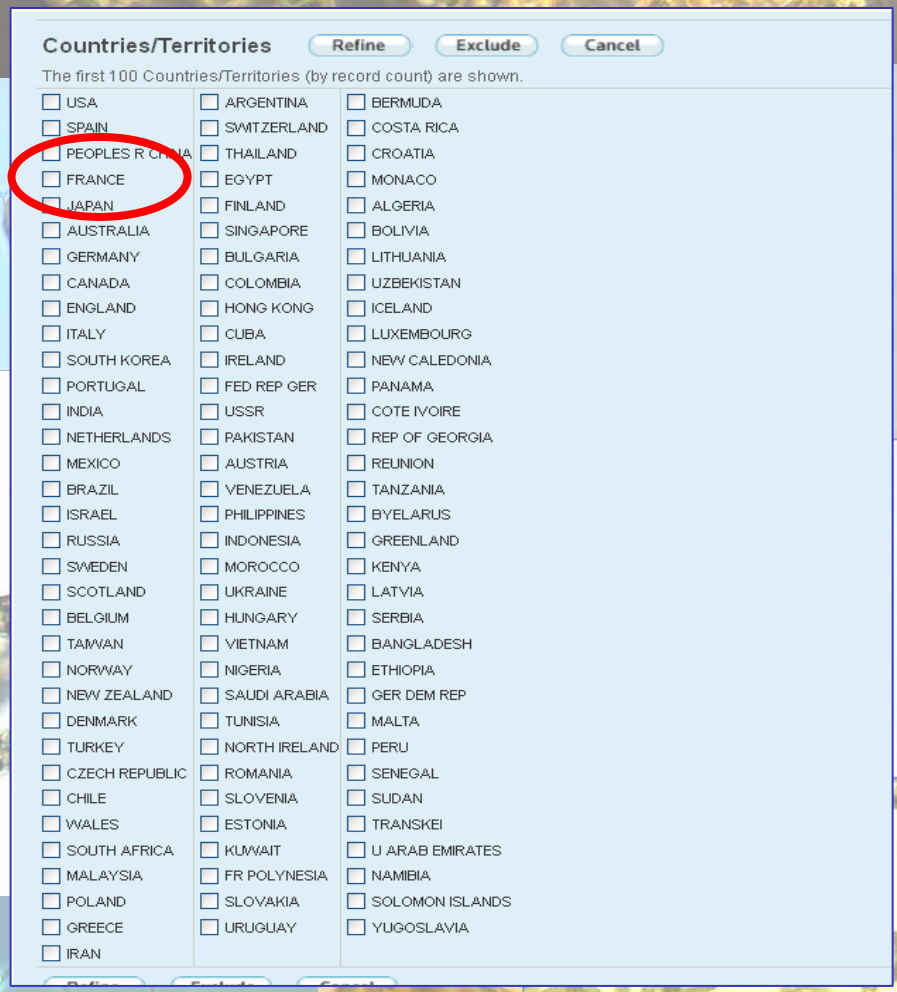
WIJFFELS RENE H	JANSSEN M	DE-BASHAN LUZ E	MORITA M
CHANG JO-SHU	KRUSE OLAF	DONMEZ G	NAKASHIMA H
DAY JG	MAYFIELD SP	DU ZHENYI	NIELL FX
WIJFFELS RH	MELIS A	DUNSTAN GA	OLAIZOLA M
CHEN F	MORENO J	FISCHER DIRK	OYLER GA
GARCIA-GONZALEZ M	RAJA R	FORDE GM	PARKER BC
LEE CG	RUAN ROGER	FUJII K	PILAT Z
MAYFIELD STEPHEN P	SAIKI H	GONG YANGMIN	POHL P
NEDBAL L	SOMMERFELD M	HARRISON STL	POLLE JEW
POSTEN C	TRTILEK M	HEITZER M	POSTEN CLEMENS
PULZ O	WATANABE Y	HO SHIH-HSIN	SEIBERT M
VILCHEZ C	BENSON EE	HU Q	SERY M
ACIEN FERNANDEZ F G	CADORET JP	HUNT RW	SHENG J
BARBOSA MARIA J	CANIVYTE JP	HUNT RYAN W	SONG LR
BERNARD OLIVIER	CANIZARES-VILLANUEVA RO	JANSSEN MARCEL	SRIDHAR S
BOROWITZKA MA	CHEN H	JEFFREY SW	STEYER JEAN-PHILIPPE
CHEN PAUL	CHEN SHULIN	JEZEK J	TEIXEIRA JOSE A
CHEN W	CHINNASAMY S	JIMENEZ C	TORZILLO GIUSEPPE
DANQUAH MK	CHINNASAMY SENTHIL	JIN E	TRAMPER J
DELANOUE J	CHISTI Y	JOHANNINGMEIER UDO	TSAVALOS AJ
FARAMARZI MA	CHOIX FRANCISCO J	KOHLHASE M	VAN HILLE RP
GARBAYO I	COSSIO BR	LEON ROSA	VANNELA R
GUERRERO MG	COUSO INMACULADA	LEROI JM	VEGA JM
HANKAMER BEN	DAS KC	MIYAMOTO K	VOLKMAN JK
HEMAISWARYA S	DAS KESHAV C	MOLINA GRIMA E	YAZDI MT

WEB OF KNOWLEDGE℠ | DISCOVERY STARTS HERE

Ifremer

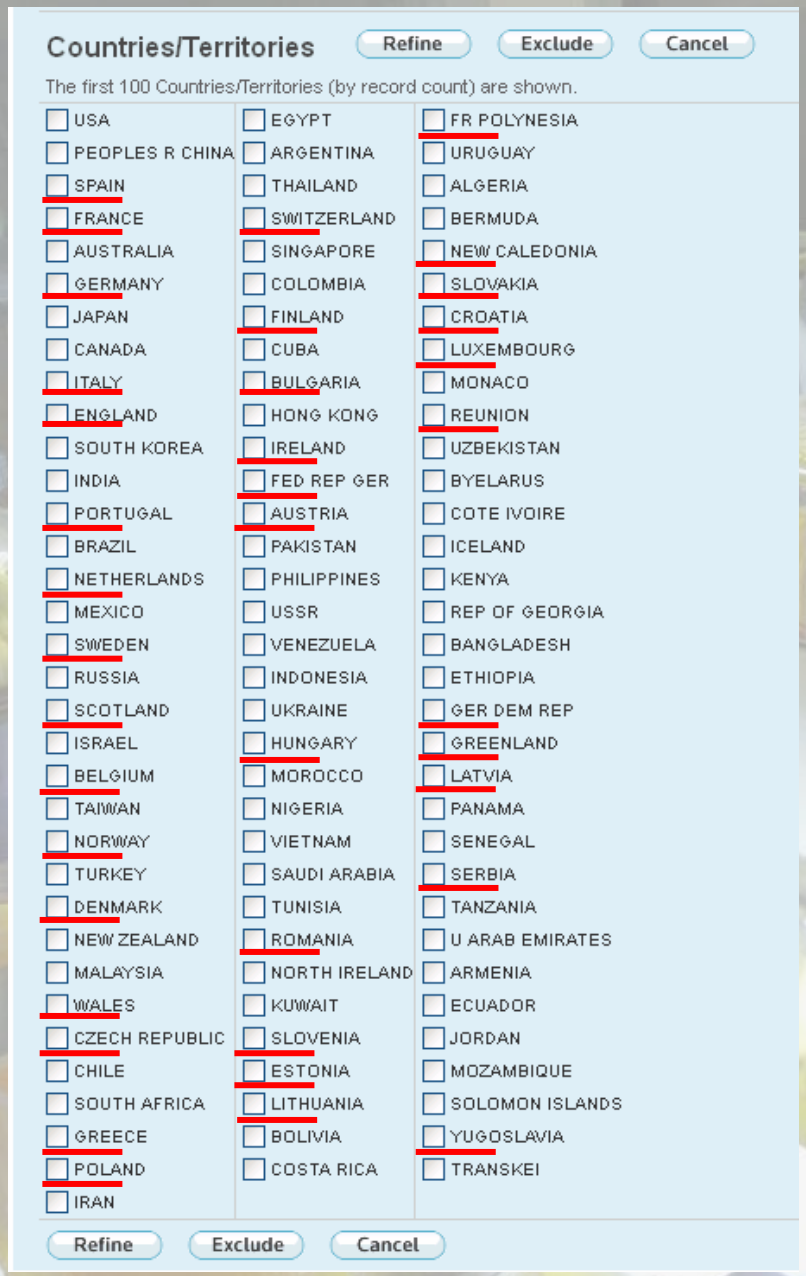
Microalgae

Microalgae



WEB OF KNOWLEDGE℠ | DISCOVERY STARTS HERE

Microalgae



Microalgae + production

Allemagne
Blue Biotech
Cyano Biofuels
Bisantech
Phytolutions
Hezinger Algaetec
Astaxa
Salata
IGV
Subitec

Autriche
Ecoduna
Seealgae Technology

Belgique
Provirom
DSM

République Tcheque
Envi
Ecofuel

Espagne
Biofuel systems s.l.
Acciona Energia
Aurantia
Algasol Renewable
Fitoplanton Marino
Algae Biotech SL
Clean Algae
Algafluid
Algaenergy
ASN

France
Activ'Alg
Algenics
Algonesia
Algosource
Algosud
AlphaBiotech
Bioalgostral
Ecosolution
Fermentalg
Greensea
Heliogreen
Innovalg
Mikralgen
Microphyt
Phycosource
Roquette

Italie
Fotosintetica & microbiologica S.r.l.
Enitechnology

Pays Bas
AlgaeFuels
AlgaeLink
Algae Food Fuel
Ingepro BV
LGem

Portugal
Algafuel
Necton
EEM/BFS

Royaume Uni
Enhanced biofuels & Technonolgies, ltd
Kwikpower International Plc
Algaebiotech Products
Boots PML
Seasalter
Varcon Aqua
Supreme Biotech
AlgaCytes
Merlin Developments

Suede
Simris
Astareal

Suisse
Neocarbon

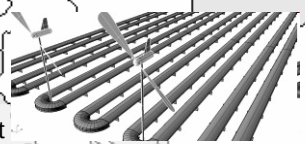
Ifremer

Les microalgues

L'Université de Wageningen (Pays-Bas) Algae Park
Centre de R&D alimentation chimie ou biofuels.
Centré principalement sur la culture,photobioréacteur,
Quatre plateformes de 25m^2 de cultures extérieurs
(raceway, photobioréacteurs tubulaires, verticaux et plans),
pilotes sous serre.
7 millions d'euros
projets sur quatre ans,
une dizaine d'entreprises,.

Exemples…..

Subitec (D) 2012PBR 4,5 M€
IGV Berlin D, 300 modules vendus ?



Univ Florence Brevet
Très avancé vollaboration avec ENI
Démonstrateur construit

Au Royaume-Uni, Carbon Trust
18 millions de livres via l'Algal Biofuels Challenge.
douze équipes académiques
Southampton, Manchester, Newcastle,
Scottish Association for Marine Science…
étude, choix et optimisation des souches ;
culture de masse (raceways);
récolte, concentration ; extraction et séparation des huiles.
construction d'une unité pilote en zone équatoriale
commercialiser d'ici 2020, 70 milliards de litres de biocarburants par an.
Collaboration étroite avec Synthetic Genomics, Seambiotic.

a4f/secil

Ifremer

Klötze Roquette

IGV

Ifremer

Mobile Algae Production Skid

PBR 2000 GC

Tubular glass photobioreactor

Novagreen

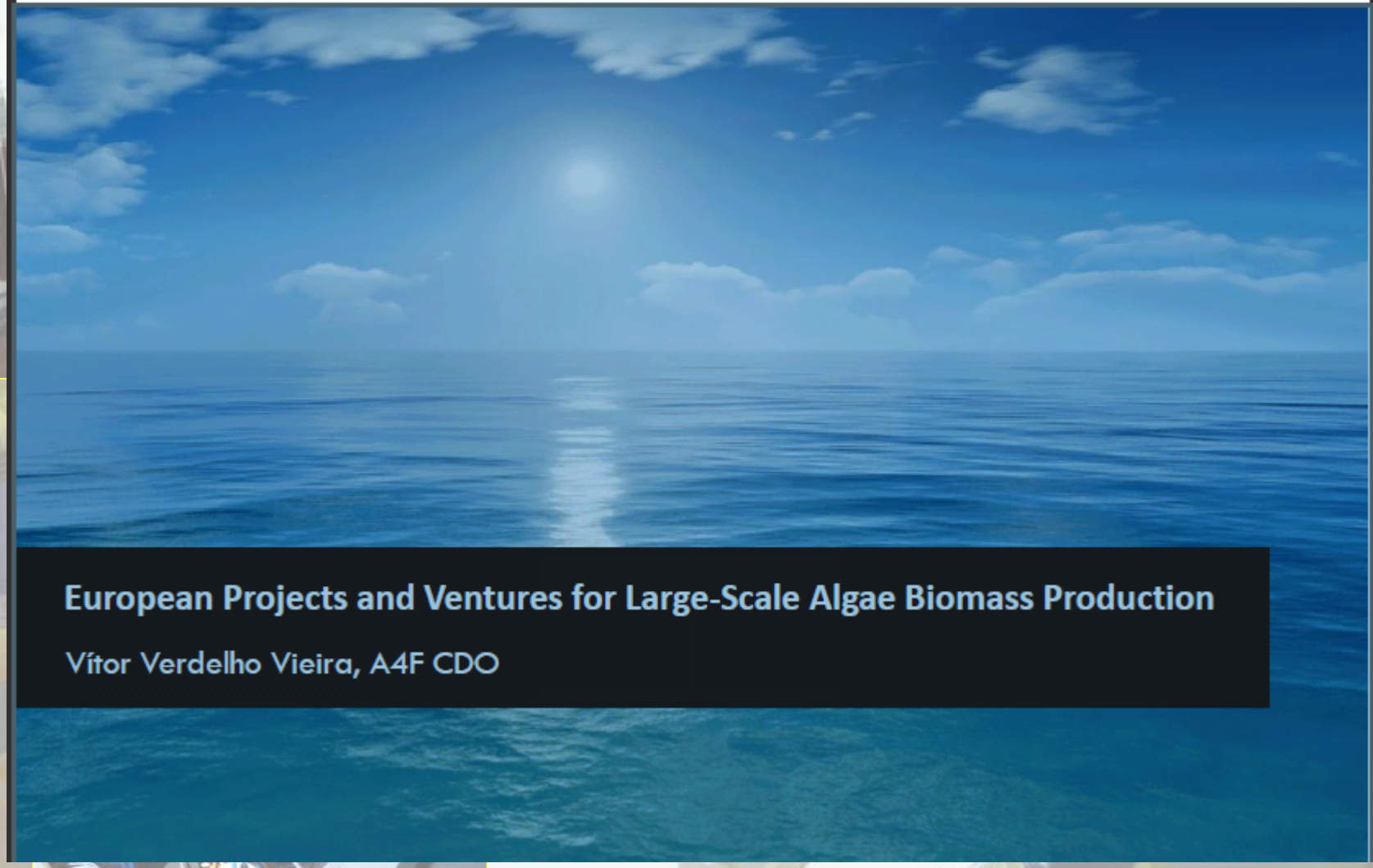
RWE Project

An inside view

Ifremer

a4f

ALGAE BIOMASS SUMMIT 2012
Denver, September 24-27



European Projects and Ventures for Large-Scale Algae Biomass Production

Vítor Verdelho Vieira, A4F CDO

La face optimiste

Une recherche de haut niveau

Une recherche qui couvre tous les aspects

- Génomique
- Génie des procédés
- Modélisation
- Physiologie
- Biochimie
- Algothèques/taxonomie

Des marchés colossaux et des places à prendre

La possibilité de s'intercaler dans la recherche internationale

Il est encore temps

La face pessimiste

Une quête de la diminution des coûts

Une balance énergétique défavorable

Une compétition internationale inégale

- Finances pour les USA
- Règles différentes (ex Chine)

Une culture de la valorisation à créer
Une communication confuse (energie vs alimentation)
Des financements supplétifs
Un risque fort d'être « suiveurs »
La France producteur en énergie ?
La course aux brevets est déjà lancée
Les collaborations dans un contexte économique ?

Laboratoire Physiologie et Biotechnologie des Algues

PBA-Ifremer-Nantes

Laboratoire Physiologie et Biotechnologie des Algues

PBA-Ifremer-Nantes

Métiers

- Ecophysiologie
- « Omics »

Axes de recherche

- Flux nutritifs: C, N, P
- Sélection variétale

Projets

Domestication	Aquaculture	Métabolites	Energie
Usine Cellulaire Sélection variétale	Cultures Probiotiques Proceed	Pigments Lipides	Méthanisation Biodiesel

Guichets

Domestication	Aquaculture	Métabolites	Energie
Soutien Equipe PdL Facteur 4 ANR	Amical (CIOM) Salinalgue FUI Proceed FP7	*Photomer* *Algofarm*	Symbiose ANR *Eneeralg* Greens Stars

http://wwz.ifremer.fr/pba