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Martedì 24 Novembre 2015 ORE 10:00

Sala Stampa - *UNICAL*



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## PRESENTAZIONE DEI RISULTATI DELLE RICERCHE SU:

*“L’industria di produzione e trasformazione delle microalgae”*

**Teresa Granato**



UNIVERSITÀ DELLA CALABRIA



# CalabriaInnova

Progetto Integrato di Sviluppo Regionale (PISR – Regione Calabria) “Creazione di un Sistema Regionale per l’Innovazione in Calabria” **Fondi POR Calabria FESR 2007-2013** gestito da Fincalabra SpA in collaborazione con AREA Science Park.

Servizi a sostegno dell’innovazione per:

- Imprenditori per far crescere la competitività delle aziende
- Ricercatori per valorizzare i risultati della ricerca scientifica
- Inventori con un’idea innovativa o un’invenzione nel cassetto

# Desk Analysis

Supporto nella definizione di un possibile **percorso di valorizzazione** dei risultati della ricerca scientifica.

Tema: Le produzioni da micro-alghe.

Esigenza: Delineare lo scenario di riferimento che si prospetta volendo affiancare alla produzione primaria del biodiesel, la produzione di composti a più elevato valore aggiunto da destinare ai settori della nutraceutica e della cosmetica.

# Dimensione del mercato vs. Valore del prodotto (Fonte: Algae 2020, 2011)

Suddividiamo le applicazioni derivate da alghe secondo la dimensione dei mercati di riferimento e secondo il loro valore sul mercato.

	<b>Low Value</b> (\$2.5K-25K/metric ton)	<b>High Value</b> (\$25K-800K/metric ton)
<b>Large Markets</b>	Biodiesel, Biomass, Vegetable Oils <ul style="list-style-type: none"> <li>•Crude oil for biodiesel, bio-crude</li> <li>•Aviation fuel</li> <li>•Algal biomass for CO<sub>2</sub> capture</li> <li>•Oils: castor, olive, canola equivalents</li> <li>•Mid-Value Oils: soy, sunflower, palm</li> </ul>	<u>Pharmaceuticals, Specialty Chems.,</u> <u>Nutraceuticals, Livestock Prods.</u> <ul style="list-style-type: none"> <li>•Healthy oils (DHA, Omega 3, 6)</li> <li>•Baby food supplements</li> <li>•Food additives for health markets</li> <li>•Cosmetics products &amp; additives</li> </ul>
<b>Small Markets</b>	Livestock Feed, Low-Grade FFAs, Yellow Grease Equivalents <ul style="list-style-type: none"> <li>•Basic proteins, carbs for livestock feed</li> <li>•Basic proteins, carbs for fish feed</li> <li>•Tallow substitutes</li> </ul>	Pharmaceuticals, Specialty Chems. <ul style="list-style-type: none"> <li>•Cancer-fighting agents</li> <li>•High-value specialty chemicals for industrial uses</li> <li>•Specialty chemicals for cosmetics</li> </ul>

# Dimensione del mercato vs. Valore del prodotto

Le applicazioni che appaiono più verosimilmente abbinabili alla produzione di biodiesel sono quelle aventi ampi mercati di riferimento.

Valgono perciò:

- la cattura della CO<sub>2</sub>
- i prodotti farmaceutici
- i prodotti nutraceutici
- le specialty chimiche
- i mangimi

# L'analisi dei Competitor

I biofuels prodotti dalle alghe rientrano tra le tecnologie che derivano da decine di anni di ricerca ma che non hanno ancora avuto un riscontro commerciale apprezzabile.

Un'analisi di *forecasting* al 2030, incentrata sullo studio dei possibili miglioramenti nell'efficienza di conversione che possano rendere nuovi *feedstock* economicamente competitivi, dà chiare indicazioni anche sulle alghe.

# Key Player (15/29)

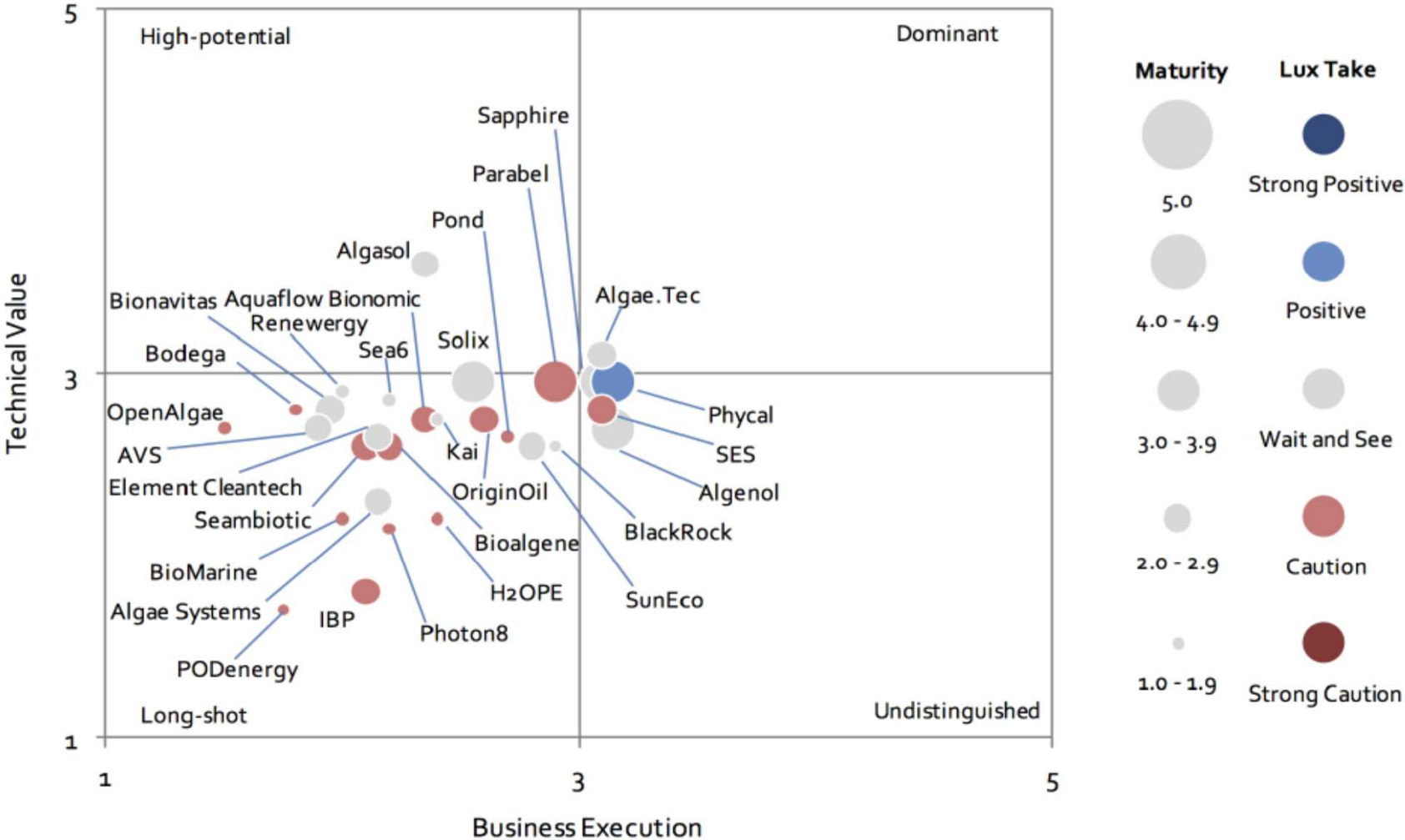
Company	Description
Algae Systems	Finished <b>fuels</b> and clean water from offshore algae and municipal wastewater
Algae Tec	Integrated algae growth, cultivation, and harvesting system for feed <b>fuels</b> , and chemicals
Algalis Renewables	Flexible plastic algae photobioreactors floating in seawater ★
Algenol Biofuels	Photobioreactor-based algae producing <b>ethanol</b>
Aquaflow Bionomic	Harvesting wild algae for <b>biofuels</b> , specialty chemicals, fertilizer, and water remediation
AVS	Processing units to concentrate and dewater microorganisms, including algae ★
Bioalgene	Algae production for <b>biofuels</b> , nutraceuticals, animal feeds and biopolymers from power plant CO <sub>2</sub> waste
BioMarine Fuels	Bioreactors and other equipment for growing and processing algae biomass ★
Bionavitas	Light transfer to increase algae growth for <b>biofuels</b> , consumer products, and bioremediation
BlackRock Energy	Technology for land-based and offshore algae cultivation and harvesting ★
Bodega Algae	Optics technology for distribution of sunlight within algae photobioreactor ★
Element Cleantech	Algae grown in raceway ponds covered with semi-transparent photovoltaic films ★
H <sub>2</sub> OPE Biofuels	<b>Hydrogen</b> production from algae
IBP	Open-pond algae production using waste CO <sub>2</sub> for animal feed and <b>fuel</b>
Kai BioEnergy	Open-water microalgae for <b>biocrude</b> production

# Key Player (14/29)

Company	Description
OpenAlgae	Algae-to-oil conversion process featuring electromechanical lysing technology
OriginOil	Algae flocculation and electromagnetic lysing to dewater and extract oil from algae
Parabel	Non-GMO algae for <b>biodiesel</b>
Photon8	Algal oil from land-based parallel film photobioreactors
Phycal	Algal oil cultivated with municipal wastewater and added sugars
PODenergy	Anaerobic digestion of ocean biomass for <b>methane</b> generation
Pond Biofuels	Algae photobioreactor cultivation using flue gas ★
Renewergy	Aeroponic system for growing algae on polymer sheets using municipal wastewater ★
Sapphire Energy	<b>Biocrude</b> from open-pond algae
Sea6 Energy	Developing macroalgae cultivation system and saltwater fermentation organism
Seambiotic	Power plant CO <sub>2</sub> waste to grow algae for <b>biodiesel</b> , bioethanol, and food additives
SES	Macroalgae cultivation and harvesting to produce <b>methane</b> and ethanol
Solix BioSystems	Algae production systems for algal oil, <b>biodiesel</b> , and co-products
SunEco Energy	Open-pond algae cultivation for water remediation, animal feed, and <b>renewable fuels</b>



# Innovation Grid



# Innovation Grid (1)

Algae.Tec (Australia) (*Integrated algae growth, cultivation, and harvesting system for feed, fuels, and chemicals*) => Coverage Area: Biosciences; Alternative Fuels; Bio-based Materials and Chemicals

The technology delivers sustainable and renewable advanced algae products such as proteins for consumption and biofuel oils for transportation and power generation.

Partnerships: Lufthansa (Aviation biofuels), Holcim (CO<sub>2</sub> sequestration), Manildra Group ("The Leader" in vital wheat gluten, native and modified wheat starches, specialty wheat proteins and alcohol), and the Shandong Kerui Group Holding (Solutions and equipment for oil fields and deposits).

Dominant companies are next-generation fuels top performers *With both concrete business execution and technical value, these companies, generally speaking, make great partners or great investment targets. Companies in this group are often first to the market with revolutionary or disruptive technologies and experience little competition. Likely partners should engage as commercialization partners if there is a good fit; competitors would be wise to look for a different market to target.*

# Innovation Grid (2)

Algasol Renewables (Bangladesh) (*Flexible plastic algae photobioreactors floating in seawater*) => Coverage Area: Technology for algae harvesting.

High-potential companies have attractive technologies, but little to show for them yet *This group contains both young companies struggling to gain market share and older companies unable to capitalize on their technologies or solutions. In either case, these companies make good licensing targets. In some cases, they may be good investment targets for those who can tolerate a higher degree of risk. Partnerships, acquisitions, or mergers should only be considered if the interested party is willing to do some heavy lifting. Competitors should look for opportunities to cooperate with or acquire valuable technologies from companies in this quadrant.*

# Innovation Grid (3)

Algenol (USA) (*Photobioreactor-based algae to produce ethanol*) =>

Coverage Area: Industrial biotechnology company that produces ethanol and green chemicals by using hybrid algae, sunlight, carbon dioxide, and saltwater.

Phycal (USA) (*Algal oil cultivated with municipal wastewater and added sugars*)

Seaweed Energy Solutions (Norway) (*Macroalgae cultivation and harvesting to produce methane and ethanol*)

Undistinguished companies perform well in the market despite lacking high technical value *These companies overall compete not with unique technologies or solutions, but with good strategy and efficient execution. Whether they be large companies with an abundance of corporate muscle or smaller companies addressing well-defined niche market segments, their impressive performances in the market make them good partners, though their relatively limited growth rates make them poor investment targets. Competitors should try to find an unaddressed market to target, but they can choose to compete if the technology is more valuable in the contested application.*

# Innovation Grid (4)

*La maggioranza delle società operanti nel settore della coltivazione e lavorazione delle alghe si posizionano nel quadrante Long-Shot.*

Long-shot companies lag behind in execution and lack valuable technologies. *The combination of poor execution and low technical value make these companies highly risky as investment, licensing, partnership, or merger and acquisition targets. Companies in this quadrant may not be risky forever, however; escape can be achieved through technological advancements leading to more attractive products or better-conceived strategies, speeding up market adoption.*

# Scale-up timeline (1)

*Uso degli strumenti “synbio” (Synthetic Biology): vasta varietà di tecnologie per la conversione di biomasse e altri feedstock non-petrolchimici in prodotti chimici e nuovi materiali.*

*Le conclusioni tratte dall’esperienza delle prime aziende impegnate nel settore dei prodotti chimici e dei materiali bio-based offrono interessanti spunti alle aziende new-entry nella pianificazione della propria strategia di business.*

*Predire la probabilità di successo di un’azienda startup, nello stadio lab o pilot, nel lancio del proprio prodotto innovativo: analisi e quantificazione delle timelines osservate nell’industria di riferimento.*

*Timelines: tempistiche legate al processo di sviluppo dal concepimento del progetto di innovazione alle milestone chiave dello scale-up: scala pilota, scala dimostrativa (“demo”), scala commerciale e lancio del primo prodotto.*

# Scale-up timeline (2)

**Solazyme**: caso emblematico per l'industria della coltivazione e lavorazione delle microalghe.

**Coverage Area**: Biosciences, Alternative Fuels, Bio-based Materials and Chemicals, Food and Nutrition, Exploration and Production.

*L'azienda si trova attualmente nello stadio commerciale rispetto ai propri prodotti primari, costituiti da oli custom-made a base di trigliceridi prodotti dalla fermentazione di microalghe.*

*Dall'origine del progetto la Solazyme è passata alla **demo-scale in 9 anni**, quindi alla **scala commerciale in 11 anni**.*

***Lancio del primo prodotto a mercato**, a partire dall'ideazione del progetto o dalla costituzione dell'azienda: tempo perfettamente nella media, poiché è pari a **7 anni** (media  $7.42 \pm 2.91$  anni).*

*Sebbene il primo lancio di un prodotto a mercato sia considerata una key-milestone, esso non rappresenta di per sé la **garanzia di successo** nelle operazioni di vendita.*

# Brevetti (dal 2010)

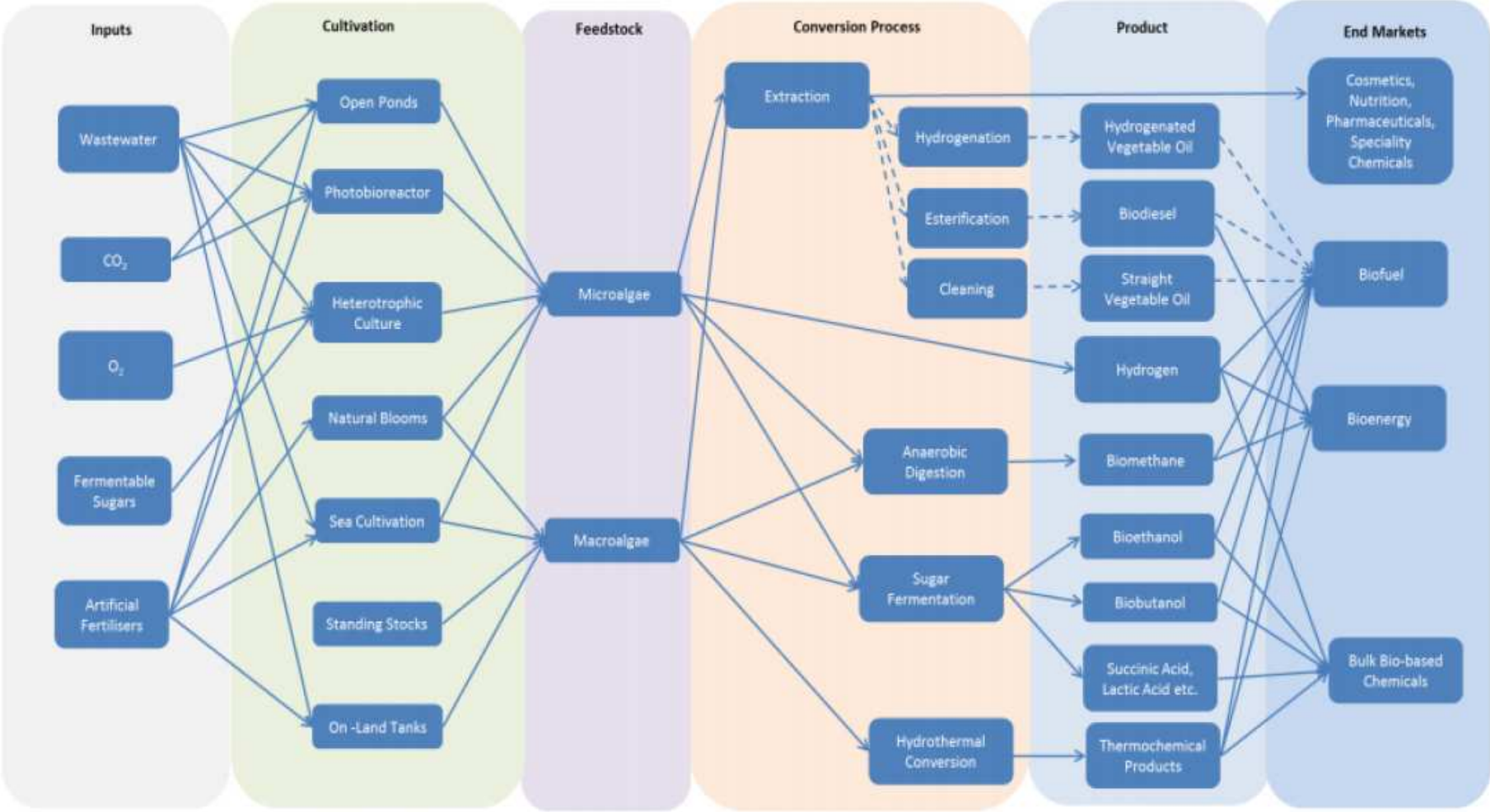
FOCUS: A partire dal trattamento di microalghe si ottengono prodotti da destinare al mercato della nutraceutica

Title	Publication number	Publication date	Applicant(s)
OMEGA 3 CONCENTRATE	<a href="#">EP2659780 (A2)</a>	2013-11-06	GOLDEN OMEGA S A [CL] (www.goldenomega.cl)
Emulsions including a PEG-derivative of tocopherol	<a href="#">EP2548456 (A1)</a>	2013-01-23	VIRUN INC [US] (www.virun.com)
Polyunsaturated fatty acid-containing oil product and uses and production thereof	<a href="#">EP2630869 (A1)</a>	2013-08-28	DSM IP ASSETS BV [NL] (www.dsm.com)
Oil containing one or more long-chain polyunsaturated fatty acids phospholipids derived from biomass	<a href="#">EP2156744 (A1)</a>	2010-02-24	NESTEC SA [CH] (Subsidiary of Nestlé S.A.)
Structural carotenoid analogs for the inhibition and amelioration of disease	<a href="#">EP2392562 (A1)</a>	2011-12-07	CARDAX PHARMACEUTICALS INC [US] (cardaxpharma.com)
Composition Comprising Omega-7 and/or Omega-4 Fatty Acids	<a href="#">EP2272383 (A1)</a>	2011-01-12	SBAE IND NV [BE] (http://www.algaeforce.com/sbae-industries)



# La Supply Chain: coltivazione e della lavorazione delle alghe

C. Smith and A. Higson, NNFCC "Research Needs in Ecosystem Services to Support Algal Biofuels, Bioenergy and Commodity Chemicals Production in the UK" February 2012.



# Grazie

## Contatti

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