Macroalgae attracts greater investment for sugar-based ethanol, advanced biofuels, drop-in fuels and biochemicals

Seaweed: A new wave of investment in macro-algae

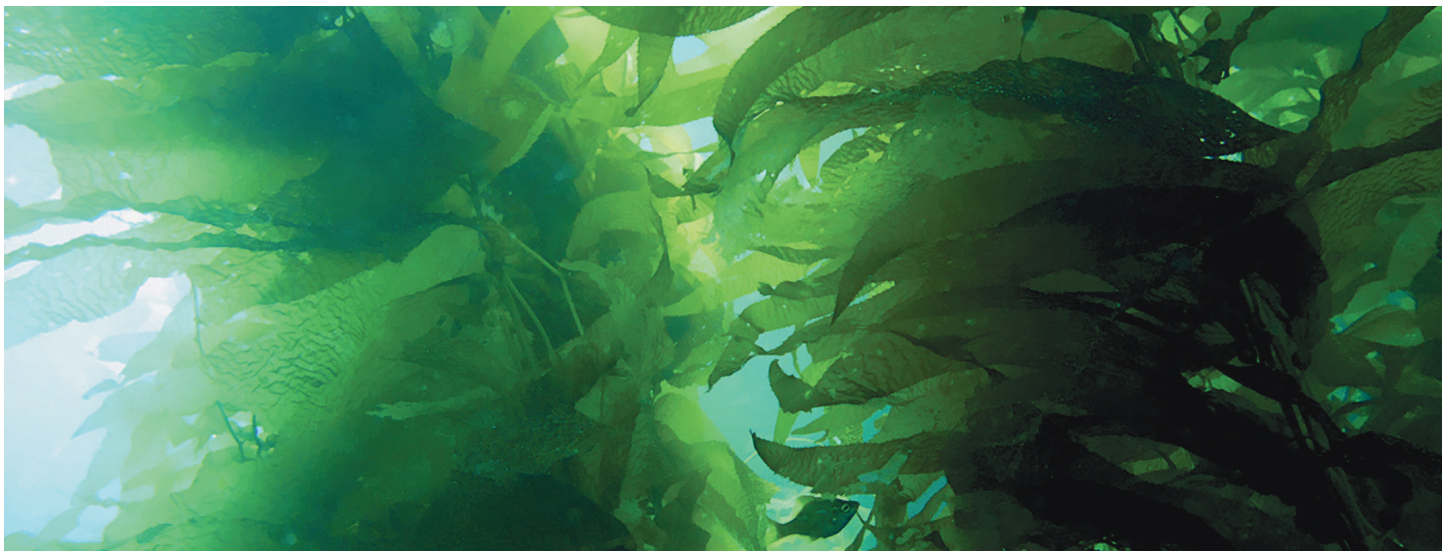
For more than 100 years, China and Asian nations have grown seaweed also known as macro-algae at a large industrial scale for the production of food, animal feed, pharmaceutical remedies, and cosmetic purposes. An emerging rise in investment from petrochemical majors and governments for projects in Asia, Europe and the Americas aims at extracting sugars from seaweed for ethanol, bio-based diesel, advanced biofuels, drop-in fuels, biobutanol, biochemicals and biopolymers.

An increasing number of petrochemical majors including Dupont, Statoil, and ENAP believe harvesting sugars from macroalgae is an attractive investment as a next-generation, sea-based feedstock for advanced Biofuels

Why Macro-Algae? A new study, *Algae 2020, Vol 2* (October, 2010 update) finds phycology experts and petrochemical majors from Korea, the Philippines, Norway, the US and Chile agree seaweed grows faster than terrestrial crops, has a high sugar content for conversion to ethanol and advanced biofuels, absorbs more airborne carbon than land-based plants, has no lignin, can be easily harvested compared to microalgae, requires no pretreatment for ethanol production, and can be harvested up to six times a year in warm climates.

Most macro-algae biofuel related projects prior to 2010 focused on ethanol. However, since 2010, the entrance of oil and petrochemical majors Dupont, Statoil and ENAP are expressing an increased interest in extracting sugars from seaweed to create not just ethanol, but also drop-in fuels, biochemicals and other valuable co products such as biobutanol and oleochemicals. This follows a key trend by Shell and BP investing $12 and $8 billion respectively in sugar-based conglomerates in Brazil to produce ethanol, bio-butanol, drop-in fuels, and bio-based chemical products.

Emerging Markets Online's updated *Algae 2020* study finds the surging investments in extracting sugars from seaweed follows an emerging microbial 'sugar to biofuels' trend in the Americas in Brazil for ethanol, biobutanol,



and advanced biofuels. In September 2010, Bunge and Chevron invested in US-based Solazyme to create renewable algae-based oils using sugar as a feedstock. In addition, LS9, Amyris, and Virent aim to use plant-based sugars to produce bio-based diesel, drop-in fuels, biogasoline, biojet, biobutanol, biochemicals and bioplastics.

Will sea-based sugars from macro-algae provide a new feedstock for advanced biofuels, drop in fuels and biochemicals for these emerging sugar-based, infrastructure compatible biofuels and chemicals platforms? Evidently, an increasing number of petrochemical majors including Dupont, Statoil, and ENAP believe harvesting sugars from macroalgae is an attractive investment as a next-generation, sea-based feedstock for advanced biofuels, drop-in fuels, biochemicals, and biopolymers. ●

For more information:
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Emerging projects in macro-algae

Project and partners	Products	Description
South Korea National Energy Ministry	Ethanol	Korea - $275 million (€210) project over 10 years to produce nearly 400 million gallons a year of ethanol by 2020, approximately 13% of South Korea's consumption. The project will create an offshore seaweed forest approximately 86,000 acres in size.
City of Venice JV with Port Authority and Electric Power Plant	Algae Biofuel for Electric Power	Italy - €200 million project announced in March 2009 by the city of Venice to capture algae seaweed and generate 40 MW of power from algae biofuel to supply up to half of the city's power supply and for to port facilities and docked ships in the harbour. The project will also cultivate microalgae in closed photobioreactors to generate biomass for power generation.
Biomara / Scotland's Ministry of Energy	Algal Biofuels	Scotland - $8 million from Scotland's Energy Ministry, the EU's INTERREG IVA Programme, and Crown Estate in April 2009 to investigate seaweed and microalgae strains for commercial scale production.
Chilean Economic Development Corporation (CORFO) and Bio-Architecture Lab (BAL)	Ethanol	Chile - $7 million investment in 2010 in a seaweed-based bio-ethanol project lead by US-based BAL in collaboration with Chilean oil company ENAP, CORFO and the Universidad de Los Lagos. The project goal is to replace 5% of Chile's petrol consumption with 165 million litres of ethanol.
Phillipines National Government, Korean Institute for Industrial Technology.	Ethanol and biofuels	Philippines - $5 million from the Philippines government to develop a 250 acre, seaweed-based ethanol plant and aquafarm cluster. The aquafarms will be in 4 locations and will use a South Korean ethanol extraction technology developed at the Korean Institute for Industrial Technology.
Statoil and Bio-Architecture Lab (BAL)	Ethanol and Co-Products (Oils, Proteins, Iodine)	Norway – starting in late 2010, Statoil will fund BAL's R&D and demonstration projects in Norway with the goal of commercialisation of BAL's technology in Norway and in Europe. BAL will use its process technology will convert seaweed from Statoil's aquafarming operations into ethanol and co-products in the partnership.
Dupont/BAL (Bio-Architechture Lab)	Biobutanol, Sugars for Advanced and Drop-In Fuels	USA - $9 million US-based Advanced Research Projects Administration Energy (DOE) announced in Spring 2010 funding to support a DuPont/BAL macroalgae project aimed at supplying biobutanol to be marketed by Butamax, the BP-DuPont JV

Sources: Emerging Markets Online, Algae 2020 study Vol. 2, Biofuels Digest, industry journals and papers