

New Algae Products from the Source of Life.

How big investments in 'biofuel of the future' will grow our future food and its own bio-packaging from algae.



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By Robert Henrikson. October 27, 2009.

Today, algae is called the '*biofuel of the future.*'
30 years ago, it was called the '*food of the future.*'

Three decades ago, the first algae entrepreneurs were building growing ponds in countries like Mexico, India, Israel, Japan, Taiwan, Thailand and the USA.

The first algae food supplements were introduced in the US natural food market in 1979. Growing food with 20 times the productivity as conventional crops, algae promised to become the 'food of the future'.

The dominant technology for commercial algae production for food and supplements has been open ponds in warm, sunny climates. Over time, some specialty algae products have been cultivated in closed or fermentation systems.

But production costs have remained high due to these factors: using agricultural land, fresh water, clean nutrients, skilled personnel, servicing big investments for pond systems, harvesting and drying infrastructure, and complying with food and quality regulations.



With production costs over \$10 per kilo, growing algae is ten times the cost of many commercial foods and feeds. Annual world microalgae output may have reached 10,000 tons of *spirulina*, *chlorella*, *dunaliella* and *hematococcus*. Even big commercial algae farms are relatively small, less than 100 hectares in size. Nevertheless, over the years, the number and variety of high value food and specialty products from algae has flourished.

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Algae in Products Today



Most people have no idea how many everyday products contain algae.

Algae is an ingredient in thousands of products for food, feed, colors, nutraceuticals, medicinals, cosmetics and personal care, biofertilizers and fine chemicals. Even more innovative algae based products are coming.

Algae Products and Markets

Food Supplements	with microalgae, marine algae, dha and epa oils
Health Food Ingredient	In protein shakes, juice drinks, energy bars
Personal Care Products	creams, masks, shampoos, cleansers. cosmetics
Nutraceuticals, Medicinals	pigments, oils, antioxidants, medical diagnostics
Edible Seaweeds	nori, dulse, wakame, kelp, seasoning
Food Ingredient	proteins, pigments, thickeners, stabilizers, oils
Pet Food Ingredient	aquarium fish and specialty pet foods
Fish Feed Supplement	for survival, health, nutrition, coloration, omega 3
Animal Feed and Oils	for survival, health, nutrition, omega 3
Fertilizers	plant food, growth promoters, soil conditioners
Biopolymers	packaging, bioplastics, adhesives
Fine chemicals	industrial enzymes, esters, resins

The drive for cheap biofuel will make algae the food of the future.

To become the "food of the future", and compete with conventional human foods and animal feeds, algae production costs must be ten times lower.

Lower costs will deliver healthy algae omega 3 oils and protein food and feed products, rebalancing our diets. We'll see algae based resins, biopolymers, bioplastics and a range of specialty chemicals replacing today's fossil fuel chemical products.

The big algae energy investment underway may take a decade to reach commercial biofuels. Algae food and bio-plastic products are likely to arrive earlier, since fuel is one of the least valuable end products. To deliver competitive algae biofuel, companies will need to crush costs to \$1/kg or less!

How will algae production costs come down? Biomimicry.

Numerous ventures have now successfully raised a combined billion dollars for algae biofuel R&D and production. Innovations and technological breakthroughs will dramatically change the way algae has been produced over the past 30 years. How?

Discover better performing algae cultures. Thirty years ago, scientists used available natural strains such as *spirulina* and *chlorella*. Today, backed by R&D budgets, scientists screen, identify and engineer strains of algae with superior and enhanced properties, faster growth rates, and abilities to grow in conditions such as low light and temperature and high saline, brackish or ocean water.

Develop simpler, less costly design and technology. Rethink, redesign and reengineer the entire growing system, harvesting, processing and drying sequence to reduce capital costs for equipment, operating costs and power consumption.

Use marginal land and water just like nature. To grow algae on the large scale needed to produce biofuels, growers should not use valuable fertile agricultural land and scarce fresh water. Rather, find remnant flat land and ocean, saline, brackish or waste water located near nutrient resources.

Use waste nutrients just like nature. To lower costs, future algae growing systems will have to follow principals of biomimicry. Recycle waste CO₂ effluent, animal and plant wastes, which are costly problems today. Ferment agricultural, animal, industrial and waste streams into carbon, nitrogen, phosphorus, potassium and trace nutrients to feed the algae. Or grow algae by cleaning up municipal waste.

Use all the algae biomass just like nature. Sell ALL of the algae. Start with the end product and work backwards. What are the products that can be sold, and for how much, and how will markets be developed for those products?

Create multiple revenue streams to offset costs. Environmental services may include CO₂ and pollution mitigation, wastewater treatment, biomass and waste heat for generating electricity and even carbon offsets.

Non-fuel algae products may represent the 70% of the algae biomass. Potential revenue streams include algae oil and lipid supplementation in animal and human feed, like healthy omega 3 oils, animal feedstocks and supplements, biofertilizers, fine chemicals and bio-plastics, extracts for pigments nutraceuticals, pharmaceuticals and medicinals.

Get big. Scale up to thousands of hectares. Large algae farms will allow economies of scale. Along the way, demonstration farms to prove out technologies will generate revenue streams from non-fuel products for smaller markets.

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Exploit the unexpected- *carpe diem*. Investment drives innovation, creates serendipity and breakthroughs. Who knows what will unfold that we haven't thought of yet.

So get use to life from the base of the food chain. The dazzling array of eco-products coming from algae will be healthy for you and our planet.

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Robert Henrikson began his green business career cementing pvc pipes at the first Proteus algae ponds in California's Imperial Valley in 1977. Over the next 32 years, Robert has been an entrepreneur in such diverse fields such as algae, bamboo, carbon and natural resources. He is an advisor and consultant to companies and non-profit organizations on product development, branding, sales, marketing and media strategy, developing business and financial models for the green economy for our health, our society and our planet.



In 1981, Robert became President of Earthrise, the pioneering algae company and founded Earthrise Farms, the world's largest spirulina farm, with Dainippon Ink & Chemicals of Japan. In the 1980s, he developed the health food retail, direct mail, bulk wholesale and animal feed markets. In the 1990s, he established distributors in 30 countries, making Earthrise® the world's most famous algae brand www.earthrise.com.

He has written numerous articles and made presentations around the world. Through his communications company, Ronore Enterprises, he authored *Earth Food Spirulina*, translated and published in seven languages, 1989-99, online at www.spirulinasource.com.

In 2009, Robert initiated the Algae Alliance, a network of independent algae consultants in commercial algae production, processing, product development, marketing and sales. www.algaealliance.com. He currently advises several algae companies and investors in algae business ventures.

Robert was CEO of Bamboo Technologies through startup 2004-08. Bamboo Technologies is the world leader in international code certified bamboo building technology, first to build engineered, manufactured bamboo homes in the USA, developing the Bamboo Living® Homes brand to advance bamboo as a green alternative for buildings around the world. Robert handled overall direction, operations, marketing and financial management, and produced catalogs, videos, DVDs and website www.bamboolive.com.

Robert created the International Bamboo Building Design Competition to promote bamboo building design to architects and builders www.bamboocompetition.com. In 2007 he published *Visionary Bamboo Designs for Ecological Living* www.bamboosun.com.

A documentary filmmaker, he has produced the *Folding Time and Space* DVD for Burning Man for the past 5 years www.folding-time.com, www.panmagic.com. He stewards a botanical garden in Hana, Maui www.hanapalmsretreat.com. Recently Robert has been involved with his family owned Wild Thyme Farm to sell the first forest carbon offsets in the Pacific Northwest into the US voluntary market in March 2009. www.wildthymefarm.com.

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