

ALGAE FOR ENTREPRENEURS



Small Business Applications of Algae

By David Sieg

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First and foremost, Dr. Mark Edwards has written nine books in the award-winning *Green Algae Strategy Series* that focus on sustainable and affordable food and energy (SAFE) production. These books are used as texts and required reading in colleges, universities, and institutes in over 20 countries for interdisciplinary courses on sustainable environment, food, and other forms of energy. Dr. Edwards' blog, Algae 101, was awarded the #1 visited site for 2010 at *Algae Industry Magazine*. His recent global book awards include:

- 2011 Pinnacle Gold Medal for "Best Environmental Book," *Abundance*.
- 2011 Nautilus Silver Medal for "Best Children's Book," *The Tiny Plant that Saved our Planet*.
- 2009 Independent Publisher Gold Medal for "Best Science Book," *Green Algae Strategy*.

Professor Edwards' new book, *Freedom Foods: Superior Nutrition and Taste from low on the Food Chain for People, Producers and Our Planet*, is described by Josh Tickell, Director of *The Fuel Film*, as "Possibly the most important survival guide for humanity ever written."

www.Making-Biodiesel-Books.com is proud to join Dr. Edwards and Robert Henrikson have created a global social collaboratory to empower people to become algae entrepreneurs at www.AlgaeCompetition.com.

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INTRODUCTION

The Algae Revolution is upon us.

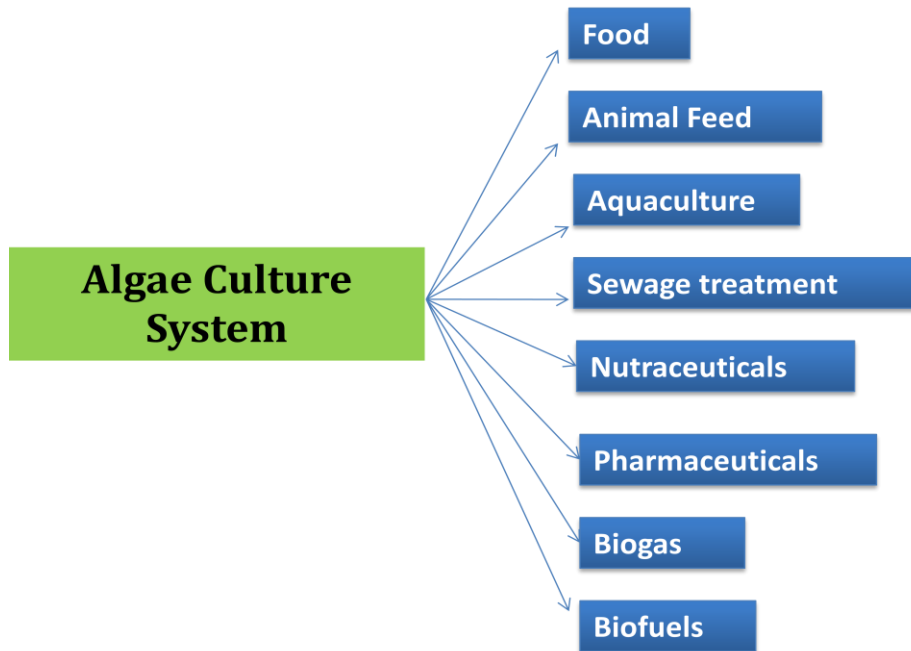
Algae, as a basic building block of life itself, revolutionized life in the oceans 100's of millions of years ago, then life on land 10's of millions of years ago. It gave us the hydrocarbon oceans of oil we now use, and the industrial revolution as we know it couldn't have started, or continued, without it.

In the coming century you're going to see it revolutionize fuel once again. But that is only the beginning. From bio-plastics, to organic health food supplements, to curing diseases, to animal feeds, to bio fertilizers, to aqua farming, to water filtration and purification, to cleaning up the environment. AND THAT is only naming a few.

Imagine for just a moment an organism that...

- Is so old it is one of Earth's first forms of life. It has survived for BILLIONS of years.
- Enabled the planets biodiversity of plants, insects, and animals.
- Has been able to adapt to Earth's most extreme climates.
- Provides over half of the planets oxygen.
- It can be found in soil, water, ice, at all altitudes and latitudes.
- Is able to reproduce in almost limitless sizes, shapes, colors and textures.
- Has over 100,000 species, and almost limitless strains.
- Has the ability to grow incredibly fast, or slow
- Is responsible for the vast underground oceans of oil
- Was responsible for the coloring of Cleopatra's gowns, and the Roman legions togas.
- Thrives in saltwater, freshwater, brine, sewage, or wastewater.
- Is able to efficiently transform solar energy into high energy biomass.
- It requires no cropland to grow, and displaces no food crops.
- Is able to "feed" on greenhouse gases and clean the environment.
- It has no growing season and can be cultivated year around.
- It has over 60% protein which can be energy foods.
- It can contain over 60% lipids (oil) which can be used in biofuels.
- It can be grown with over 90% carbohydrates and used to make paper.
- It can produce food 30 to 100 times faster than land based grains.
- It can be used to produce biofuels, bioethanol, jet fuel, and bio gasoline.
- It can produce low cost medicines, pharmaceuticals and vaccines.
- It can produce fine cosmetics, herbal wraps, and skin crèmes.
- It can produce biofuels many times faster and cheaper than corn or soybeans.
- It can create nutritious health foods and has been eaten for centuries in Asia.
- It can be used to make bio plastics.
- It can be used to feed the world's animals and livestock.
- It can be used to grow organic vegetables.
- It can be used in aquaculture to grow fish and vegetable at the same time.
- It can be used to cure:
 - Diabetes
 - Cancer
 - Obesity

- Used in Weight loss
- Reduce anxiety and sleep disorders
- Anti-aging effects on skin, hair, and organs.
- Improves mental function and enhances concentration.
- Improves immune function.



Yet despite all of these benefits, it suffers from a perception problem.

- Most products on the market are used to kill it or contain it.
- Is seen as green slime, a bad odor, an annoyance, something to be rid of.
- Very little research or money is being devoted to it outside of biofuels.

It is currently being used to only 1% of its potential.

And THIS is where opportunity for algae lives. This book is all about the creative, explored, and unexplored uses of algae. It is an attempt to bring the algae out of the mud puddles, swamps, bogs, and laboratories, into the spotlight of the 21st. century.

Billions of dollars will be made this century by people who are able to “think outside the box” and develop new ways (and reconfigure old ways) in which this humble and misunderstood organism can change the world.

This book is different in many ways from my other books. It is not a “How-To” manual. I have explored that extensively in my other books. This book focuses on the “What” and “Why” of algae. It is created by an entrepreneur, for entrepreneurs, and small business owners looking to explore the various commercial applications available through the use of algae.

I have tried to answer the questions I would have if I was attempting or considering this as a money making endeavor. This book is also a “work in progress” and probably will be for many years to come as advances in biotechnology are made. There will be new editions every year.

What you need to know ahead of time is that we are standing on the edge of a frontier. As with any unexplored territory, there are no planes (short cuts) going to your destination, there are no interstate highway systems connecting the dots, there are no road maps. You build your fortune by studying who came before you and striking out on your own to create your own destiny.

You apply, or reject, their knowledge in favor of your own (hard-won) experience.

If you see an area I didn't cover, or wish I'd covered more, Let me know. I'll use your questions and comments to make a better book in the next edition.

Contact me here: dsieg@making-biodiesel-books.com

Let's change the world, for the better, together.

David Sieg
Des Moines, Iowa USA
September, 2011

Purpose of This Book

Over the last couple of years the algae revolution has changed the face of petro-chemical industries. Only a few things have had such tremendous impacts on the developments within the industrial sector. From the increase in the number of processes using algae it is evident that in the coming years, the whole global scenario will be altered and changed by algae.

The purpose of this book is to provide an insight of the various commercial processes which use algae. This book will feature information on the process and benefits of using algae for commercial processes. There are numerous industrial applications of algae which are of great importance and have developed in to successful industries over passage of time.

When I was doing preliminary research for this book I was amazed at the price tag for similar books on this subject. \$1000 to \$5000 for an eBook seemed to be the norm in this market. This is, of course, way beyond the reach of small business owners, and all but the most successful entrepreneurs. I wanted this book to be more affordable.

I wanted this book to also be an inexpensive resource to the average person. I wanted small business owners who have dreams, and can make a difference, not to let the price tag stop them. Small business owners and entrepreneurs are in my opinion, *WHERE* the home grown innovation will take place.

I also wanted to make this book readable for the average person. Too many books of this nature seem to focus on unintelligible industry jargon, baffling financial facts, figures, and graphs. They seem more impressed with themselves than they are in giving useful, actionable, information. I've tried to boil this info down into the most understandable way I could. Sometimes I was able to, other times I couldn't find the correct words myself without resorting to industry language.

Latin of course, is Latin. Many species names, even after 15 years in the business, I still can't pronounce correctly, so don't feel bad if you can't either. But there is no other way to identify them. Technical terms, are also, technical terms. It serves no purpose other than to call them exactly what they are.

Yes, I know this book costs more than my other books. It also took almost 6 years to research, write, and edit. When I thought I was finished, more advances in the field made some parts obsolete and had to be done over. This is a *constantly changing* area of biotechnology.

I hope this book helps you to expand your thinking, your dreams, expands your ideas, expands the number of techniques available to you, expands your products lines, and ultimately, expands your bank account.

This book is also my own small gift to this incredibly exciting, expanding, and ever growing, field of research.

Forward by Dr. Mark Edwards of the “Green Algae Strategy” Series

Algae for Entrepreneurs lays out a Green Algae Strategy that offers millions of new jobs and fascinating new careers. Every chapter of *Algae for Entrepreneurs* offers dozens of new business and career opportunities. Wise readers will apply these insights to their favored industries. Every industry will benefit from new algae-based products.

Contemporary entrepreneurs must compete in increasingly crowded markets with continually rising input costs. As natural resources move beyond their peak, input costs will rise even more rapidly, diminishing margins for entrepreneurs. People will have to work harder for less reward. Competing in free-market consumptive societies provides entrepreneurial benefits when natural resources are cheap. Free markets do not price the consumption of natural resources, which provides substantial advantage to those consuming resources in the short term. However, waste and consumption makes no sense when vital natural resources approach extinction.

Entrepreneurs today must build businesses in communities where air pollution causes respiratory problems for their family. Water pollution threatens the health of their children and community. Soil degradation leads to dust storms that coat everything with layers of grime. Fortunately, each of these social challenges offers opportunity for entrepreneurs. Algapreneurs can use algae-based solutions to remediate air, water, and cropland.

David Sieg highlights biofuels because the entrepreneurial potential of algae biofuels is stratospheric. A few large, well-funded firms are likely to cash-in on the algae-to-biofuels play. Far more entrepreneurs will make fortunes on other applications that provide high value to human societies with sustainable and affordable food, nutrients, functional foods, additives, fish and animal feeds, and bio fertilizers. Other entrepreneurs will offer new and stronger nano-materials for clothing, textiles, packaging, and building materials.

Fabulous opportunities await social entrepreneurs in wastewater recovery, carbon capture, and soil regeneration. Others will place cultivated algae production systems, (CAPS) in remote villages, impoverished rural areas, and inner cities. Microloans, NGO, or government support may pave the way for installing CAPS in developing countries to provide clean water, healthy nutrition, animal feed, bio fertilizer, and cooking oil. Governments are likely to offer thousands of jobs in training others or operating CAPS to provide famine or natural disaster relief.

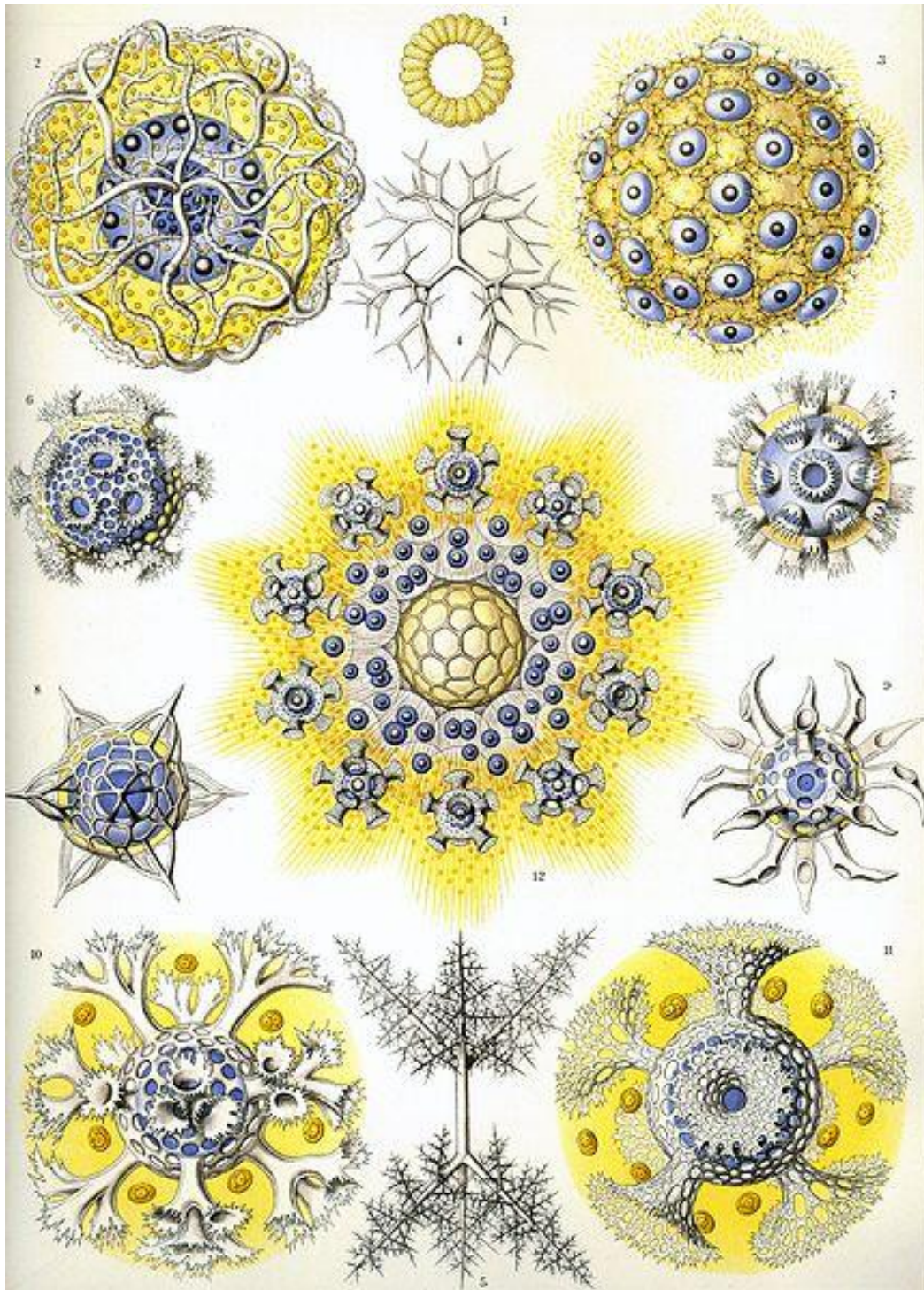
Probably the best targets of algae opportunity lie in medicines. Currently, most medicines and pharmaceuticals are produced with chemicals or in plants or animals. Algae can produce nearly all the compounds necessary to create superior functional foods, nutritionals, nutraceuticals, cosmetics, pharmaceuticals, vaccines, and medicines. The competitive business plan for algae-based medicines is simple: faster, easier, less costly, sustainable, and better. Algae-based medicines are absorbed more easily than industrial versions because the algae cell size is so tiny.

A Green Algae Strategy offers entrepreneurs thousands of business new opportunities that can transform our extractive and consumptive society to a new model of recover, recycle, and repair. We can recover waste stream nutrients from our air, water, and soils and reuse them to meet vital social needs. While green entrepreneurs are producing tomorrow's sustainable and affordable food and energy, they will be repairing our ecosystems to provide clean air, water, and fertile soils.

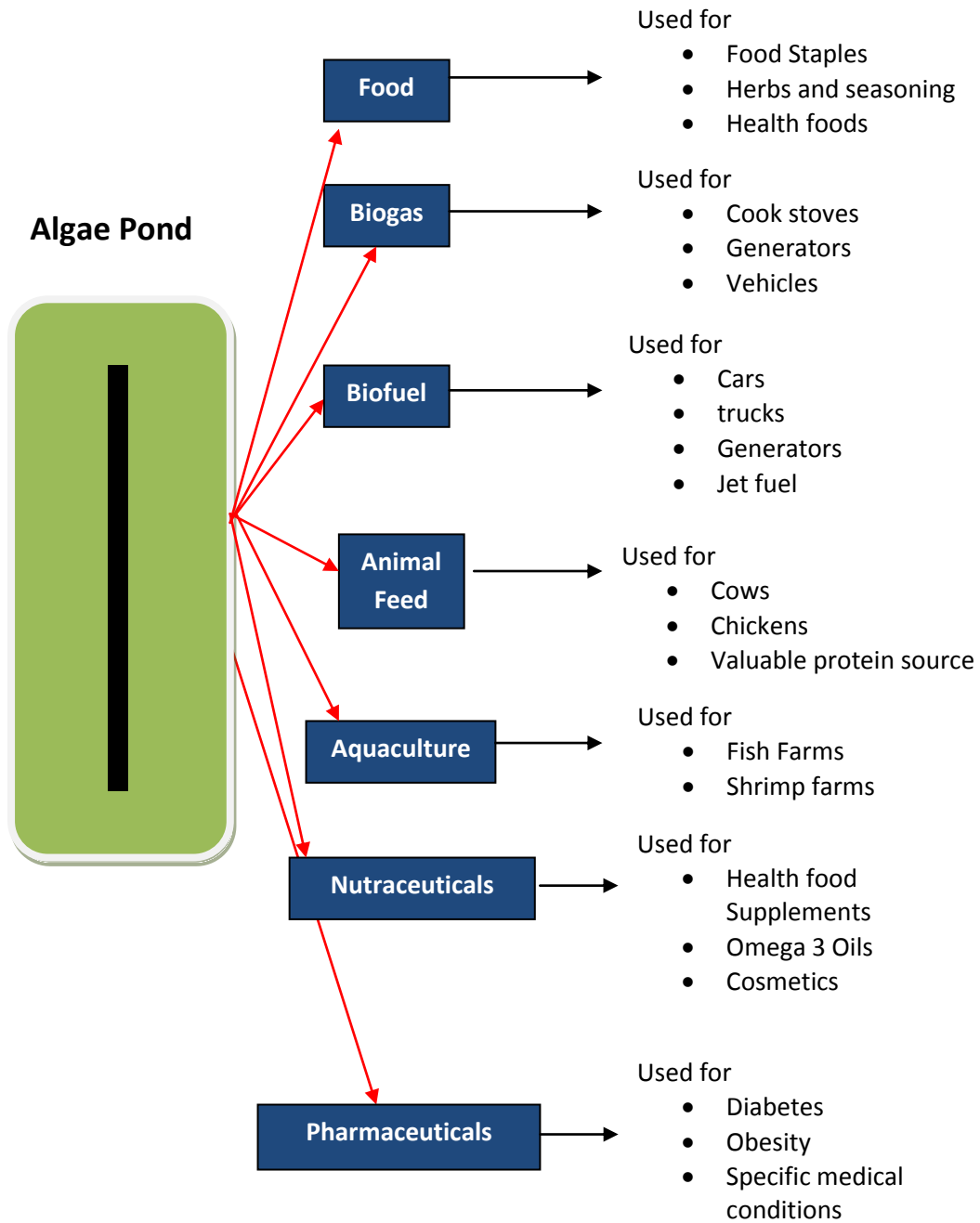
Algae for Entrepreneurs offers an extraordinary legacy for our children – a green industry of valuable products, plentiful natural resources, and clean communities in which to raise our grandchildren and their children, in good health.

Mark R. Edwards
September 2011

Part One...Algae Overview



Commercial Uses of Algae Overview



What Is Algae?

Algae are single celled organisms and are one of the fastest growing plants in the history of life on this planet. They can grow both in fresh water and marine (salt water) environments. They are photosynthetic and like all other green plants they convert carbon dioxide to organic carbon. Over half of the world's oxygen that is released into the environment is a result of photosynthesis. There are over 65,000 known species of algae with a variety of red, blue-green, green and brown algae.

The industrial sector has been a flourishing sector over the past few years. Most of the chemical industries were heavily dependent on synthetic materials and petrochemicals. With quick consumption of non-renewable energy sources industries today face an energy crises of global proportions. Increased global warming also poses a constant threat. Industries are looking for alternate renewable sources of energy.

Algae are all set to transform industries in ways which can't now even be imagined. Algae have become a prime target for obtaining chemicals which are in considerable demand. Alga culture is promoted in different parts of the world in many different applications. The use of natural chemical constituents in industries has increased enormously in the past decade, and show little sign of slowing.

Algae were once thought as a nagging issue which clogs ponds, smells bad and makes coastlines look like from a horror movie. Algae cultivation has added an environment friendly aspect to potential chemical constituents which can be extracted from algae species.

Algae are a part of our daily life. Without Algae derivatives life would be remarkably different. We are in contact with algae derivatives all the time and it would be difficult to survive without using them. Various derivatives and algae constituents are part of our food, drugs, cosmetics, clothes, paints and many other products.

Algae have emerged as one of the most promising potential sources of biofuels. Studies have confirmed that algae-based biofuels can help reduce the greenhouse effect. Algae are also efficient carbon fixers. They can absorb up to 50% of atmospheric carbon converting it to organic carbon. During the process of photosynthesis algae produce oxygen. Some believe ocean algae is responsible for more planetary oxygen than even the rain forests.

Why is Now the Time to Pursue Algae?

If algae were a business corporation it would be a huge multi-national conglomerate combining

- Shell Oil
- Florida Power and Light
- Duke Energy
- General Mills
- Borden
- Dole
- Nestle
- Morton Salt
- Proctor and Gamble
- Purina

- Waste management systems
- Southwest Water company
- Merck
- Pfizer
- Safeway
- Hi-Health⁵

For the last 50 years algae producers have been limited to a narrow range of products, mostly health foods, and some ingredients for the food industry. Today, the marketplace is very different as algae producers can examine an array of valuable co-products that have many times more value.

There are a number of political and market factors converging together at this time to create a “perfect storm” to support the idea of mass utilization and cultivation of algae on a global scale.

Global Considerations:

- **Oil prices:** Low oil prices of the previous decades provided no financial incentive to pursue algae as a serious source of oil. Today however it is dramatically different. Soaring oil prices are effectively destabilizing the entire world. Concerns about national security are motivating substantial investments in renewable fuels. The first and foremost of which are algae.
- **Natural Gas prices:** Heavy agricultural consumption of natural gas for fertilizers, herbicides, and pesticides has led to a 500% increase in the price for these commodities in recent years. Much of this cost increase can be attributed to lack of domestic supply and increased reliance on imports.
- **Food Prices:** In decades past, food grains could be produced at 10% of the cost of growing algae. In the last few years food prices have been rising dramatically, doubling and tripling in response to the price of oil. New algae strains and growth models promise to slash production costs as well as provide an alternative to using food crops in the production of biofuels.
- **Food Security:** Inexpensive food grains sold on the world markets allowed governments to buy food cheaply to feed their growing populations. The rising cost of food has resulted in social unrest and riots in many countries. This trend is only beginning and promises to cause global unrest in the future.
- **Ethanol Inflation:** First generation Ethanol and biofuel induced price increases on the global food supply chain have increased the costs on all foods worldwide.
- **Governmental Action:** Governments around the world have recognized the need for truly renewable food and biofuels, and algae are the leading contender. As a consequence, government grants and research are starting to pour into this field.

Consumer Interest:

- Increasing food and fuel prices, water scarcity global warming, and pollution are motivating consumers to “Go Green” like never before.
- Traditional products like “Fair Trade” coffee, and organic vegetables have proven consumers are aware of, and willing to pay a premium for, products which they see as non-exploitive and contributing to the general welfare of everyone.

Changes in Nature:

- **Natural disasters:** Tsunamis in SE Asia, Earthquakes in China, Flooding in the Mid-West USA, famine in Africa, draught in Australia have severely impacted food production in the each of these places. As the weather world-wide becomes more complex, new answers will be needed to address global food production. Algae can be used to address world hunger.
- **Water Scarcity:** many communities and cities worldwide are facing shortages in water because as much as 80% of available water goes to irrigation of crops and other food related activities. Algae are very water efficient and require much less water to cultivate. In addition, algae can be cultivated in ANY type of water, even raw sewage.
- **Dead Zones:** Agricultural waste has been flowing into lakes, rivers and oceans creating “dead zones” where just about all life dies from a lack of oxygen. Algae have the ability to bring these coastal and inland waterways back to life.
- **Greenhouse Gases:** It’s estimated that each acre of farmland production adds about 2.25 tons of CO₂ into the atmosphere.¹ Algae on the other hand, “eat” CO₂ and exude oxygen.
- **Climate Change:** I think everyone has noticed the unusual weather patterns. Every year since 1993 has been reported to be in the hottest 20 years on record. This year (2011) Texas experienced over 100 days, of 100 degree heat. Traditional food crops have been, and will continue to be, devastated and suffer from diminished production.
- **Water Pollution:** Urban and rural communities have had their water contaminated by agricultural run-offs for years. The EPA has reported that 37% of US lakes are unfit for swimming due to this condition.²
- **Fossil Fuels:** Heavy use of petroleum products have led not only to “oil wars” but to price increases, which have had severe implications to the world’s food supply, resulting in food cascades and famine in some parts of Africa.

While natural climatic changes linked to growing food crops put the entire food chain in jeopardy, this same condition improves the commercial landscape for alga culture.

Changes in Technology:

- **Biotechnology:** New genomic advances are making it much easier to understand and implement in algal oil production. Current breakthroughs underway will make harvesting and oil extraction not only much easier and more economical, but should also lead to methods which will enable future entrepreneurs with the ability to manipulate algae species to their specific needs.
- **Nanotechnology:** Current alga nanotechnology is enabling scientists to coat thin filaments, to grow human cells inside the human body.³
- **Chemical and Mechanical Engineering:** is enabling scientist with new methods of optimizing plant growth and algae conversion into useful and valuable co-products.
- **Private and Government Sector Funding and Growth:** “Peak Oil” has motivated private sector and government funding on a large scale to find a replacement for fossil fuels. Exxon-Mobil recently announced 600 million in R&D. The US Department of Defense is currently conducting a “Manhattan Project” of algae biofuels as it is seen as one of the major replacements for “drop-in” fuels. Their fear is that they could run out of Fuel as early as 2016.⁴
- Current feed stocks of biofuels not only consume our ever diminishing crop lands but also consume trillions of gallons in water in order to provide a disappointing yield in biofuels.

Many scientists now believe commercial algae farms can produce up to 5000 gallons of oil per acre. Corn, in comparison only produces 18 gallons. In addition, corn ethanol only produces 64% of the energy of gasoline. This makes corn ethanol and energy loser in the highest sense. Therefore,

350 gallons of ethanol * 0.64 = 224 equivalent gallons of gasoline.⁵

Because algae have a longer chain of hydrocarbons which can be made into gasoline, jet fuel or green diesel, they burn 30% to 50% hotter than gasoline. This makes algae energy calculation,

5000 gallons of algae oil * 1.30 = 6,500 equivalent gallons of gasoline.⁵

Algae's potential as a biofuel is 30 times higher than that of corn ethanol. In addition, since valuable co-products exist as well, algae becomes the clear choice when choosing a biofuel feed stock.

Algae's Competitive Advantages:

Survival strategies adopted after several billions years on earth have made algae are different from land based plants in many ways.

- **Composition:** land based green biomass, such as corn, may be up to 97% non-oil or waste because most plant composition is cellulosic rather than protein for food, or energy producing oils. Some strains of algae have been known to produce 60% lipids. These are oils which can be used for a variety of commercial applications, including biofuels, jet fuels, or biodiesel.
- **Stored Energy:** The stored energy in conventional land plants such as corn can be converted to ethanol however they burn with less heat and only 64% of the energy of gasoline. Algae can convert solar energy and Co2 into longer carbon chains resulting in more powerful liquid transportation fuels.
- **Growth Speed:** Food grains require a full growing season to mature-from spring to fall-often up to 140 days or more to produce one crop. Algae in comparison can grow to maturity in a single day.
- **Direction of growth:** Land based plants tend to grow slowly in only one direction...up. Algae grow in 360 degrees.
- **Superstructure:** Land based plants devote most of the growth energy into building roots, trucks, leaves, etc. Algae on the other hand require no such support. Water support algae in its natural environment.
- **Consistent, Reliable Production:** Algae aren't subject to same conditions as land based crops. Therefore draught, insects, wind, rain, can devastate a traditional crop has no such effect on algae. Algae can weather natural cycles with ease, and have for several billion years.

10 Algae Market Predictions for the Future

Top questions in the minds of many entrepreneurs are

- “What products will get the highest return on my dollar?” as well as,
- “What products are emerging as the near future of algae production cycle?”

This section attempts to answer that question. Time and again in the research I have done certain key facts keep emerging. It is these facts which are drawn on now. They are presented here in no particular order of relevance.

Drop-In Fuels: The majority of the major market segments are currently mandating larger petrol and gasoline refineries to combine with biofuels within their current system. These regions also include United States, Brazil, European Union, China and The Indian subcontinent. Many oil and gas refineries are dealing with blending requirements by way of government distributors, in addition to vehicle makers in order to advance to improve biofuel combinations. These businesses hope to discover energy sources which are that will work with current motors, pipelines, storing models and filling stations.

Renewable Oils: After the “brewery” style, Solazyme, recognized for inexpensive, high-tech manufacturing designs making use of typical commercial fermenters. Plan to observe alot more businesses, utilizing the same system before long, among them Amyris, (renewable crude and green diesel via yeast) and Virent (eco-friendly diesel) Additionally When lower-cost, fiscally advantaged sugars appear in the united states, European union, China along with India, count on escalating armed service utilization for collaborative research and development implementation trials.

Diversified Products and Solutions: Motivated traders have considerably more trust in industry requirements to provide a way of gauging long-term potential in transportation fuels and petrochemical derivatives. Due to this, as well as others, the initial market leaders within algae energy sources tend to be diversifying straight to current gas, diesel and aircraft industry, along with eco-friendly chemical compounds, polymers, and energy development. Consequently the main participants are planning outside of merely biofuels directly into additional expanding market segments to encourage angel investor trust.

Co-Products: A growing direction in industrial and privately financed algae initiatives is a biomass concentration on significant worth solutions for example: animals and fish feed, omega 3s, health related foodstuffs, beauty and pharmaceutical drug purposes. Many algae producers search for the best worth goods intended for major market segments initially, after that intend to increase up eventually towards biofuel generation. Several investment strategies are currently choosing these types of superior worth, but lesser trading markets, to build up the capital required for business operations, personnel, and important technological know-how.

Seaweed and/or Macroalgae: Is likely to attain support from petrochemical majors Statoil, Dupont, ENAP due to its capability develop more rapidly as compared to ground dependent vegetation, together with a superior carbohydrate material for quicker transformation to ethanol along with other enhanced biofuels. Furthermore, it soaks up airborne carbon dioxide, does not have lignin which enable it to harvest with less effort as compared to microalgae. What's more, it needs virtually no pre-treatment for ethanol generation allowing it to be gathered as much as half a dozen intervals annually in hotter environments. Seaweed biofuels consist of methanol, ethanol, and bio butanol.

Global Joint ventures: Current monetary and regulating industry trends within the northern regions of the United States and European Union will likely be moving algae engineering exports southward and east to Central and South America, The African continent, and Asian countries. Progressively more collaborators are creating and employing strengths in system, financial systems, and geographies. Long-term trade favors large-scale improvement products of algae out of the Americas, the Middle East and Asia with growing demands for algal biofuels, products and services and engineering from China and India.

Capital Light, International Exports: Several pre-commercial, venture capitalists and also angel supported initiatives are progressively looking for a two pronged approach. The initial tactic attempts to license engineering to companies with investment capital to cultivate and increase the pre-commercial corporation to commercial quantities. It is also called the capital light technique. The second tactic is good for suppliers to ship know-how to localized collaborators in international geographies with advantaged circumstances for natural light, working costs, business development, and state help and support.

Strategic Collaborators: Suppliers and purchasers are actually building beginning stage R&D relationships in the algae area. Many algae vendors now have collaborative R&D associates with key market participants, for example, the Exxon-Synthetic Genomics \$600 million collaborative for eco-friendly crude development, the Algenol-Dow intended for bio products and services, BP-Martek for algae fermentation, Shell-HR Biopetroleum for hybrid PBR-pond development, Chevron-Solazyme for eco-friendly crude and drop in energy sources, Dupont-BAL for bio butanol from seaweed.

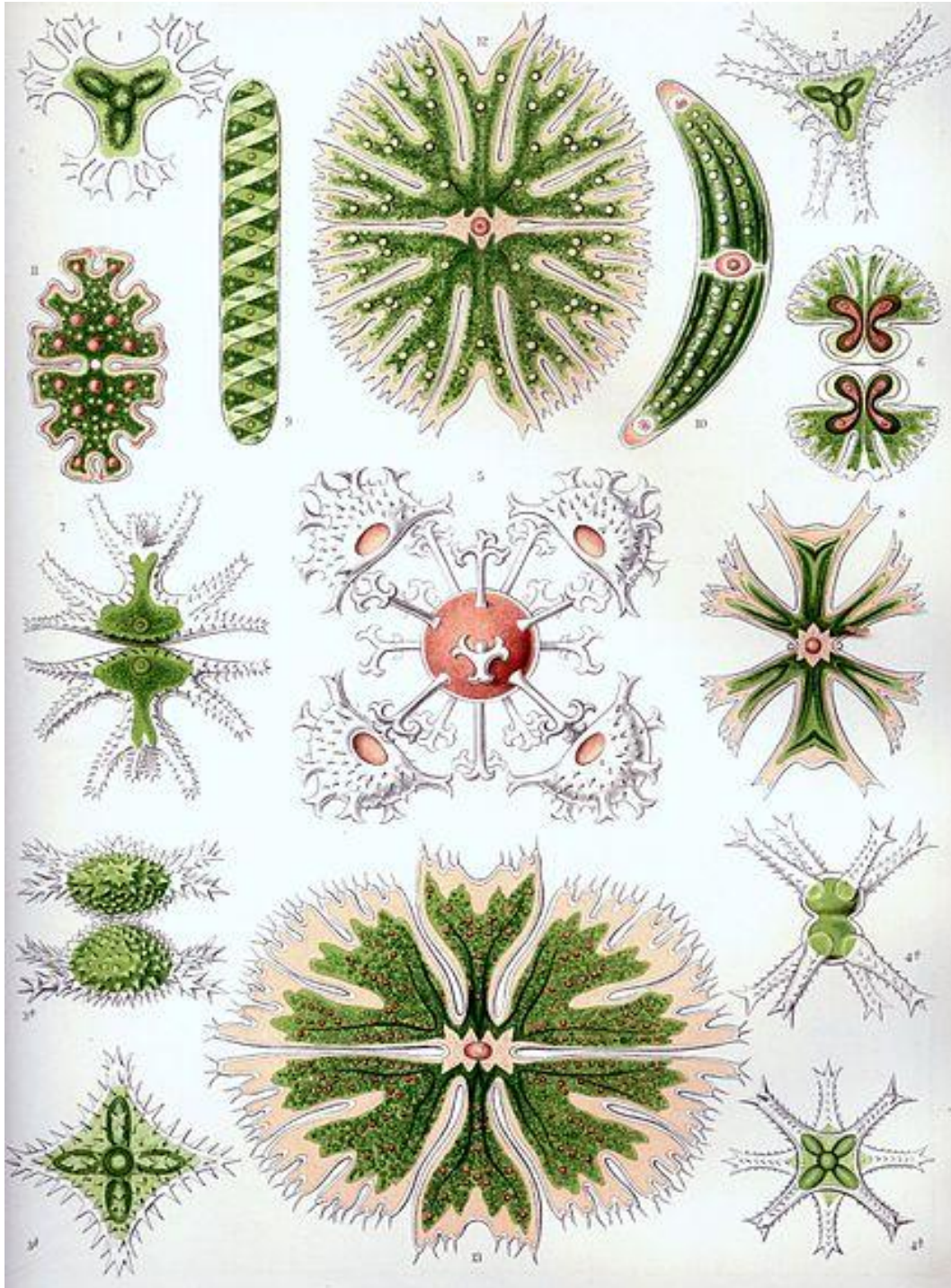
Government Research and Development: Authorities are awakening and discovering the possibilities of algae. The governments of United states, China, European union, India, Canada, Brazil as well as other world-wide are backing algae collaboratives at colleges and laboratories, public-private relationships, pre-commercial demonstrations phase businesses and others. A number of national algae R&D efforts are currently phasing straight into pre-commercial, deployment-stage algae undertakings employing pond, photo-bioreactor, and fermentation centered manufacturing platforms. Federal government R&D, implementation, and commercialization encouragement starts to grow directly into different nations and areas globally.

Growing Industry Growth: Both E.U. and US centered algae growers are increasingly looking for rising markets in Asia, Africa, Latin America and also the Middle East as a sector to improve latest market growth in addition a more friendly and accommodating government and regulatory regions for more immediate private development. Both Shell Oil and BP currently have placed businesses to create ethanol, bio-butanol, and drop-in energy sources, in addition bio-based chemicals.

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Part Two...The Biofuels Perspective.



About the Author



David Sieg, teacher, writer, consultant, and biofuels entrepreneur. David Sieg has done it all. Covering all aspects of algae biodiesel, algae biofuels, and alternative energy. He is also the Managing Director of International Biofuel Solutions, LTD. Thailand and President of Information Specialists, Corp., USA He currently lives in Des Moines, Iowa USA with his wife, Tram and Son, Lennon.

David Sieg consults on all areas of algae production on projects around the world. Contact him below to make your algae project a reality.

These reports were written with the intent of providing realistic, actionable, no BS, info on all aspects of the algae to production process. If you liked this book, we'd like to hear about it.

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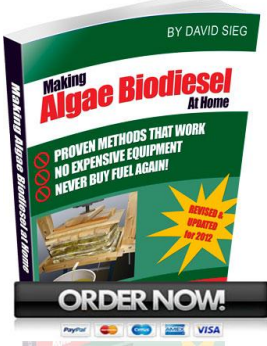


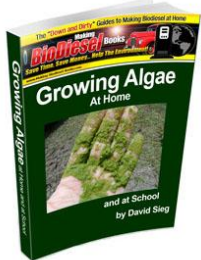
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