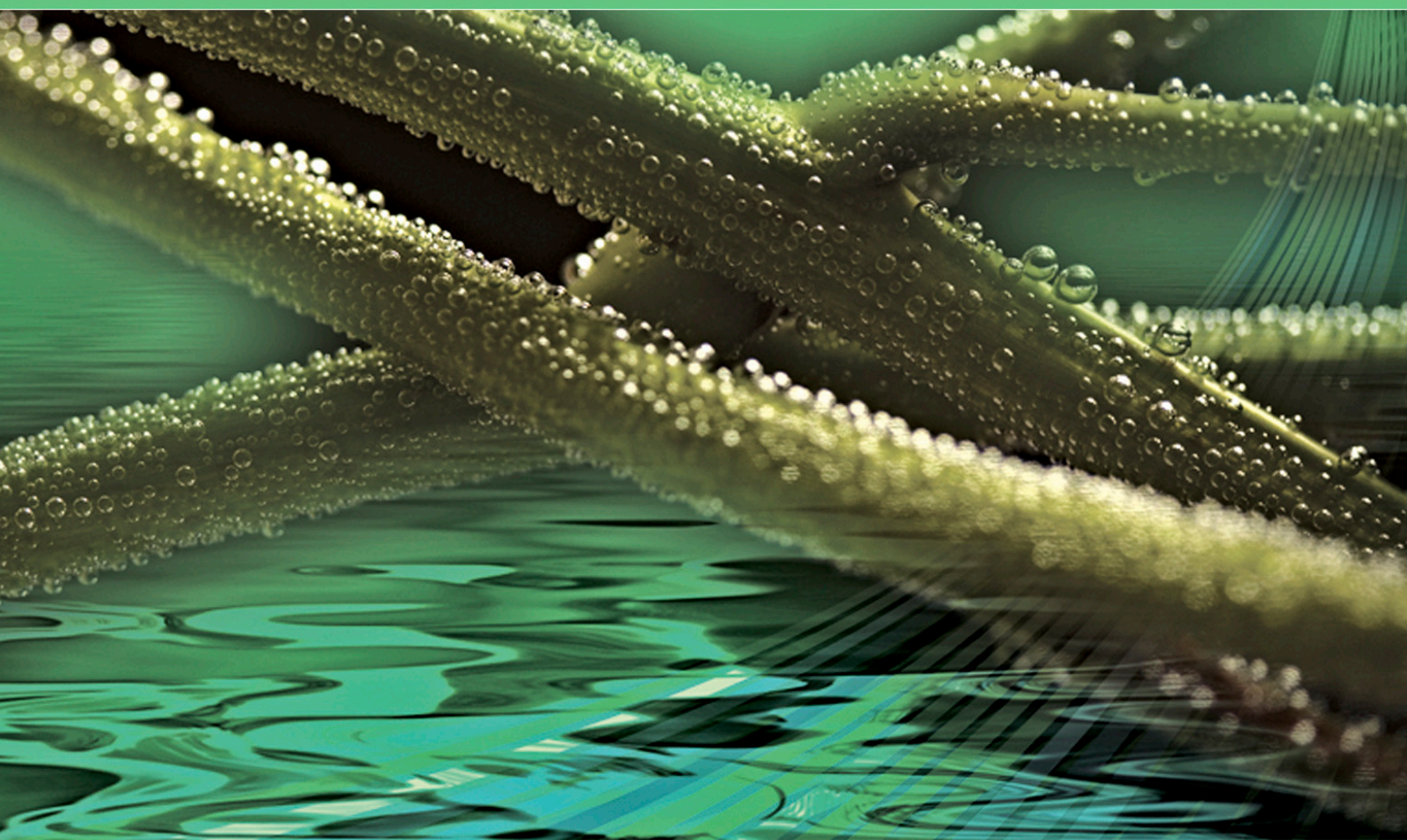


ALGAE WORLD 2010

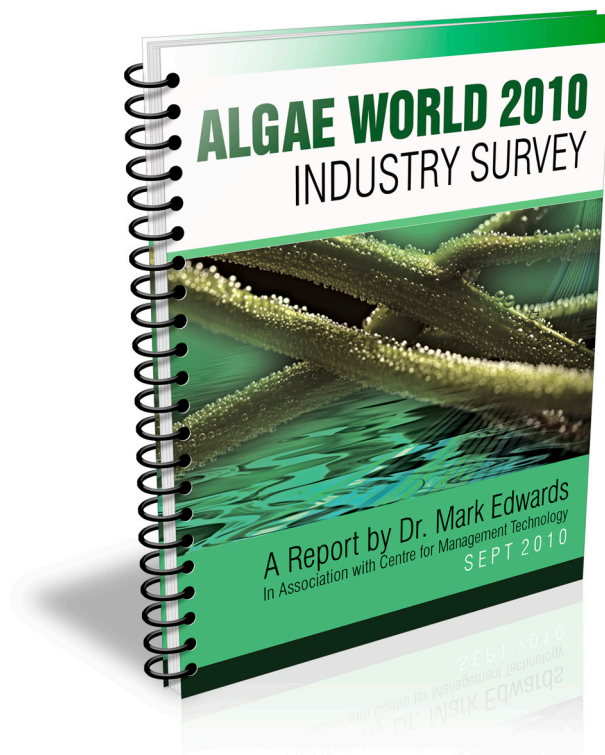
INDUSTRY SURVEY



A Report by Dr. Mark Edwards

In Association with Centre for Management Technology

SEPT 2010



For more information on ALGAE WORLD please visit
www.futureenergyevents.com/algae

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EXECUTIVE SUMMARY

The 2010 Algae World Europe Industry Survey provides unique insights about the emerging algal industry. Respondents were positive about the future of the industry and optimistic about algae's potential to help solve critical energy, food transportation, water remediation and carbon sequestration challenges.

The respondents have considerable experience in the algae industry as 25% of respondents had more than five years of experience in algae industry and 15% had 11 to 30 years experience. About half the respondents are scientists, 25% are algae producers and 20% are academics. Algae World respondents came from over 50 countries with many from Europe, Asia, U.S., the Pacific Rim, India and the Middle East.

Most industry participants believe algal production will focus on three biofuels; biodiesel, JP-8 jet fuel and ethanol. Microalgae appear to be the favored feedstock followed by cyanobacteria, blue green algae, freshwater algae and marine macroalgae (seaweed). Most growers plan to use algal strains from algal collections, genetically modified organisms or carefully selected strains from natural settings. Algal producers are experimenting with a diverse set of production models with about a third using closed systems, a third using open ponds, another third using semi-closed ponds or polycultures. About 35% indicated algal producers will cultivate algae in the tropics and 30% selected the mid-latitudes. Roughly 25% indicated algae will be produced all over the earth.

Production models seem to vary based on the production objectives, type of feedstock and location. International producers tend to use open ponds while U.S. producers are planning to use closed or semi-closed cultivated algal production systems. International producers are using naturally selected algae species while U.S. producers are planning to use a combination of species selection and genetically modified organisms that maximize the production of algal oil.

The industry's most critical production challenges are production systems, harvest, extraction, and component separation followed by algal species selection, culture stability, quality control monitoring and contamination issues. Critical input challenges were dominated by total cost, followed GMO, genetically modified organisms, water source and cost, land source and cost and nutrient source and cost. Lifecycle analysis and indirect land-use are also industry challenges.

Critical algal production nontechnical challenges include access to capital, trained personnel, credible producer claims, intellectual property issues and access to production models. Critical supply-chain challenges include growing system, component separation, design and construction, processing and distribution logistics. Access to markets and nutrient supply also received high ratings.

Over 27% of respondents believe their country could displace imported transportation fuels in 10 years with a focus on algal biofuel production. About 36% believe their country could become independent of oil imports in 20 years and 20% in 30 years with a focus on algal biofuel production.

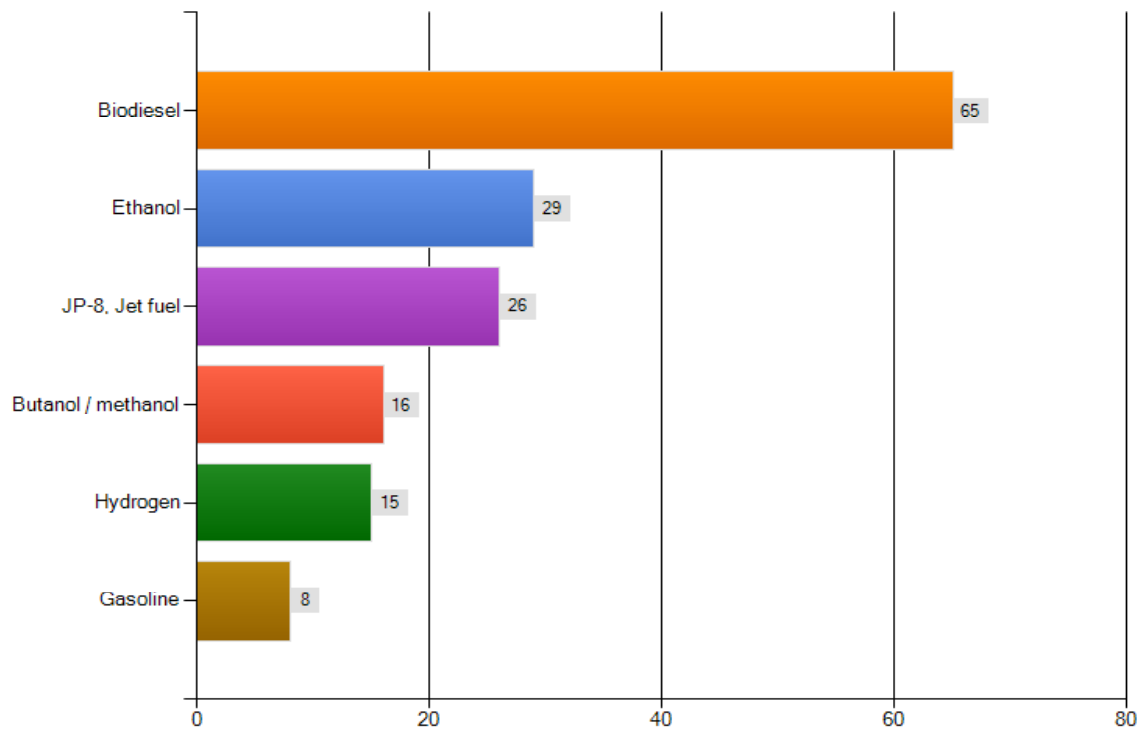
Besides biofuels, the main coproducts from algal biomass are likely to be organic fertilizer, animal feed, feed for fish and fowl, wastewater remediation and carbon capture and sequestration. Over 40% of respondents predicted that coproducts would include chemicals and unique compounds, nutraceuticals, pharmaceuticals and food ingredients. The social and economic issues that algae may address include carbon capture, cleaning polluted water, animal and fish feed, health foods and nutraceuticals, liquid transportation fuels, and nutrient recovery, organic fertilizers, displacing oil imports and medicines and pharmaceuticals.

Recommendations to move the industry forward include better access to information, substantial increases in public and private funding for algal R&D, stronger education and training, more information on production issues and better networking and collaboration. Industry participants want to see demonstration projects, decision support systems and independent reviews of algal production systems.

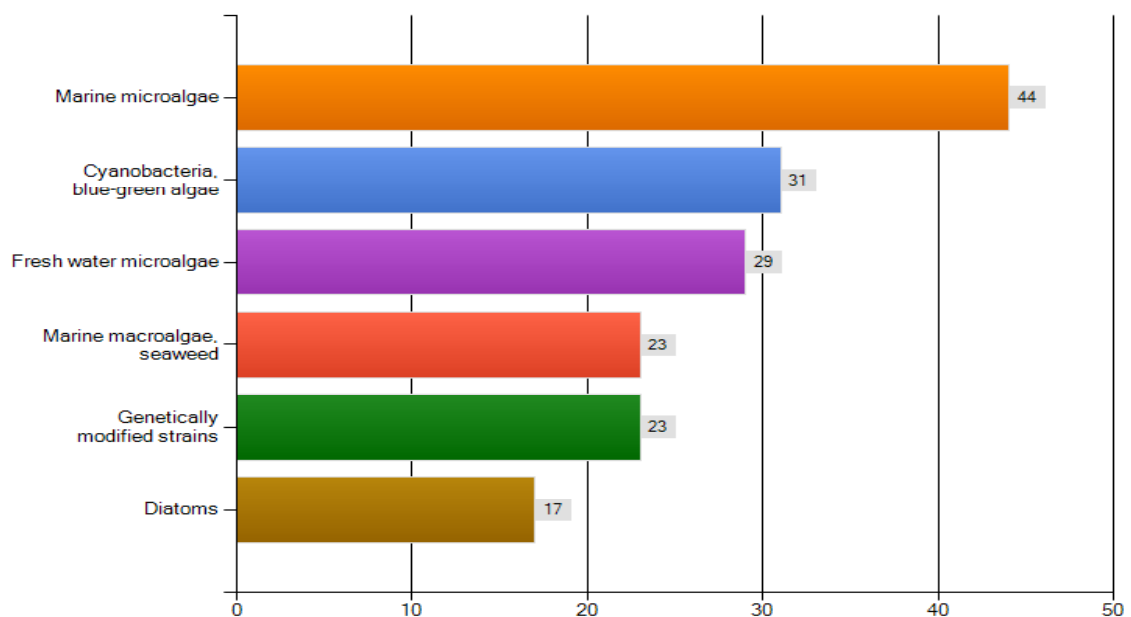
Future of algal industry research needs to drill down on production, supply chain and social and economic issues. Improved information on industry needs will support industry participants and provide critical information needed for public policy decisions and support.

SURVEY RESULTS FOLLOW

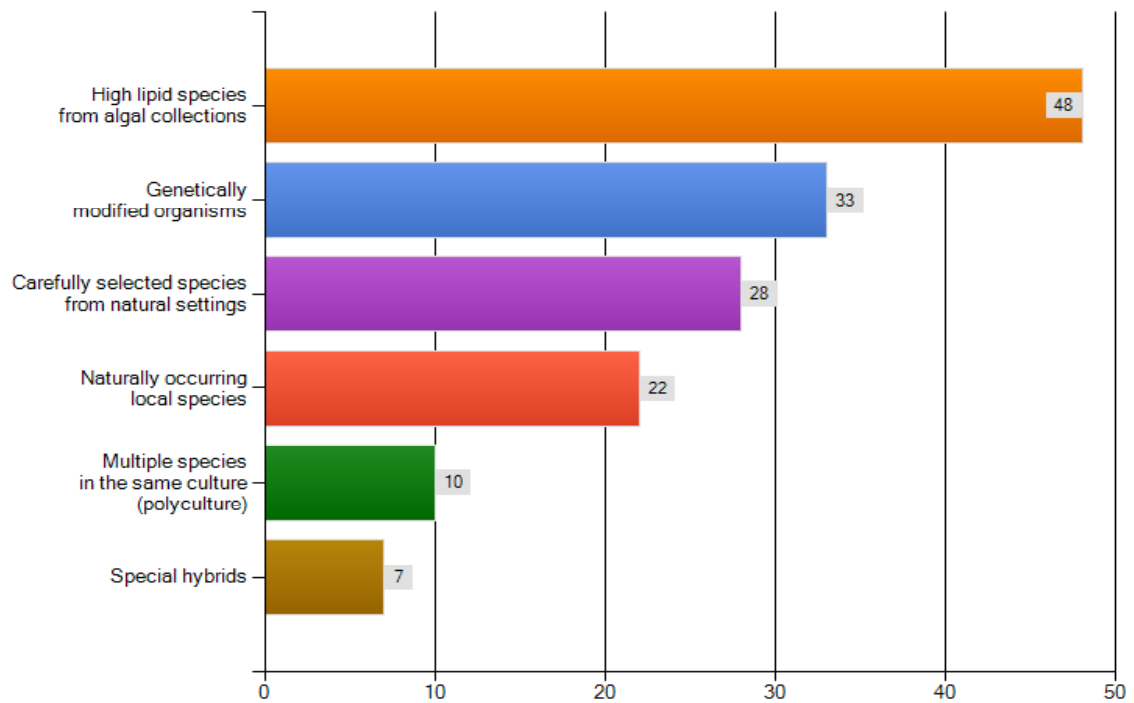
What biofuels are most likely to be made from algae? Check all that apply.



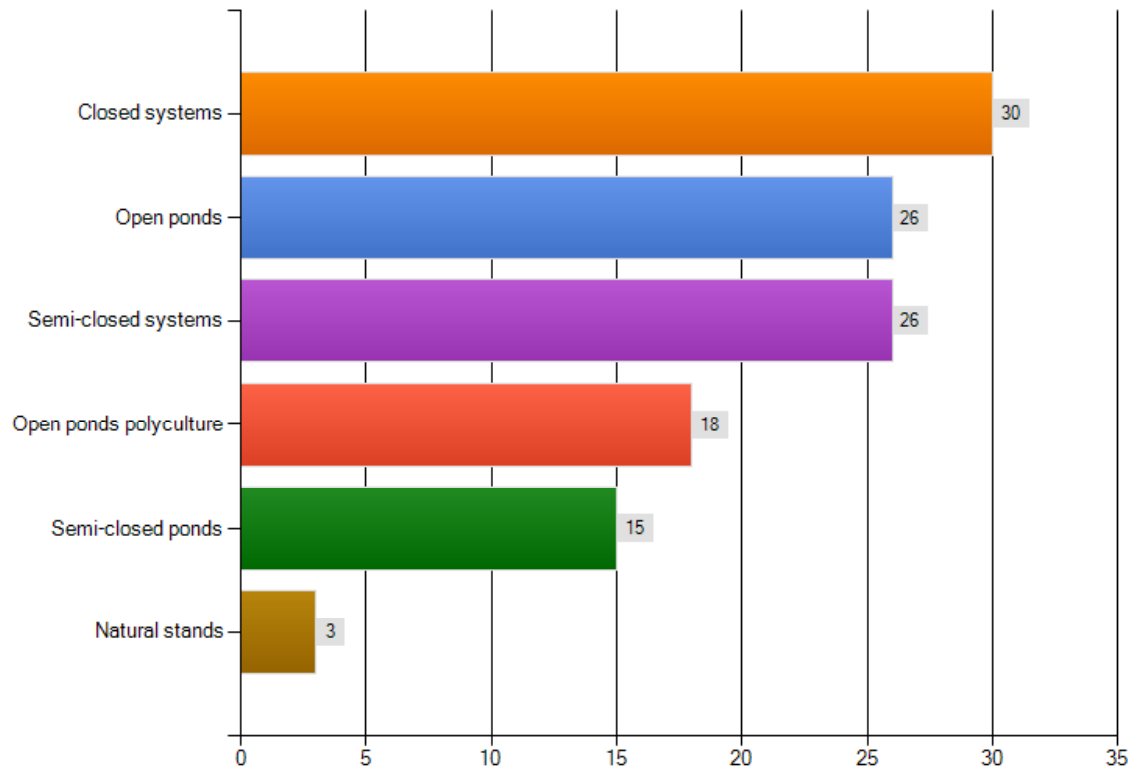
What feedstock appears to have the most promise in commercializing algae? Select all that apply.



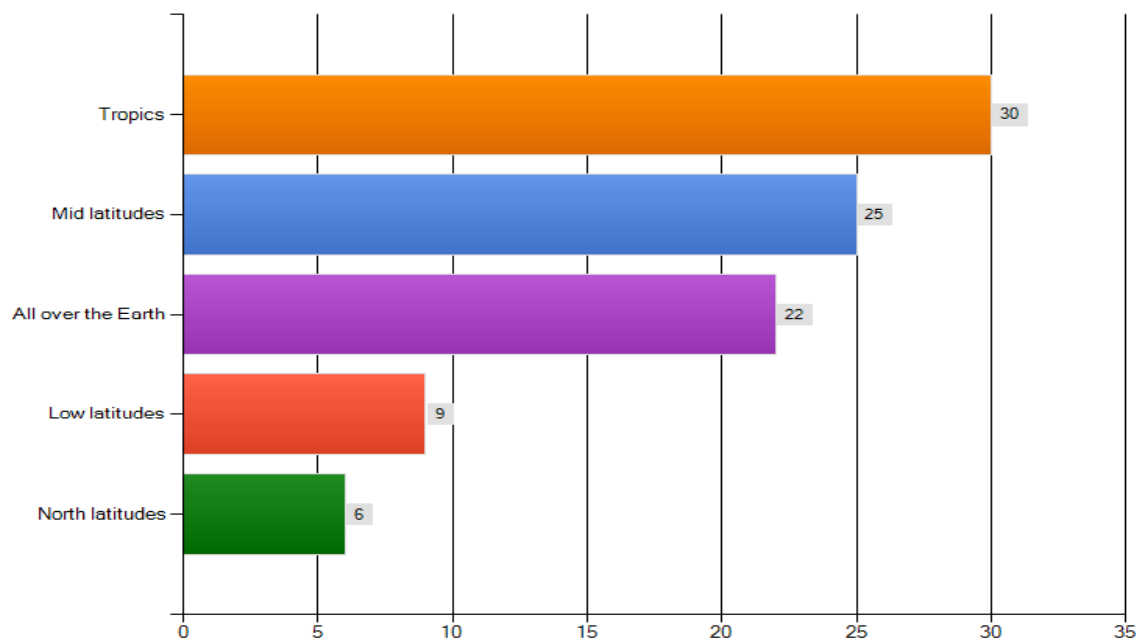
What will be the most likely source of algal species for oil production? Check all that apply.



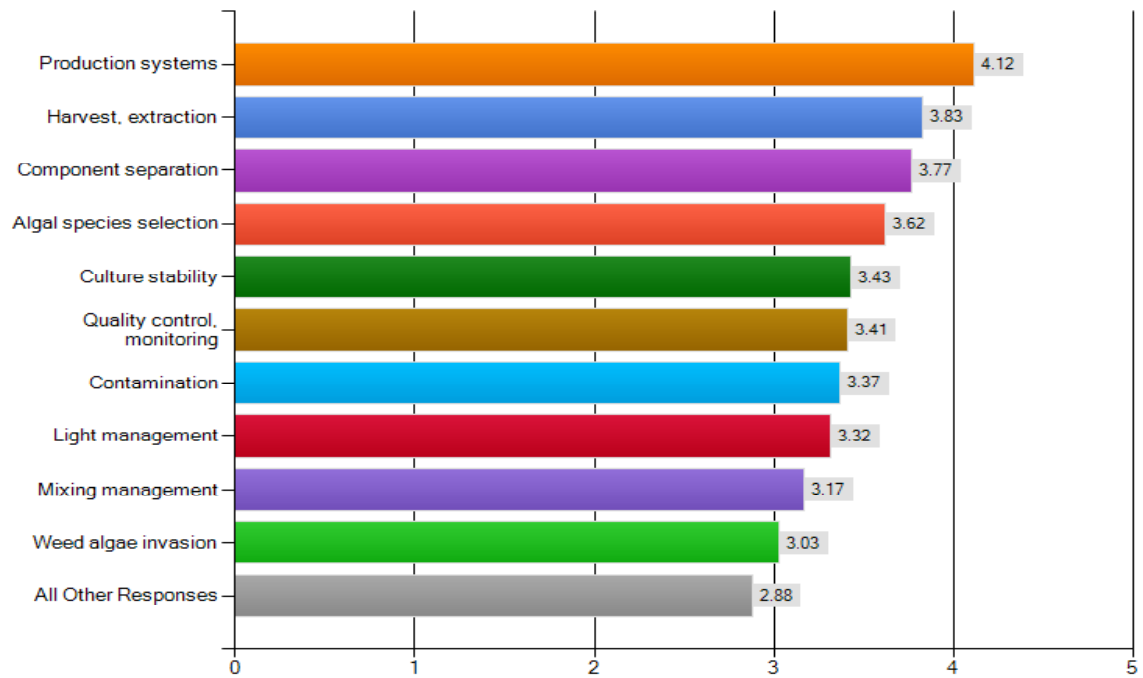
What type of growing system do you believe will become most prevalent for producing algal oil?



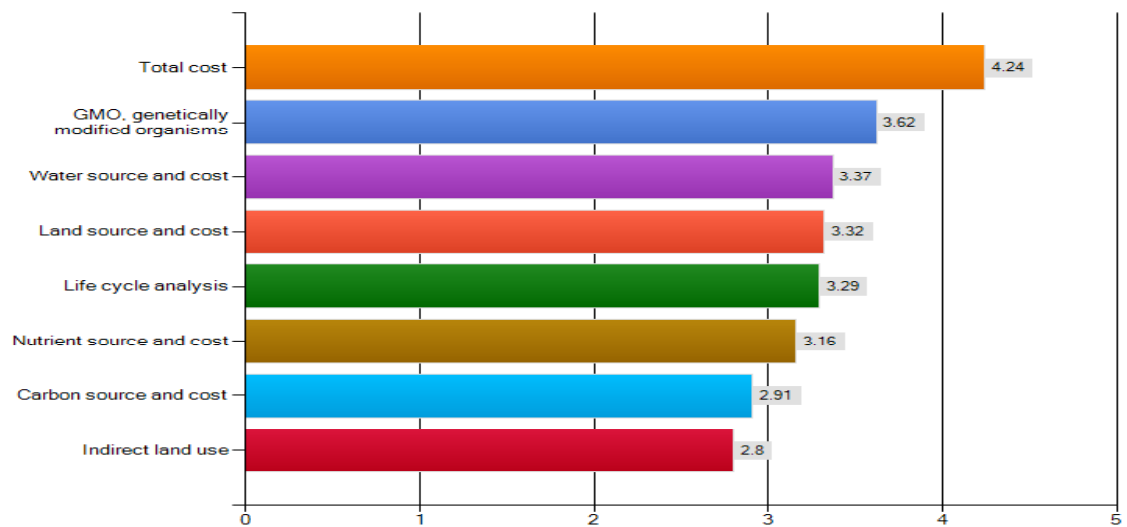
Where will most algal producers grow algae?



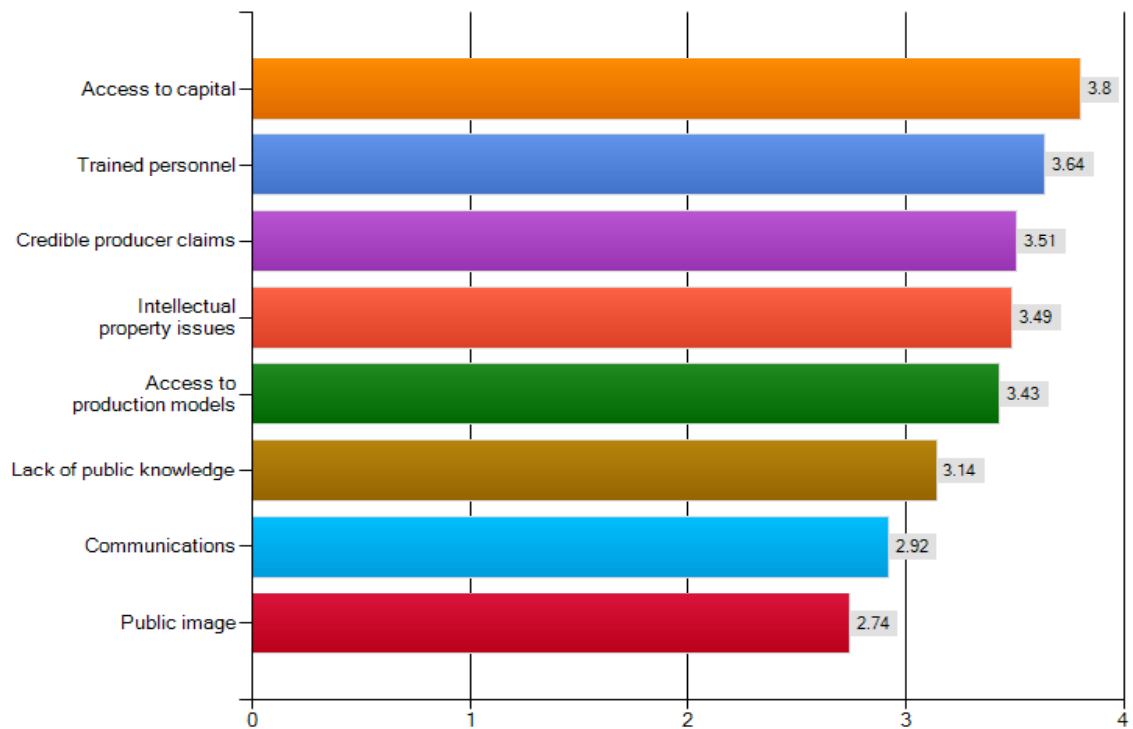
What are the industry's most critical production challenges? (5 is high)



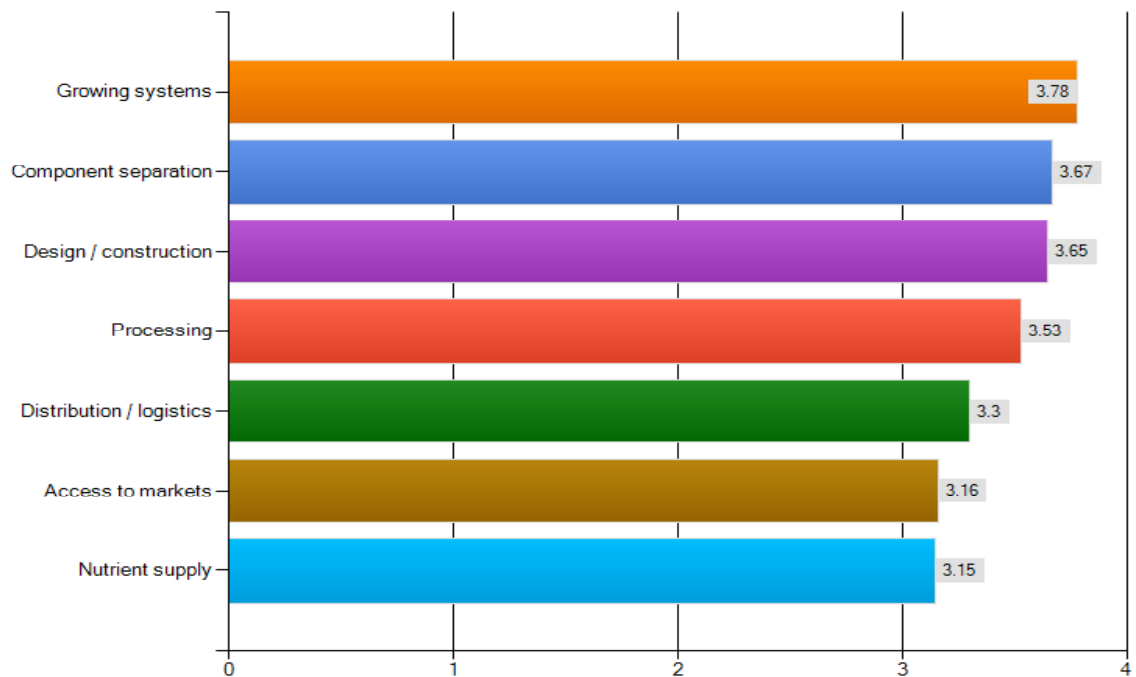
What are the industry's most critical input challenges? (5 is high)



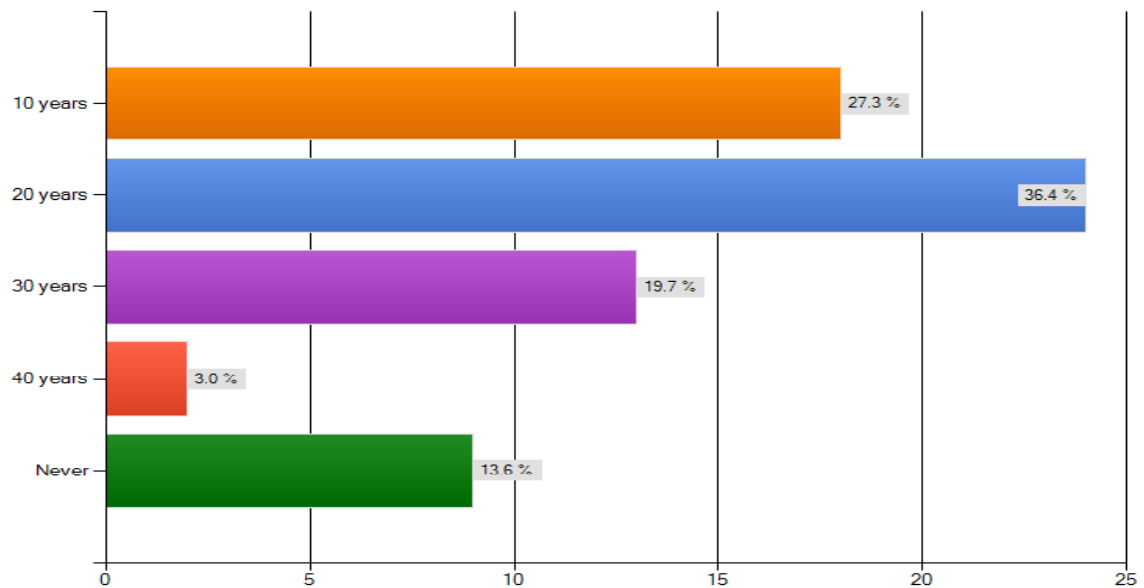
What are the industry's most critical non-technical challenges? (5 is high)



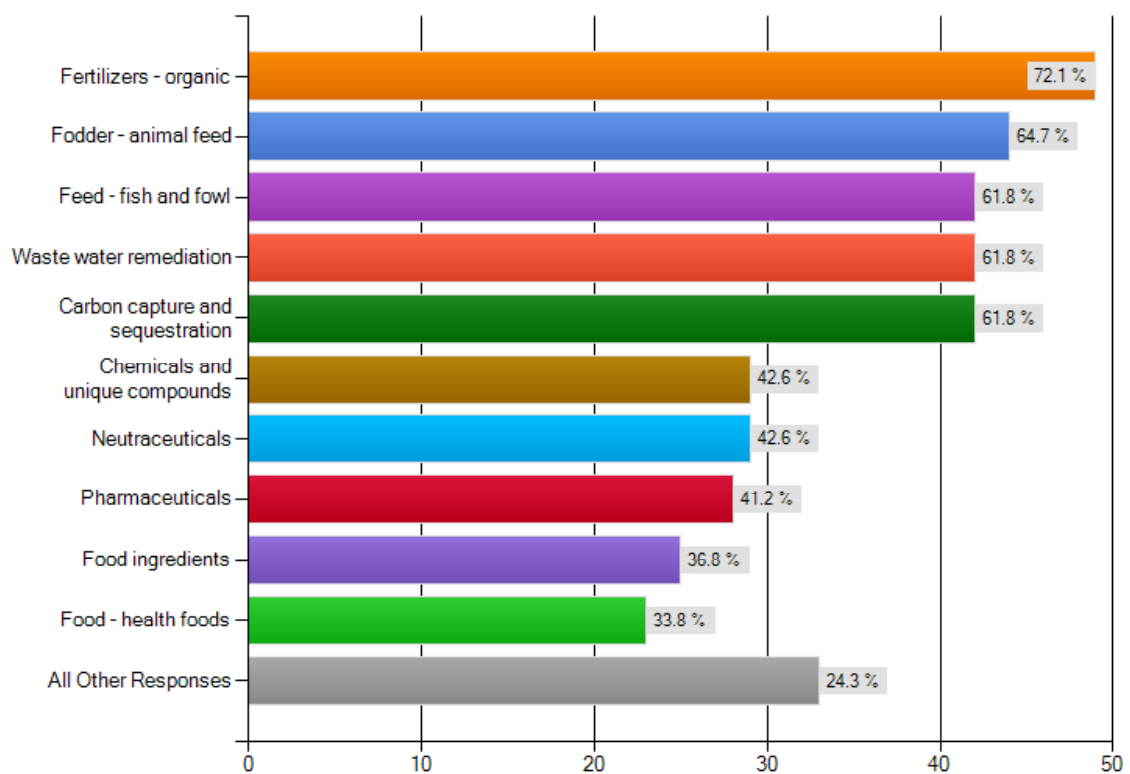
What are the most critical supply chain challenges? (5 is high)



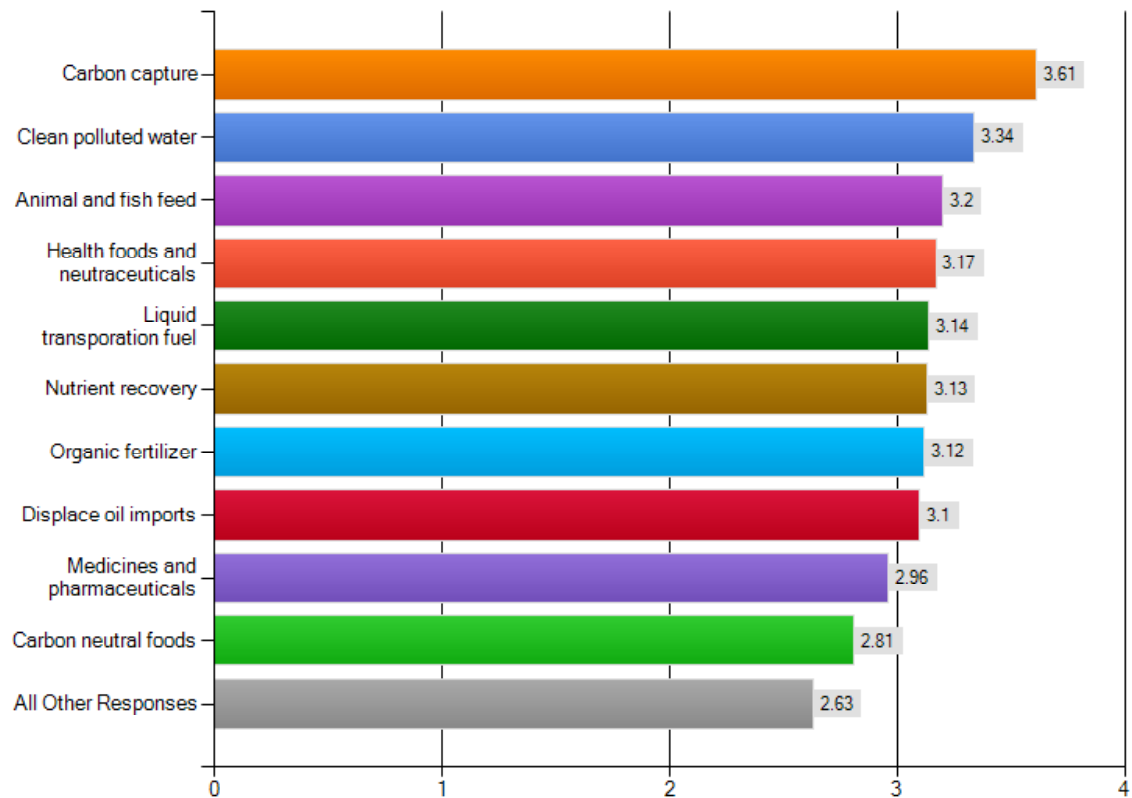
If your country focused algal biofuel fuel production , how soon could the algal industry replace imported transportation fuels?



Besides biofuel, what will be the main co-products from algal biomass? Check all that apply.



What are the most likely social and economic issues algae may address? (5 is high)



WHAT THREE KEY THINGS NEED TO HAPPEN TO MOVE THE ALGAL INDUSTRY FORWARD?

The primary words used to enhance the industry were government support, success models, funding sources, education, credible claims, cost reduction, communication and cooperation. The industry needs government investment because the initial investments and risks are very high. The recommendations are grouped and ordered based on how often respondents recommended the action.

GOVERNMENT SUPPORT

- Concerted, focused and coordinated lobbying at government level
- Increase Congressional Advocacy and obtain incentives
- Grants for more basic R&D
- Parity with other biofuels
- Cap and trade
- Decades of sustained and increasing government and industry R&D and scale-up financing regardless of fluctuating oil prices.
- Water remediation funding
- Dedicated algae research programs
- Algae need to become an industrial commodity

SUCCESS MODELS

- Low-cost production systems
- Multi-year pilot farms
- Viable economic models
- Enhanced lipid production
- International consortiums and collaboration
- Identify most productive species
- Proof of cost effective large scale production techniques
- Cost competitive algae-to-fuel systems need to be demonstrated
- Commercial scale production
- Show economically feasible, sustainable working systems

ACCESS TO CAPITAL

- Level playing field with other fuels
- Financing models
- Cooperation among financial institutions
- Government-backed loans
- Tax incentives

TECHNOLOGY DEVELOPMENT

- Production system design and operation
- Technical standards; standards for reporting yields
- Solve harvest and separation technologies
- Development of all steps of the process chain
- Scaling of bioreactors
- Understand the entire algae biology
- Species selection
- Discovery of valuable byproducts
- Reliable and understandable lifecycle analysis
- Support much more outdoor tests and experiences
- Development of new culture technologies

CREDIBLE CLAIMS

- Stop the stupid hype!
- Stop the PR machines
- Science based, facts driven algae industry development
- Minimize grandstanding, maximize credibility
- Challenging of outrageous production claims

REDUCE COSTS

- Develop low-cost growing systems
- Lower costs
- The cost of production at the very large scale needs to be drastically reduced

COMMUNICATION AND COOPERATION

- Better communication among different working groups
- Collaboration between and among companies
- Too many individual efforts, IP driving this issue
- Collaboration among the different supply chain participants
- Knowledge of Best Practices

GOOD RECOMMENDATIONS

- Carbon dioxide pipeline!
- Patent pooling
- Find the black swan
- Rational approach to IP
- Parity with corn/soy for algal biofuels
- Optimize carbon capture

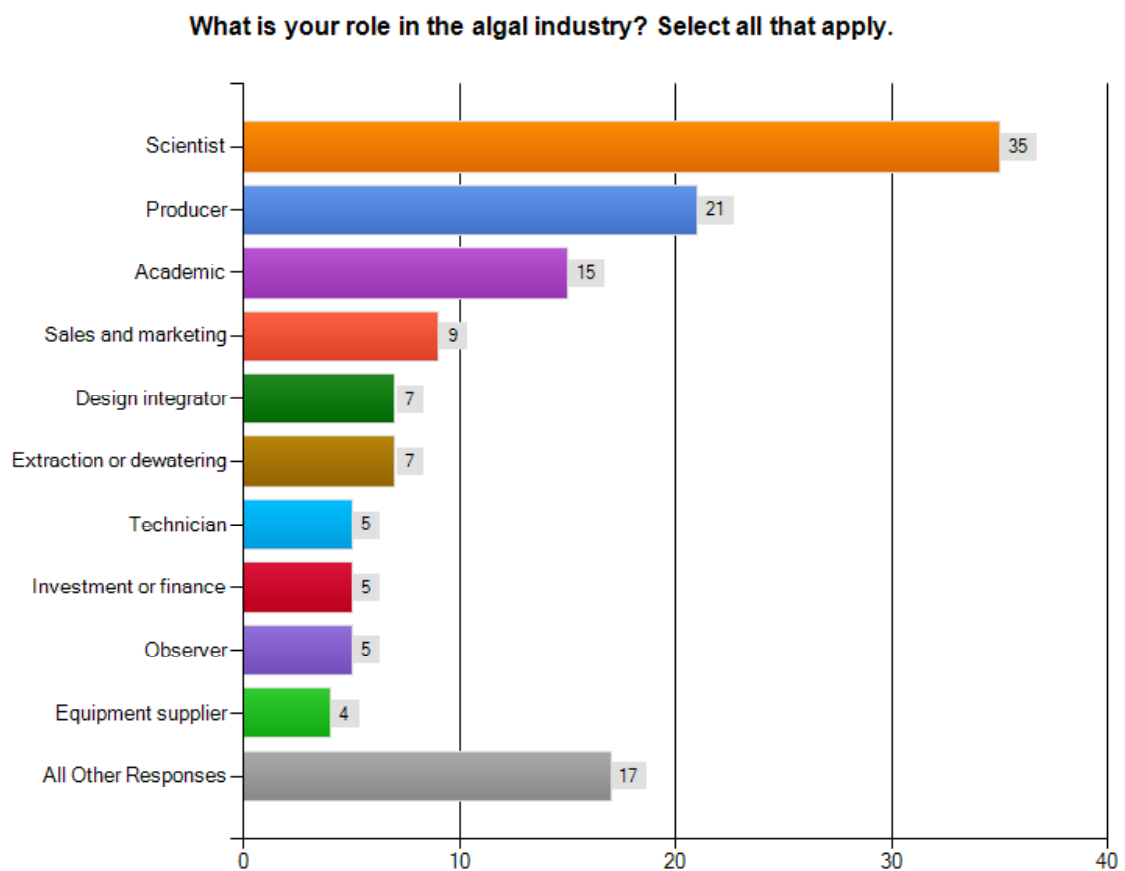
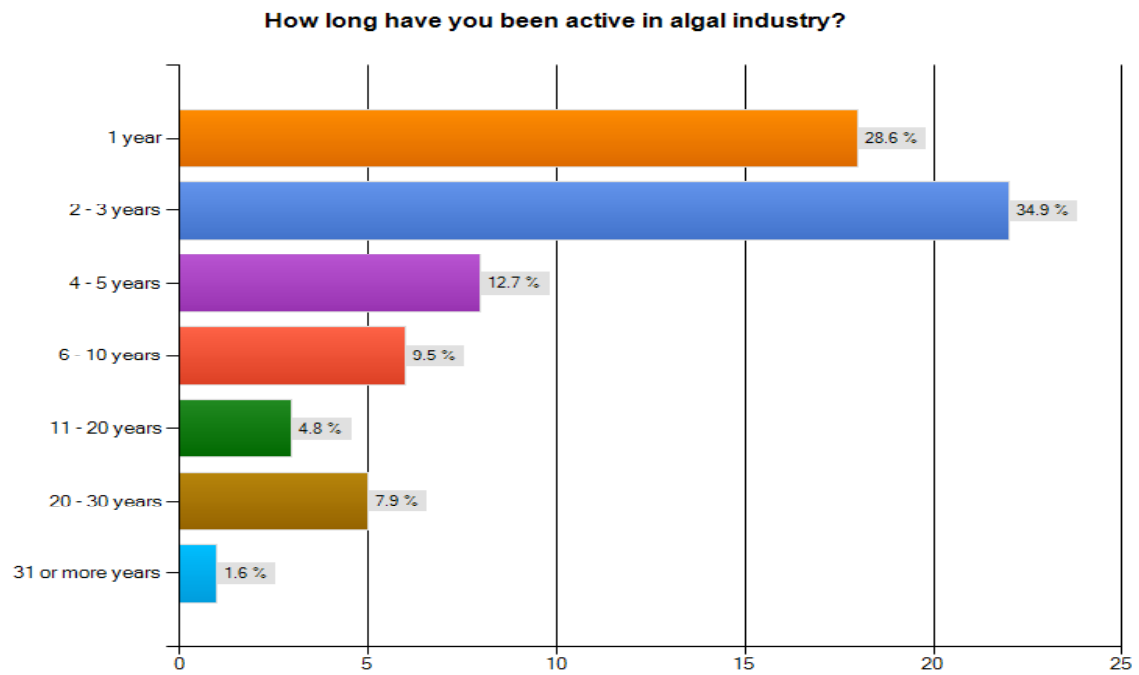
WHAT ALGAL INFORMATION WOULD MOST BENEFIT YOU?

Respondents indicated a desire for better information on algae, insights on financing, support for education and training, production information and stronger collaboration. Additional requests included the ideas below.

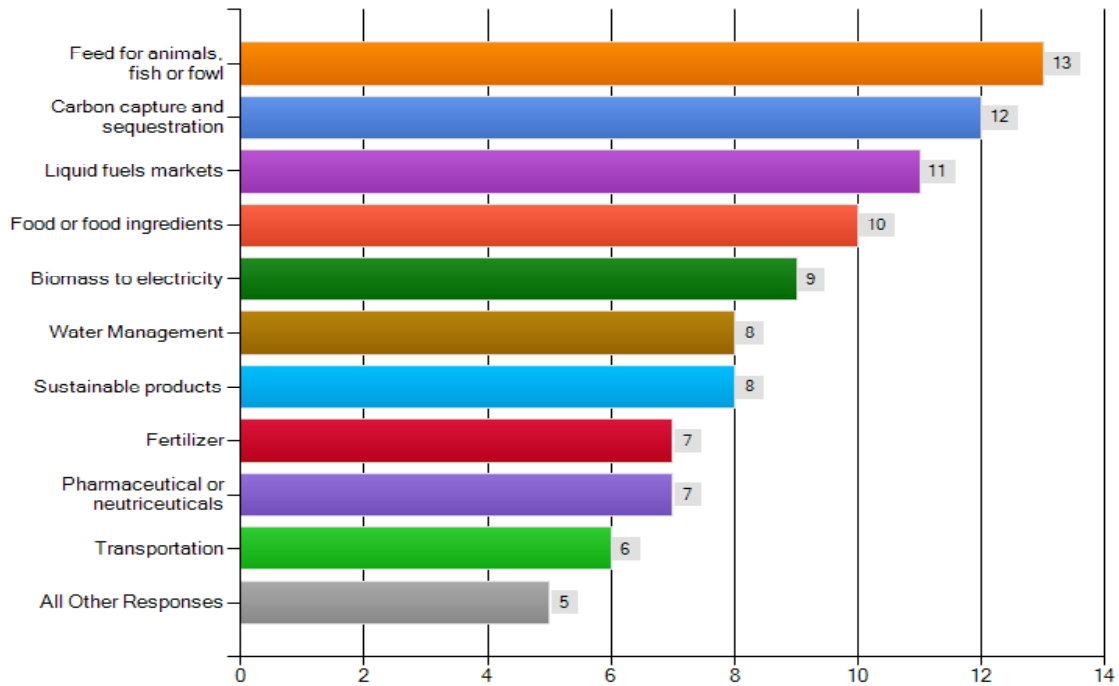
- **Industry Summary.**
The algal industry may follow the lead of other forms of renewable energy such as solar and wind to create a summary of the industry.
- **Demonstration units.**
The algal industry should build and operate demonstration facilities so that people can see algal production.
- **Decision support.**
Information on production, extraction and processing are too distributed and need to be more accessible.
- **Products and coproducts.**
What is the total product array for algal biomass and what production strategies are used to maximize each product?
- **Real production numbers.**
Actual rather than theoretical production numbers would be a huge breakthrough.
- **Ideal strains.**
What are the ideal strains for various products and what are sources for these strains?
- **Market trends.**
What are market trends in the algal industry?
- **Independent reviews.**
Are there independent reviews of algal production methods?

WHERE DO YOU GET YOUR NEWS ABOUT ALGAE?

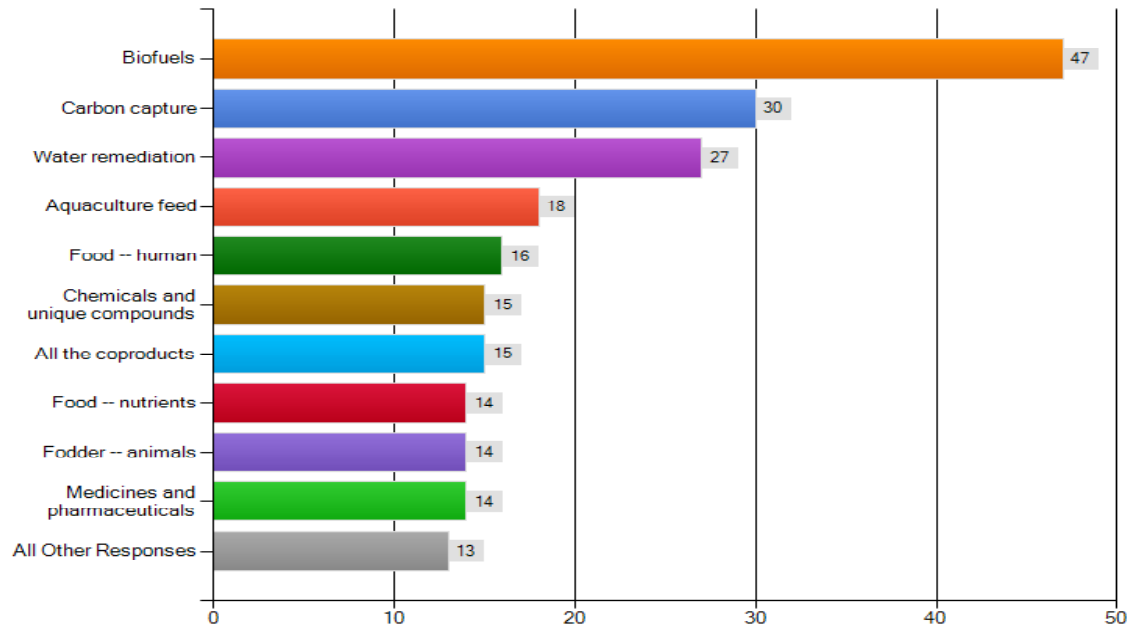
- Google News Alerts
- Blogs, internet, Linked-In
- Biofuels Digest
- Conferences
- Algal Biomass Organization
- Journals and research papers
- Oilgae.com
- SIO algae commercialization series
- Biomass Magazine
- CleanTech network
- GreenTech media



Are you an end user of algal products? Select all that apply.



What is your primary interest in the algal industry? Select all that apply.



ABOUT THE AUTHOR



The Brains behind the Algae Industry Survey — Algae Evangelist Dr. Mark Edwards

We were honoured to work with dedicated Algae evangelist **Dr. Mark Edwards, Director of GreenIndependence.org** on the inaugural Algae Industry Survey at the Algae World 2008 conference in Singapore and again this year for the Algae World 2010 Industry Survey..

Dr. Edwards heads Green Independence, an Algae Collaboratory that brings together scientists, academics, practitioners, students and communities who share knowledge and biotechnology tools to bring algae's full promise to the world.

He was moderator at the highly rated “Algae Biofuels: The REAL Story” Webinar last year in November 2008, which saw participation from over 300 people from all over the world. Dr. Edwards' recently released book, “Green Algae Strategy” has been enjoying considerable success and rave reviews from peers and industry experts.

Dr. Edwards conceptualised the idea of the Algae Industry survey because he realized the need to measure where the industry stands and what needs to be done to move forward as an industry towards commercialization.

ABOUT CENTRE FOR MANAGEMENT TECHNOLOGY (CMT)

Centre for Management Technology (CMT) is a world leader in renewable energy, alternative fuels, petrochemicals & commodity conferences, conducted in over 23 countries.

CMT has with its 27 years of unstinting performance played a dominant and significant role in the industry and were behind globally recognized events like:

Algae World (17 & 18 Nov 2008, Singapore)

Algae World (27 & 28 April 2009, Rotterdam – Netherlands)

Algae World (29 Sept & 1 Oct 2009, Bangkok – Thailand)

2nd Algae World Europe (31 May & 1 June 2010, Brussels – Belgium)

UPCOMING EVENT: **3rd Algae World Asia (19-20 Oct 2010, Singapore)**