

## Algae: Emerging Options for Sustainable Biofuels

Interest in algae as a potentially major source of fuels, chemicals and biomass has resulted in a surge of development efforts by some of the world's premier energy firms. Algae's unique characteristics, including high yields of oil, direct use of carbon dioxide as a feedstock, and potential to utilize waste water are driving this activity. This new study characterizes and assesses the issues and drivers, technical status, production economics, and commercial prospects for algae as a potentially more sustainable source of feedstocks for biofuels production.

The most important socio-economic challenges driving the widening interest in algae technologies and applications are:

- **Climate change** and the imperative to take action to mitigate global warming
- **Waning petroleum resources** combined with political conflicts that threaten supplies
- **Growing economies competing** with developed nations for fuels, food, and other commodities
- Pressure on **water resources** for agriculture

Various types of algae production for fuels and other purposes have been under scientific and engineering study for decades, but many fundamental, technical, economic and practical difficulties remain to be addressed.

Nexant's report evaluates the following types of **algal systems and issues**:

- **Biotechnology developments** for microalgae, including bio-prospecting and trans-genomic research focused on either lipid or hydrocarbon accumulation in cells
- **Algae growing systems**, including open ponds and closed systems (photobioreactors, or PBRs, and sugar-fed types of algae, grown in non-photosynthetic closed systems)
- **Integration with CO<sub>2</sub> sources** (e.g., power plants, fermentations, other such large industrial sources)
- **Harvesting oils** by various means - using oil-release algae, dewatering algae/extracting oils, integration with aquaculture (e.g., fish or shrimp eat algae, fats extracted, protein meal co-products)
- **Uses for residuals** – feedstock to ethanol production, other fermentations, food/feed or methane production from residues
- **Specialty chemicals co-production**
- **Fuel product quality**
- **Production economics**

The study also examines drivers for development and **government policies and programs** impacting algae systems development. Nexant identifies and profiles the various leading entities and initiatives, private and public, in this field and assesses their status of **progress and prospects**.



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