Biofuels Potential for Hawaii

Algae for Biofuels in Hawaii

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What is algae?

- Protist Kingdom
- Eukaryotes
- Unicellular (microalgae) and multi-cellular (kelp)
- Autotrophs, heterotrophs, mixotrophs
- Source of oil, protein and carbohydrates
Why algae for biofuels?

- **CO₂ sequestration**
- **Oil yield per hectare (2.47 acres):**
  - Soy: 400 gallons/ha-yr
  - Corn: 1000 gallons/ha-yr (ethanol)
  - Palm: 1500 gallons/ha-yr
  - Sugar cane: 2000 gallons/ha-yr (ethanol)
  - Microalgae: >10,000 gallons/ha-yr
- **Co-products**
- **Non-arable land**
- **Fresh, Brackish, Salt or Wastewater**

[Image: Global Fossil Carbon Emissions](https://www.greenworldtrust.org.uk)

[Image: Corn and Microalgae](https://www.eere-pmc.energy.gov)
What are the key challenges?

- Low Cost, Large Scale Algae Production
  - Open Ponds vs. Bio-Reactors
  - Contamination leading to system failures
  - Dewatering a large volume
  - Extraction methods
  - Permitting, land availability

Credit: www.neduet.edu.pk
Industry Advancements

• Commitment from Government and Large Companies
  – DARPA – approx $35M awarded for 2 projects
  – USDOE – allocating $85M for development of algae biofuels
  – Venture Capital – more than $150M
  – Shell - est. multi-million
  – Algenol/Sonora Fields - $850M
  – ExxonMobil - $300M into Synthetic Genomics

• Game Changing New Technologies transforming the value chain
  – Grow out systems
  – Harvesting strategies
  – Dewatering
  – Oil extraction
  – Oil refining

www.ecofriend.org/
Mission Statement:
To be the world’s leading provider of certified, high performance algae seed stock.

KAS Elite Algae™ Seed Stock
• Fast growing, adapted to production conditions
• Targeted expression/growth of high value compounds (oil, protein, chemicals, CO₂ capture)
• Resilient to contaminants

Providing expertise and lab services
• Strain selection and testing of algae and conditions to optimize productivity
• Develop products & downstream processes to make value chains more competitive
Vision of the Future

Global Production of Algae for Biofuels using Kuehnle AgroSystems Elite Algae™ Seedstock

Credit: Alberta Research Council
Credit: U.S. Department of Energy
Credit: Cequesta Algae
Credit: Kuehnle AgroSystems