

“Clean the water and air while producing renewable, sustainable, biofuels.”

Kevin Shurtleff

Algae Energy Systems Branch

• Incentive & Solar Buildings



• Algae Energy Systems



• Vehicle & Roadway Electrification



• Next Generation Fossil Energy



• Environmental & Wind Measurements



EDL

Energy Dynamics

LABORATORY

Utah State University Research Foundation

“Algae Farming for Fun and Fuel”

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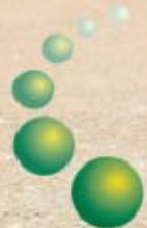
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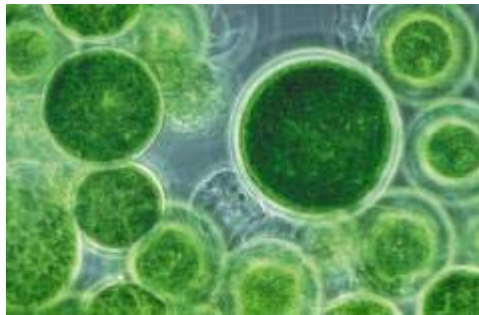
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EDL Algae Energy Branch

- ▶ Mission: Commercialize low cost, large scale, renewable biofuels fuels from algae.
- ▶ Approach: Spin-out a for-profit, algae-to-biofuels, company using the best technologies developed at USU, EDL, and elsewhere.
- ▶ Strategy: Partner to access markets, technologies, and funding.
- ▶ Objectives:
 - Solar BioInnovations Facility operational June 30th, 2010.
 - Complete DOE funded, 2 acre, pilot scale demonstration project by December 31st, 2011.
 - Start full-scale, 1,000 acre, algae-to-fuels commercial production by December 31st, 2012.

Algae – Nature's Miracle Energy Crop

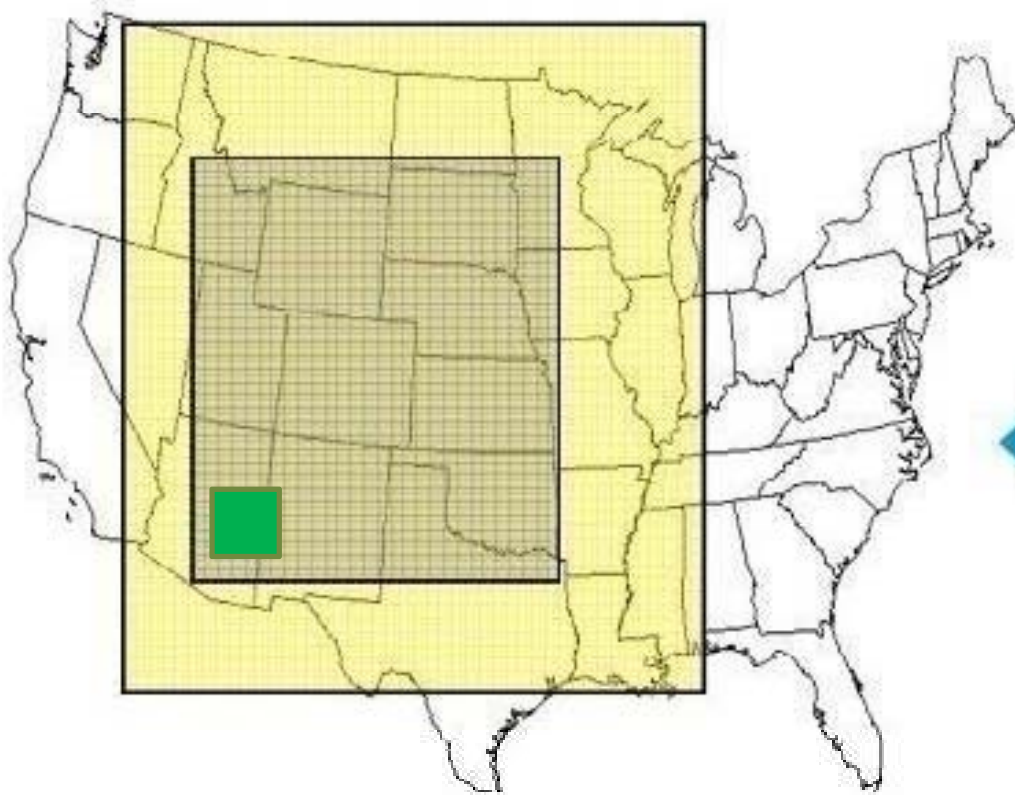


I  POND SCUM

Image: <http://www.maler-stamm.de/farbenfuersleben/fassaden/algen-und-pilze-auf-fassaden/index.html>

- ▶ Algae are aquatic plants that convert sunlight, carbon dioxide, and other nutrients into biomass containing vegetable oil.
 - Vegetable oil can be directly converted into clean, green, biodiesel.
- ▶ Algae use waste water, unproductive land, and carbon dioxide from power plants to produce fuels.
 - Algae do not compete with food crops.
- ▶ EDL is producing fuels from modern algae.
 - Many experts think ancient algae is the source of fossil fuels.

Algal Fuel Best Option for Domestic Production



CROP OIL YIELD (GALLONS/ACRE/YR)

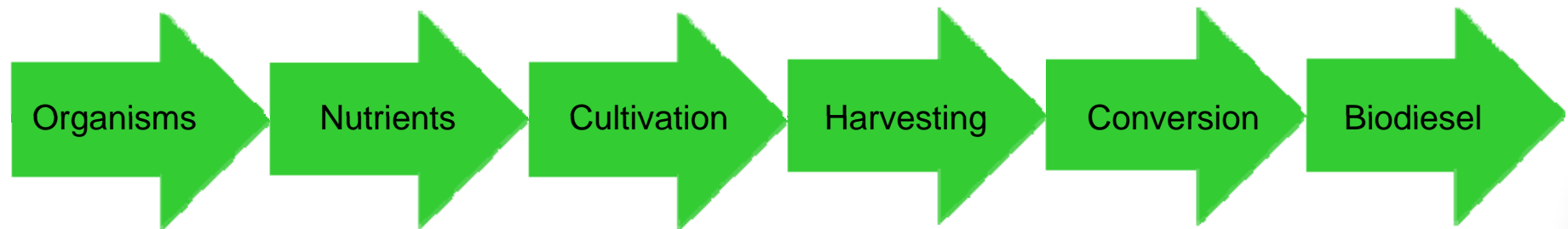
Soybean	48
Camelina	62
Sunflower	102
Jatropha	202
Oil palm	635
Algae	1,300-5,000

Source: DOE Algae Roadmap

Land area to produce 50% of current diesel consumption.

Source: <http://newenergyandfuel.com/>

Algae-to-Fuels Process



- ▶ EDL Algae Energy Branch now has a fully-integrated algae-to-biodiesel process.
 - Demonstrated continuous wild algae cultivation.
 - Demonstrated water enhancement for optimum algae growth.
 - Demonstrated floating algae pond.
 - Demonstrated effective harvesting by centrifugation.
 - Demonstrated one-step conversion to biodiesel process.
 - Investigating additional uses for lipid extracted algae (LEA).
 - Scaling all processes to 2 acres.
 - Investigating reduced cost processes.

Solar BioInnovations Facility



- ▶ State-of-the-art algae research, development, demonstration, and deployment.

Solar BioInnovations Facility - Production



- ▶ Large raceway algae production.
 - 100+ pounds in three months.

Technical Progress – Cold Weather Algae Growth



Technical Progress - Floating Algae Pond



- ▶ Lower cost.
- ▶ Fewer regulatory barriers.
- ▶ Uniform mixing for improved growth.

Technical Progress – Scale



0.25 acre “floating” pond (118 foot diameter)

Planning 1.0 acre floating pond (235 foot diameter).

Technical Progress – Biodiesel Production



Leading Site - Coal Fired Power Plant



- ▶ High density algae growth in blow down ponds
 - 100 acre North pond
 - 38 acre South pond
 - Plenty of flue gas, waste heat, nutrients, and power.

EDL Algae Energy Team

- ▶ **Jeff Muhs – EDL Director**
- ▶ **Kevin Shurtleff – Team Lead**
- ▶ **Bill Bradford – Environmental Engineer**
- ▶ **Curtis Carrigan – Mechanical Engineer**
- ▶ **Tiera Liby – Biological Engineer**
- ▶ **Lee Martineau – Biological Engineer**
- ▶ **Greg Townsley – Outdoor Facility Manager**
- ▶ **Curt Roberts – USURF Business Development**



Thank You

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Questions?

