Recreate Energy: Energy for a Brighter Future
Daniel Felix, Erica Stoll, Omar Casarrubias, Rene Valencia, Santiago Buitron, Shaun Kim
Department of Mechanical and Aerospace Engineering at University of California, Irvine
Sponsor: Daniel Vega

Introduction

- Global reliance on crude oil creates a need for alternative sources
- Recreate Energy's goal is to turn algae into crude oil through hydrothermal liquefaction
- Already completed extensive research into the best micro-algae and the system to suit its needs
- Our team has 3 subteams: heating and cooling, electronic box, and electroflocculation

Existing Solutions

- Continuous Flow Reactor System at the Pacific Northwest National Laboratory
  - High temperature and pressure converts algae to crude oil with byproducts
  - Crude oil can be converted to gasoline or aviation fuel
  - Uses wet algae to avoid drying process and related costs

Saltlake Project at Camorosso, Italy

- Spirulina algae collected from wastewater is used to produce crude oils and other byproducts
- Spirulina algae absorbs pollutants such as nitrates to serve as a dual purpose and purify the water

Electroflocculation System Subteam

Objective

- Create a system that can pump algae and water solution in, separate algae from water, and create an algae slush byproduct that can be harvested.

Challenges

- Weather resistant, small scale, and cost effective design
- Holds 1L of fluid in tank
- Separate biomass through electrolysis
- Easy removal of two byproducts
- Compatible with Arduino

Key Elements

- Acrylic sheets for tank and electrode case
- 6015 aluminum alloy electrodes to achieve electrolysis
- Tube brush and motor to separate algae slush
- Slanted floor to allow wastewater to exit
- Solenoids and water pumps to move fluid

Electroflocculation System Subteam

Objective

- Design and fabricate a Heating and Cooling Thermoelectric system to properly optimize algae growth conditions

Challenges

- The design must be cost effective, weather resistant, and a small-scale system
- The Heating and Cooling system will contain Peltier Modules
- System must be controlled via Arduino

Impact on Society

- Optimal temperature conditions will allow algae to yield a consistent biofuel production.

Future Improvements

- Update components on Heating Setup depending on future performance

Safety

- The box is separated by 3 sections by sealed sheet metal to prevent water leakage to the electronics.

Budget

- The entire system including the three sub-teams should not exceed $1000

Analysis

Thermal Analysis

- Temperature distribution shown below

NOTE: All designs shown are under the jurisdiction of RECREATE ENERGY under NDA

Manufacturing:

- Not qualified for welding. May use epoxy instead to save on cost
- Can operate without PCB hat, but should install one
- Case made of aluminum for its thermal conducive properties
- Outer case made of steel for its sturdy properties

Design Flaws:

- Water resistant but not waterproof; will not be able to function in heavy rain, etc.
- Mounting platform to mount inner box

Electronics Box Subteam

Overview:

- Designed protective case for the raspberry pi and arduino.
- The electronics must be protected from the elements and physical abuse, while still be able to receive data from sensors, transmit information to databases, and regulate its own environment.

Inner Box

- Self cooling case for the Arduino, Raspberry Pi, and PCB
- Lower power max air flow while minimizing miniature entry
- Slide panel for easy access to electronics
- Ports for all connections
- Keeps the Arduino at recommended operating temperature

Outer Box

- Steel frame to withstand blunt force
- Impact resistant mesh that allows air flow
- Solid top panel to prevent direct weather damage (sun, rain, etc.)