University of Houston Law Center

Environmental Law for New Technologies

Environmental Legal Issues Involving Algae Biofuels

INTRODUCTION

- The United States of America is committed to advance the vision of a viable, sustainable domestic biomass industry that produce renewable energy in order to reduce the dependence on oil and other fossil fuels, as well as to provide environmental benefits.
- Algae biofuels is a promising technology that could provide a new way to create energy in a clean and safe manner, with the possibility to meet the required demand.
- On June 2010, the Department of Energy announced the investment of up to $24 million for three research groups to tackle hurdles in the commercialization of algae-based biofuels.

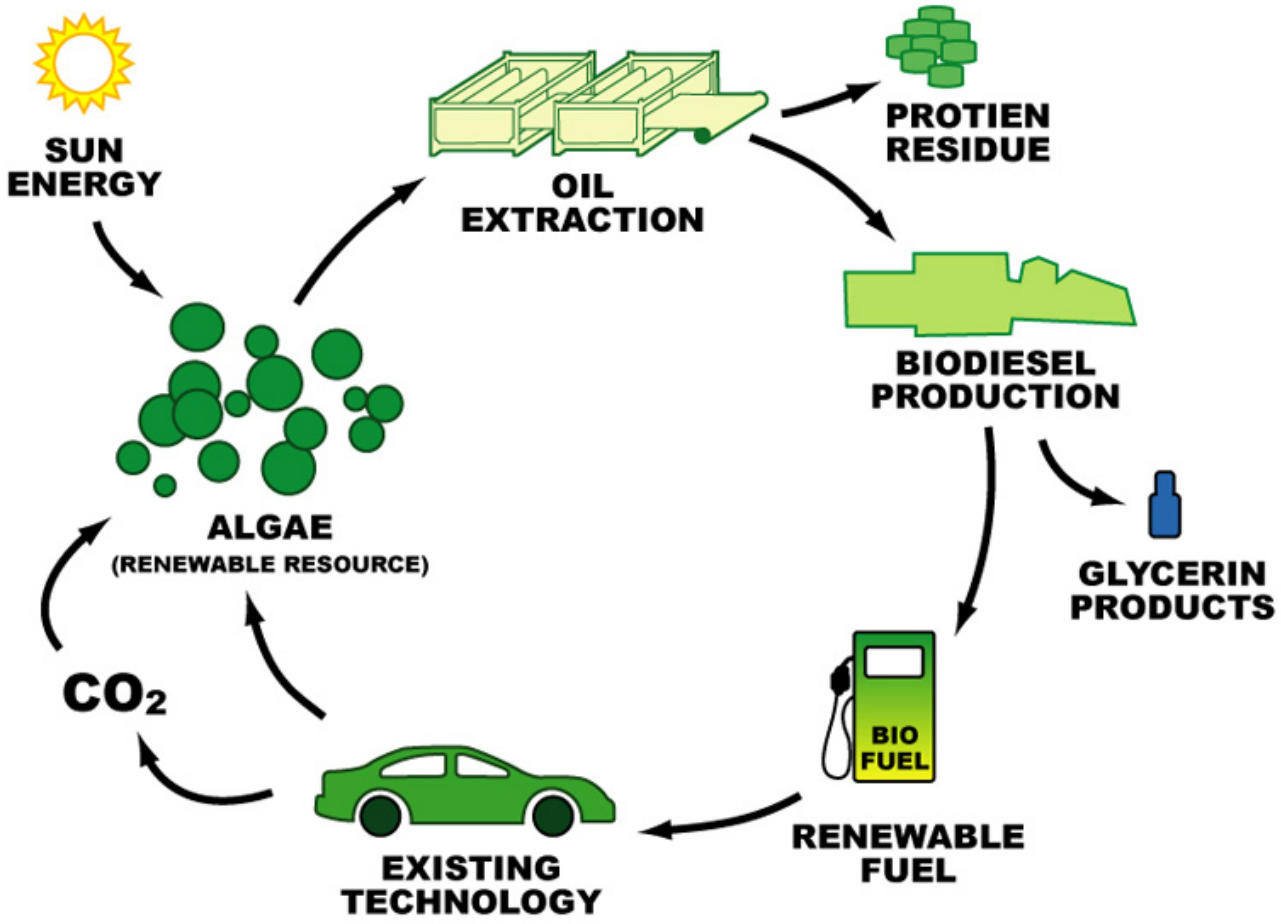
Algae and Biofuels

- Algae occur in a variety of natural aqueous and terrestrial habitats ranging from freshwater, brackish waters, marine, and hyper-saline environments to soil and in symbiotic associations with other organisms.
- Biofuels can be derived from an array of feedstocks using surprisingly diverse technologies. Biofuels are just one form of "bioenergy", or energy derived from biological plant and animal matter, which is known collectively as biomass.
- There are three generations of biofuels. Researchers and industry groups are taking a look at microalgae- often called the "Third Generation" of biofuels.
- Biofuels are considered to be an environmentally friendly alternative to fossil fuels in part because they have the potential to emit fewer green-house gases per mile traveled than gasoline and petroleum diesel, when evaluated over the entire fuel lifecycle.

Algae-based Biofuels

- Viable fuels that can be produced from algae range from gaseous compounds like hydrogen and methane, to alcohols and conventional liquid hydrocarbons, to pyrolysis oil and coke.
- Several aspects of algal biofuel production that have combined to capture the interest of researchers and entrepreneurs around the world.
  - High per-acre productivity;
  - Non-food based feedstock resources;
  - Use of otherwise non-productive, non-arable land;
  - Utilization of a wide variety of water sources (fresh, brackish, saline, marine, produced, and wastewater);
  - Production of both biofuels and valuable co-products; and
  - Potential recycling of CO2 and other nutrient waste streams.

Process of Production of Biofuel with Algae.



Open or Closed Photobioreactors?

Much of the existing research into algae oil production has taken place in enclosed photobioreactors. Indoor culture of algae in photobioreactors offers scientists many advantages. In a photobioreactors, for example, light and temperature can be carefully controlled and invasion by competing species can be minimized. Despite their advantages, photobioreactors probably will not have a significant impact in the near future on any product or process that can be operated in large outdoor ponds.

Photobioreactors cost about ten times as much as open ponds, so many operators grow the algae in a photobioreactors and then inoculate open ponds with the desired species.

Advantages and Disadvantages.

- ✓ Impressive productivity;
- ✓ Algae can be grown using land and water unsuitable for crop plant;
- ✓ Carbon Neutral. Growing algae consume carbon dioxide, providing greenhouse gas mitigation benefits;
- ✓ Broad Product Portfolio. Bio-oil produced and the resultant biofuel will have molecular structures that are similar to the petroleum and refined products we use today; and
- ✓ Renewable energy usage.
- ✗ However, a central question dominating algal biofuel is whether the best oil-producing algae crop will come from strains occurring in nature, or if they will need to be genetically modified to enhance their fuel-producing potential.

Environmental Legal Issues.

- Several environmental laws may be applicable as:
  - Renewable Fuel Standard;
  - Clean Air Act;
  - Toxic Substances Control Act;
  - Clean Water Act;
  - Plant Protection Act;
  - National Environmental Policy Act; and
  - Endangered Species Act.

RENEWABLE FUEL STANDARD.

- EPA implemented it as a result of a congressional mandate within the Energy Policy Act of 2005.
- The RFS calls for the increased blending of biofuels into conventional motor fuels.
- Provides an overall incentive for producing cellulosic and other advanced biofuels.
- Includes some degree of sustainability criteria, including feedstock restrictions that help protect sensitive lands such as old-growth forests.
- It also requires that biofuels produced under the mandate meet specified greenhouse gas reduction targets.

Clean Air Act.

- The CAA grants the EPA the sole authority to regulate the lawful commercialization of new fuels and fuel additives.
- It also grants EPA the authority to set percentage-based limits for the lawful biofuel content of finish fuels.
- The CAA framework regulation presents significant hurdles to the lawful commercialization. The successful commercialization is most affected by the so-called "substantially similar prohibition".
- Demonstrate that the fuel additive, when used at the recommend range of concentration, is substantially similar to any fuel additive included in fuel utilized in the certification of any 1975 or subsequent model year vehicle or engine, or that the manufacturer has obtained a waiver.

Examples of Current Applications.

- Several companies have developed systems to divert carbon dioxide emissions from industrial operations into algae production, including a Solix Biofuels plant in Colorado connected to a beer brewery.
- Saphirre Energy automobile.
- Continental Airplane.

Questions?