Algae Biofuel Enhancement Project
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Abstract
Fossil fuels are a limited resource that will eventually be depleted; an alternative must be found and implemented in order to supply the world’s energy needs.[11] The high cost of growing algae with Photobioreactors (PBR) decreases it’s attractiveness as a possible alternative to fossil fuels leaving room for improvement.[12] Overall, algae biofuels offer a clean, natural form of energy that can be helpful to the environment and to humanity.[13] Algae growth removes CO2, cleans wastewater, and is able to grow extremely fast.[14] If no alternative to fossil fuels is used, CO2 levels will continue to rise exacerbating global warming.[15] To find the right system, we propose using an universal scale of comparative values that will shift the industry in the right direction.

Background
PBR systems are the most efficient way of extracting algae and the most diverse when it comes to algae strain choice.[16] Since the entire system is closed it allows the use of almost any algae and can grow the algae at a very fast rate.[17] The cost prevents the growth of algae biofuel as a whole.[18] With hundreds of PBR systems known today the possibility of creating new and more advanced systems promises a great outlook for the future of algae biofuel.[19] Therefore, our dependency on oil will simply shift from fossil fuels to algae-based renewables.

Project Method

Creating a standard, like any measurement system, starts with getting the U.S. federal government involved. The U.S. government can ensure that all PBR system collects similar data to provide comprehensive analysis with comparable values. The project will then be successful when companies and investors use the government’s report to make economic decisions. As a result, adequate investments can be made and the PBR industry can shift towards the system with the highest potential, and largest ABEP value.

Conclusions

Acknowledgments

References

Algae Growth Process

Research

• PBR systems [2][4][9][10][14][16]
• The data we collected provided a huge gap between both qualitative and quantitative values
• So we developed a comparative scaling system to easily understanding
• ABEP Scale (all total points scaled out of 100)
• Eight categories (0-7)
• Algae Strain
• Based on company’s characteristics, we were able to narrow down which algae strain would be the most used [1]
• Nannochloropsis sp. D&M-20 [9]

Implementation

• ABEP Scale for PBRs [11]
• Integrates the scaling systems or similar system into the U.S. Department of Energy
• U.S. Energy Information Department

Data Collection

• PBR systems
• Energy Conversion, Biomass Volumetric Productivity, Cost, Light Harvesting Capability, Scale Up Potential, Cleaing, 

Energy Required

Biomass Produced

Cost

Light Access

Scale Up Potential

Cleaning

Nutrient Exchange

Gas Exchange

Land Efficiency

The ABEP Percentile Scale

BAG CONTAINMENT

HORIZONTAL TUBULAR

PANEL

VERTICAL TUBULAR

AQUEOUS SYSTEM

HYBRID SYSTEM

Oil is ready

Can be used as oil directly in diesel engines or refined further into fuel

About algae

• Among the fastest growing plants, about 50% of their weight is oil
• Contains no sulfur, non-toxic, highly biodergradable
• Algae fuel is now known as algal fuel or algae

Algae Biodiesel

High performance diesel substitute, chosen from the past decades have revitalized the algae biofuel race

The process

After initial growth, algae is harvested. Nutrients produced during algae growth, are recycled to the plant

Screw press

Extraction of oil

90% of the oil from the plant

Solvent used to separate

5mg all 0.1

30mg

1.5mg

Algae

Yield of various plant oils (calories per liter)

Sunflower

Soy

Canola

Grass

Other

200

110

20

20

251

275

36,407

1.572

1,305

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Nannochloropsis sp. D&M-20 [9]