

Using Algae as Jet Fuel

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Abstract

Traditional aviation fuels have become more expensive and have contributed heavily to the world's emissions of greenhouse gases; therefore many different types of fuels are being explored as possible alternatives. To determine more alternatives and to discover the most beneficial jet fuel, the use of algae oil, ethanol, and petroleum as jet fuels were compared to one another. It is determined that algae fuel is the most beneficial jet fuel due to its cost effectiveness, energy efficiency and environmental impacts based on this criteria.

Project Goal

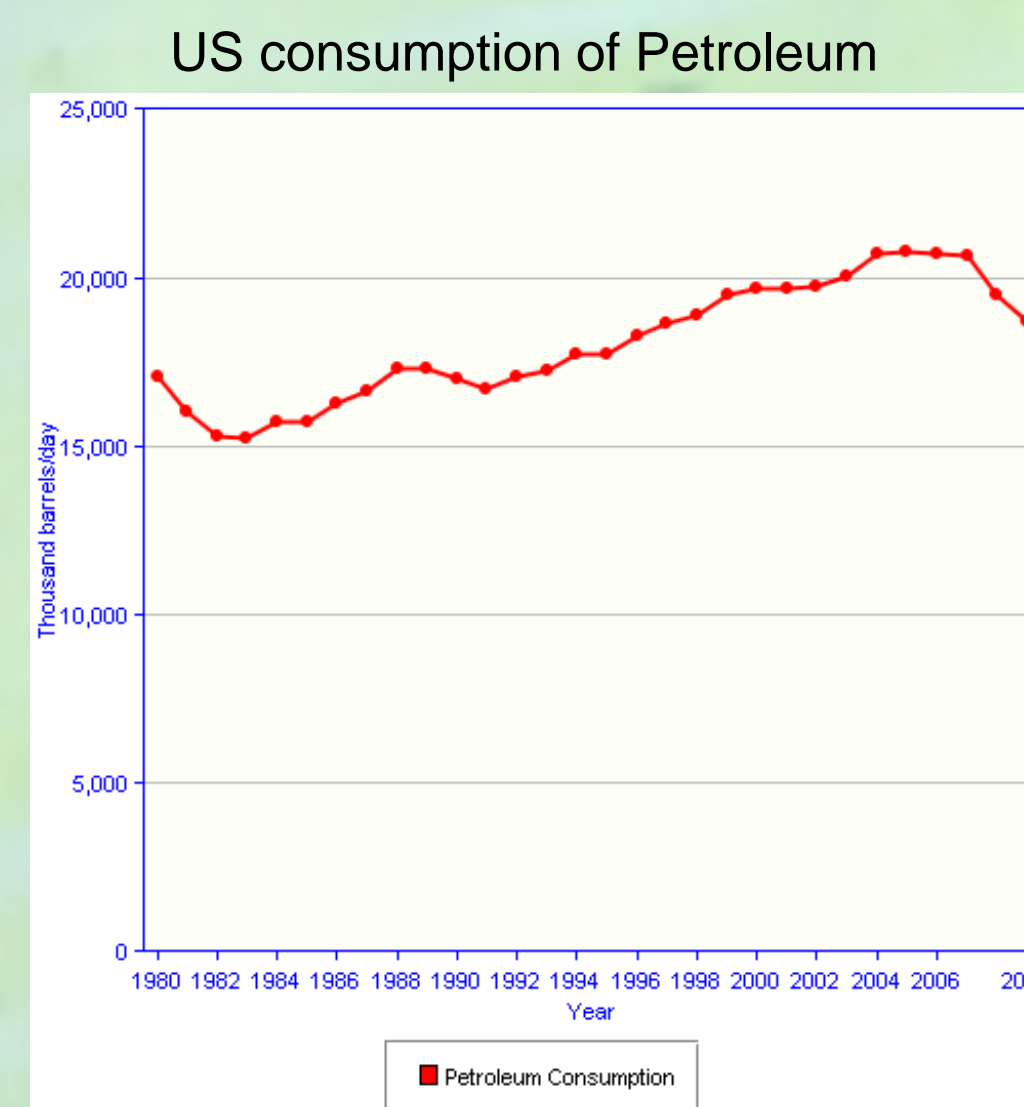
The goal is to compare the economics, efficiencies and safety concerns of mass produced algae fuel against crude oil (a fossil fuel) and ethanol (a first-generation biofuel) to **determine if algae oil would be a beneficial alternative jet fuel.**

What is Oilgae?

Oilgae is the oil produced from algae which is used as a fuel. It is a third-generation and generally new biofuel and is being researched by many companies and labs. Benefits of Oilgae that have been discovered include being carbon neutral, not using as much land as other biofuels use, producing up to 30% more energy than some other land crops, and the ability to be used as an aviation fuel.

Other Important Fuels:

Petroleum is one of the most available fuels and can be used for many different purposes. However, there are negative environmental effects and rising prices.



Ethanol is a first generation biofuel made from corn or sugar cane crops. It uses a great amount of land and can interfere with crops being used for food.

Methodology

Algae oil was compared to crude oil jet fuel and ethanol jet fuel. We carried out an economic analysis by gathering the following information for each three fuels:

- The cost of the final product (jet fuel) for algae oil, crude oil, and ethanol
- The subsidies of the above jet fuels

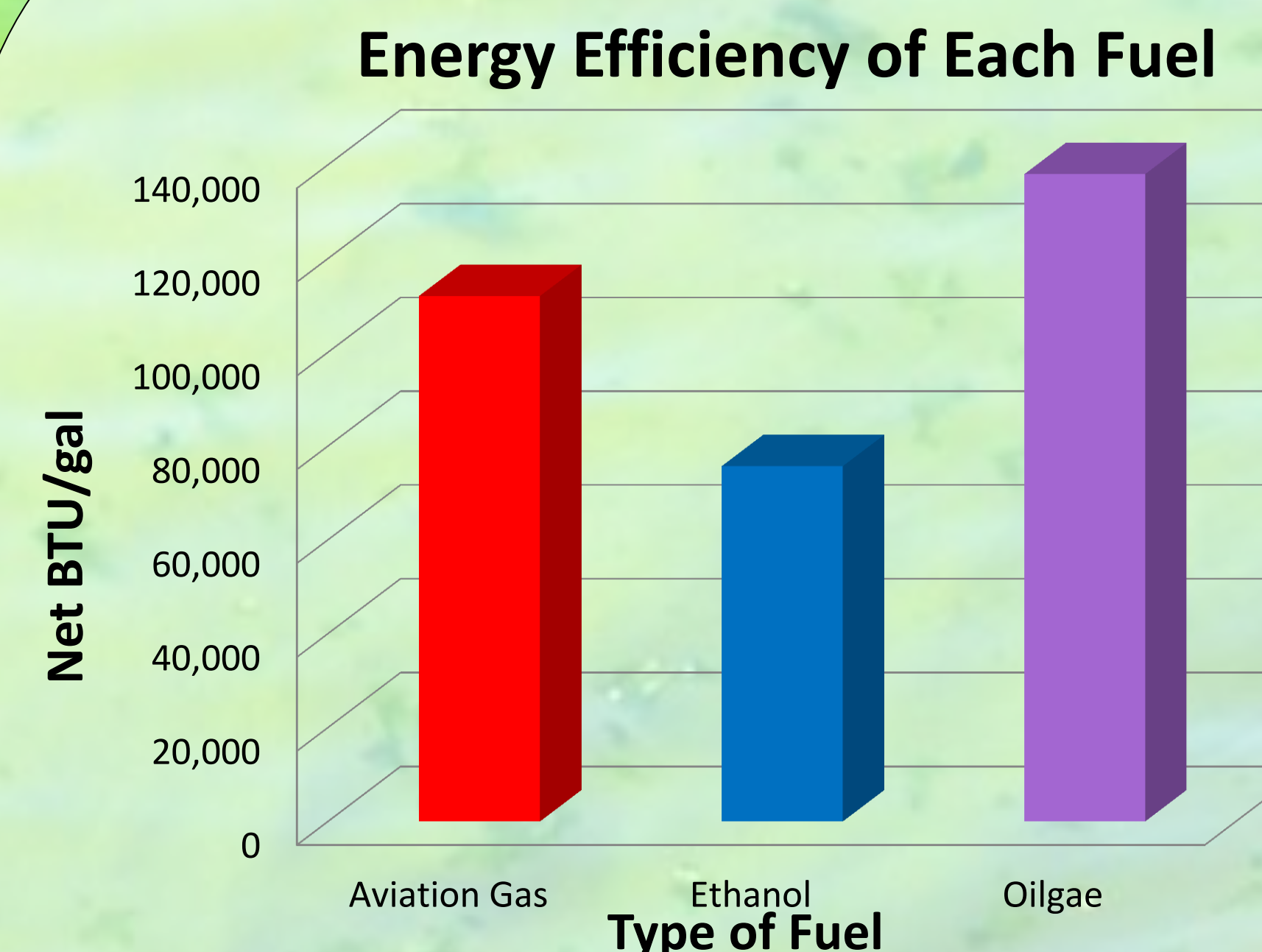
An efficiency analysis was carried out by gathering the following information for each three fuels:

- Fuel produced in BTU's per gallon
- Amount of each substance needed to effectively fuel a plane.

Lastly, environmental and safety concerns were analyzed by gathering the following information for each three fuels:

- Land use for refining process
- Emitted CO₂
- Possible accidents
- Modes of transportation

Results & Data



Net Energy Efficiencies:

- *Crude oil jet fuel:* 112,000 BTU/gal
- *Oilgae:* 138,000 BTU/gal
- *Ethanol*:* 75,700 BTU/gal

Final Product Costs:

Crude Oil Jet Fuel: 100\$/barrel (IATA as of Dec. 2010.)
Oilgae Jet Fuel: 5\$/barrel (DARPA research 2010.)

Safety Concerns & Environmental Impacts:

- | <i>Crude Oil Jet Fuel</i> | <i>Oilgae Jet Fuel</i> | <i>Ethanol</i> |
|---|--|---|
| • Acute intoxication causes nausea, dizziness, etc. | • Accidents (such as spills) can affect biodiversity | • Uses a huge amount of land (interferes with land needed for food) |
| • Accidents (such as spills) have a high negative effect on biodiversity. | • May need fertilizers for growth | • Fertilizers and pesticides used in growth can seep into ground & water. |

Transportation: Pipeline and tankers can transport both crude oil jet fuel and Oilgae jet fuel.

*Ethanol does not have a high enough net efficiency to be sold as jet fuel.

Conclusions

Based on the background information, the results and the data:

- Oilgae has the highest net energy efficiency.
- Oilgae has the potential to be produced in such a way that it will cost less than crude oil and ethanol.
- Oilgae has less severe safety concerns and less negative environmental impacts.
- Oilgae jet fuel can be transported with the same methods used for transporting.
- Oilgae is currently not as accessible as crude oil jet fuel.

Therefore, it seems that Oilgae jet fuel has the most benefits and, once easily available, will be the best choice of fuel to use as jet fuel.



It is recommended that more companies begin investing in and researching ways to produce Oilgae on a larger scale to make it a more available fuel sooner.

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