Microalgae Renewable Aviation Fuel Production

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Abstract — Airlines are faced with increasing petroleum-based jet fuel price (which tripled in the last 7 years), dependency on imported petroleum oil and deteriorating climate due to greenhouse gas (GHG) emission. Renewable aviation fuel, also known as bio-jet fuel is the most desired alternative; it is a drop-in alternative fuel; less dependent on oil and greener than petroleum-based jet fuel; has low volume per unit energy (i.e., has a low gallon per Btu); and could reduce flight-related GHG emissions by over 60% compared to petroleum-based jet fuel. The renewable aviation fuel can be produced domestically from local resources, thus it provides the airline industry a secure supply of liquid fuel. Bio-jet fuel is produced from sustainable biomass like microalgae. The process starts with microalgae growth in water in the presence of lights, carbon dioxide (CO2) and nutrients, e.g., nitrogen, phosphorus, and potassium. Grown algae are harvested, i.e., separated from the growth medium then dried. Algae oil is solvent extracted using hot hexane solvent. Oil extraction is one of the most expensive and energy consuming steps in the process. The extracted oil is converted to biodiesel by the process of transesterification. The biodiesel is used to produce microalgae bio-jet fuel. Advantages of the microalgae bio-jet fuel include 5 – 10% lower fuel consumption than petroleum jet fuel, greener productions with up to 10 times more CO2 consumption than other crops for equivalent growth, no competition with food, fertile land and water and can be harvested batch wise. Microalgae grow rapidly and could produce up to 58,700 L oil per hectare (6,275 gal oil/acre) which is a higher oil productivity than other crops. One of the methods to produce bio-jet fuel is to blend microalgae biodiesel with conventional petroleum-derived jet fuel to provide the necessary specification properties. Sustainable approaches to reducing the production cost and the fresh water use in producing microalgae bio-jet fuel will also be discussed.

Keywords — microalgae bio-jet; harvesting, oil production, aviation greenhouse gas.

3 learning objectives for your presentation, focusing on what knowledge participants will gain from the presentation

* You will explore an alternative to one of the world most critical commodities - oil

* You will learn about a feedstock that has the potential to revolutionize the world of aviation jet fuel.

* You will have a knowledge advantage as the industry is just about to take off.

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