Renewable Aviation – Creating the Industry

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Background

The renewable aviation fuel industry has in the past 3 years moved from being a theoretical future possibility to becoming an entrepreneurial sector with real projects in the planning phase.

A number of enablers have allowed these first steps to be taken, but many hurdles remain before renewable aviation fuel becomes another commodity, and part of the typical aviation fuel mix in the US and elsewhere.

DARPA's BAA08-07 program enabled a number of industry-led consortia, including one led by UOP, to develop a route to Hydrotreated Renewable Jet (HRJ) from renewable fats and oils (triglycerides). This in turn led to strong support from key industry players, notably Boeing. With their support, the first flights using a drop-in renewable jet component have been conducted by Continental in the US, as well as Air New Zealand and Japan Air Lines, and OEM's have begun limited engine tests.

Having established the chemistry, the next step is to establish the fuel specification that forms the basis for critical platform certification activities. The historic passage of ASTM D7566, "Aviation Turbine Fuel Containing Synthesized Hydrocarbons", provides a specification for Fischer Tropsch derived fuels and anticipates up to 50% HRJ in commercial jet fuel. The inclusion of HRJs in D7566 is expected by the end of 2010.

Reviewing the HRJ Value Chain

In order to define gaps in the renewable aviation fuel value chain, we compare and contrast with the fossil jet supply chain.

Feedstock – The main raw material for HRJ is triglyceride oil, meaning anything from commercially available oils or fats such as soy, canola and tallow, non-food energy oils like camelina and jatropha, through to algal oils. The primary issue is the impact of feedstock availability and pricing on HRJ fuel price. The limited availability of these oils relative to crude oil, and (in some cases) competing uses such as food, mean that the cost of HRJ from these sources is currently between 50% and 100% higher than fossil jet. The primary opportunity therefore is to promote expanded planting and higher yields, and hence increases the availability of non-food energy oils like camelina. In parallel, the nascent algal oil sector should continue to be encouraged, such that over time, supplies will increase and prices will fall, narrowing the gap between HRJ and fossil jet.

Conversion Technologies – The critical issues for conversion technologies are availability of investment capital to build renewable jet production units and an assured market. Technical barriers have been overcome, as demonstrated by the imminent launch of commercial technology to convert triglycerides to HRJ via deoxygenation and selective cracking, such as UOP's Renewable Jet Process, The key today is finding the first investor willing to build the capacity at a likely cost of $150-$200 million, given that this first mover will need to sell high cost HRJ into an unestablished market. However, with each such unit producing an expected 60 million gallons per year of HRJ, significant supplies of HRJ could become available from late 2011.

Certification – Aviation fuels are subject to much more rigorous certification than land-based fuels. Commercial flights cannot use a fuel before it is certified, yet certification requires significant fuel volume. As a result, significant quantities of fuel need to be produced before there is a commercial market to sell into. The establishment of ASTM D7566 is the first step on the road to certification, but the gap in the availability of fuel remains, particularly if endurance tests are required. Similarly, certification of each platform in the military is quite costly prior to the availability of commercial HRJ production facilities.

Growth of Long Term Demand – Following technology development, certification, and even the construction of the first HRJ unit, the critical thing is to establish a long term demand for the product at near-term HRJ production prices, while at the same time creating incentives for the whole value chain to reduce costs in the long term. Government initiatives which encourage the use of aviation biofuels (such as the RFS) start to create long term demand, but unfortunately, at a price point below the current production costs. What is therefore necessary is a long, yet temporary solution which can reduce the delta cost between HRJ and fossil jet. This could take the form of either (a) an enhanced blending credit reflecting the lower yield of jet per unit of triglyceride oil than (say) diesel; or (b) long term offtake agreements by strategic stakeholders such as the US military or airline consortia. The critical enablers are the combination of long term offtake and the right price. Both are required for a commercial producer to make the long term capital investment in a new plant.

Markets – The development of markets is an area with many hurdles. Even with incentives, HRJ production will take decades to meet the full potential market demand due to feed availability and speed of plant construction. However in the near term, the key is to mitigate the market volatility between the agricultural world supplying the feedstock, and the well-established market in fossil energy which effectively governs HRJ price. This type of covariance issue can be handled through financial instruments hedging the variations in the two prices, such that HRJ varies in line with fossil jet, even if the price paid for HRJ is higher. Alternately, a strategic buyer could put an offtake in place based upon the price of the raw materials – in essence accepting that jet prices will change based upon two sets of market variables rather than one.

Closing the Gaps – How can the Air Force contribute to developments in technology, organization and policy that would accelerate the aviation biofuels industry?

As a major buyer of jet fuel with long term demand, and a strategic desire and mandate to diversify supply, the Airforce is uniquely placed to use its resources to create a permanent demand for HRJ.

Specifically, as a part of Government administered services, the Air Force could accelerate the development of a renewable aviation industry through the following:

1. Create a permanent demand by placing long term (5-10 year) offtake contracts for HRJ, at pricing calculated to be consistent with the real cost of HRJ production. The duration and pricing of the contract needs to be consistent with the payback for the unit to induce a commercial organization to build the plant.
2. Drive down the cost of oil feedstocks by collaborating with USDA to encourage the planting of triglyceride crops suitable for HRJ production and enhanced yields of non-food crop species.
3. Continue Air Force HRJ certification efforts on current platforms, and use its procurement specifications and influence to require that all future propulsion units offered by the OEM's be compatible with both JP-8 and blends containing HRJ-8, sharing the cost of certification between Government and industry.
4. Potentially take a direct equity interest in the first 3 to 5 units to be built, in conjunction with the long term offtake contracts of item 1. This would allow the producer to achieve a lower cost of production via reduced financial and market risk, thereby benefiting both the Air Force and the operator. The Air Force could then exit after 5-10 years, selling its interest as the market stabilizes.
5. Ensure that renewable jet is considered in new biofuels and environmental legislation. In particular, ensure that incentives are appropriately adjusted for fuels such as jet which must inherently produce lower yields than diesel made from the same feedstock.