A new technology debuts for renewable jet fuel

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A new path to affordable jet fuel? Emerging Fuels Technology contends that a combination of gas-to-liquids and hydrotreating is right on emissions and the economics.

Here's the how and why.

From Oklahoma we've heard that Emerging Fuels Technology will begin licensing an innovative new technology that significantly reduces the cost of manufacturing renewable fuels from bio oils, typically referred to as HEFA fuels (hydro processed esters and fatty acids). HEFA fuels are approved for 50% blends into conventional jet fuel.

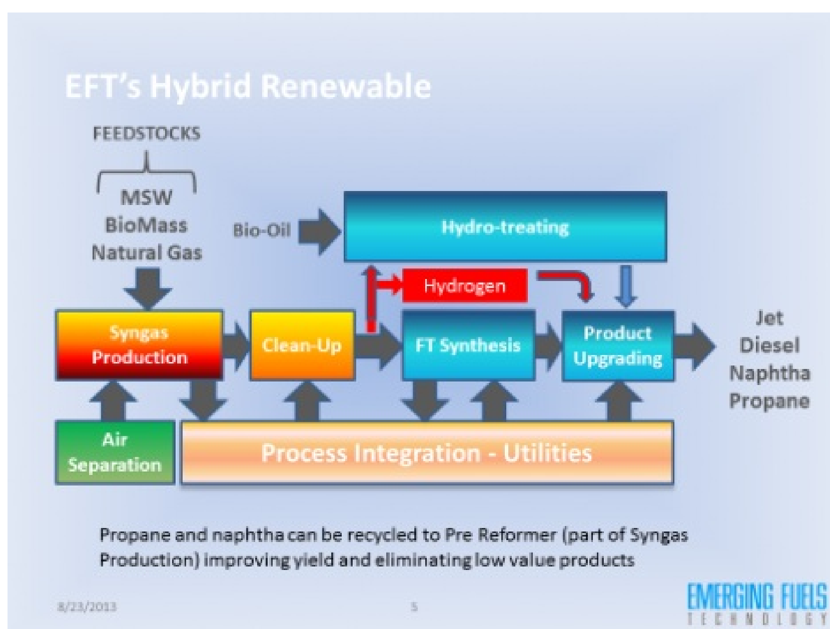
Over the past few years, we've not heard as much as we hoped regarding commercial-scale deployment of HEFA fuels — and that's because of cost. Primarily for the hydrotreating technology by which virgin or waste oils are upgraded into fuel — which requires technology, capex, labor and (above all) hydrogen.

Right now, high free fatty acid oils are generally available at a 30-35 percent discount to virgin oils — or, around 20-23 cents per pound, compared to 31 cents for virgin soybean oil. Requiring 7.5 pounds of virgin oil to make a gallon of jet fuel — it's easy to see that a technology that can hydrotreat waste oils can get feedstock at around $1.50-$1.75 per gallon. Or around $2.33 per gallon for soybean oil.

So far, so good. But the capex and opex of a system has been just too much, combined with the feedstock costs — to get fuels down to the sub $3.00 raneg where airline orders would be strong — or even into the $3.50 range where some small "pilot" orders would be used by airlines desiring to blend say 2-5% renewable content as a "sign of things to come".

That's where EFT's technology comes in.

By incorporating HEFA upgrading technology into the company's FT based Gas to Liquids plant designs, the resulting FT/HEFA "Hybrid" plant significantly lowers the cost to convert bio-oils into renewable fuels while, at the same time, increasing the total yield and jet yield.



The approach takes advantage of three synergistic features of a GTL plant:

• Lower Operating Expenses. A GTL plant can generate surplus hydrogen needed to process bio-oils, enough to co-process one barrel of bio-oil into fuel for every barrel of GTL fuel that it makes. The use of the "free hydrogen" plus the "free labor" benefit of utilizing the GTL plant's staff results in little or no additional operating cost.

• Lower Capital Expense. A 2,000 Barrel per day GTL plant can become a 4,000 barrel per day “FT/HEFA Hybrid” plant for roughly a 15% increase in capital cost, much lower than a stand-alone HEFA processing plant.

• Higher Yield. During conventional hydro processing of bio-oils, the light hydrocarbons formed when the triglycerides in bio-oils are saturated are lost. In a GTL hybrid plant, these hydrocarbons are recycled to the front of the GTL process and converted into suitable fuel range products via FT synthesis, thereby increasing the overall yield.

The advantage

The combination of yield increase with the lower capital and operating costs of the FT/HEFA “hybrid” design provides a significant advantage over any other method currently available to produce HEFA fuels. The technology has been tested on a wide variety of bio-oils sources including numerous seed crops and algae oils to evaluate hydrogen consumption and relative yields. EFT has filed several patents for key elements of the technology.

Plant cost? Something like $250 million for a 4,000 barrel per day plant. That’s 61 million gallons — so think CAPEX of roughly $4 per gallon. And, by adding just 15% in capex for the HEFA portion, you get a lift of 1000 basis points in terms of the return on capital — it’s almost two-thrids better on capital return than a FT-based GTL plant.

What is the Global potential for natural gas based FT jet fuel?

A recent EIA assessment of 48 Shale gas basins in 32 countries revealed an estimated 5,760 Trillion cubic feet of technically recoverable gas. Those countries include much of Europe, Asia, Australia, Africa and South America. In addition, there is known to be more than 1,500 Tcf of “stranded gas around the world that is also a potential resource. Additionally, 2009 World Bank data on flared gas suggests that this wasted resource alone could produce 1,350,000 BPD of synthetic crude oil of which at least 810,000 BPD could be jet fuel.

The Airbus relationship

In December 2014, Airbus Group signed a Memorandum of Understanding with EFT to promote technologies to produce commercially viable, environmentally friendly, sustainable fuels for aviation, compatible with existing aircraft and equipment. The development of the EFT FT/HEFA Hybrid technology is a result of EFT’s research and development efforts over the last two years and is covered under EFT’s Collaboration Agreement with Black & Veatch, a global leader in the engineering, procurement and construction of energy infrastructures, to support development worldwide.

“We look forward to interacting with all the stakeholders in the aviation supply chain and believe our relationships with Airbus Group and Black & Veatch will help enable broad global development of sustainable/renewable aviation fuel facilities,” said Kenneth Agee, President of Oklahoma-based EFT, at the time.

As part of the project, Black & Veatch is applying its expertise in modular and skid mounted design and standardization to develop and implement Packaged Designs for small-scale GTL plants and XTL plants. These Packaged Designs use repeatable, shop-fabricated modules that can be shipped by truck. The result is reduced project costs and timelines.

Where can you do it?

Well, think of all that gas piling up in the general vicinity of the Henry Hub in Oklahoma — or even north of the border down in southwestern Kansas, also a gas hub but also moving into virgin oil country.

Feedstock? Think canola, known in Europe as rapeseed. It’s an excellent rotational crop for wheat, soybeans and corn, that increases yield of crops in rotation (20% avg) while lowering chemical & fertilizer usage (15% avg), and features low water consumption. Plus, there are about 500,000 acres of canola expected to be planted in the region. That's almost double the feedstock required to support a GTL-HEFA hybrid plant.

We also might find that the combination of oilseeds and natural gas works well for camelina, or the novel crop carinate that Agrisoma is developing.

Here's the catch

Co-processing F-T paraffins derived from syngas and paraffins derived from hydroprocessing esters and fatty acids is not covered under D7566 currently.

Each component of the co-processed product is certified, but new language needs to be added to D7566 to allow co-processing.

The carbon advantage

According to preliminary analysis, the aggregated GHG emissions for production of diesel, SPK jet fuel blend component, and paraffinic naphtha is 50.34 gCO_2e/MJ which is 44% below the fossil fuel baseline of 90 gCO_2e/MJ for distillate fuel production (DOE/NETL-2009/1360). Traditional LCA analysis of GTL plants without CCS show GHG emissions ~15% higher than conventional fuels. Some LCA studies show parity with

conventional fuels. But none of these studies include CO_2 capture or co-feed of biomass derived gases or highly integrated process designs. Thus the EFT hybrid plant has significantly lower GHG emissions rates for fuel production than traditional plant designs.

Next steps?

Co-Process F-T SPK with fatty oil derived paraffins at 50/50 ratio

Test jet fuel component for conformance with all D7566 Annex A1 and A2 requirements

GCxGC comparison of Hybrid SPK with products from oil feeds and GTL SPK

Provide samples to SwRI and interested parties for comparison to F-T and HEFA SPK products

Blend with conventional Jet A and test against Table 1 requirement