Little Big Tech: Can Fischer-Tropsch Technology Work at Smaller Scale?

Can small-scale micro-rectors provide economic alternatives to massive F-T plants like Shell's Pearl GTL plant in Qatar?

While companies pursue alternatives to Fischer-Tropsch technologies, Velocys is seeking to make F-T work economically with micro-reactors.

In a Digest from November, Robert Rapier aptly stated the challenge in front of XTL technologies [1] — companies whose primary focus is gas-to-liquids (GTL), coal-to-liquids (CTL), or biomass-to-liquids (BTL):

“The two major problems with any of the XTL technologies are that capital costs are extremely high, and a long-term, cheap feedstock supply must be secured. Shell’s initial estimate for the [Pearl GTL plant in Qatar] was $5 billion, but by the time the project was completed the costs were estimated to be around $20 billion.”

The problem that underlies both challenges – scale. Shell’s Pearl GTL plant in Ras Laffan operates at a scale of 140,000 barrels per day. That drives the large capital costs, but ensures that biomass has a tough time working within traditional Fischer-Tropsch technology – an approach that converts a synthesis gas to liquid hydrocarbon fuels.

The high cost of shipping biomass

F-T has been looked at many times over the years, but the cost of shipping biomass simply skyrockets due to the increased cost of shipping and logistics with feedstock aggregation.

For that reason, there has been quite a bit of attention paid in the Digest to technologies that offer alternative routes to F-T, while still working with syngas made from gasifying biomass. Coskata, LanzaTech, Cool Planet, INEOS Bio, KiOR, Ensyn and Enerkem are just a few of the better-known alternatives – working with thermochemical processes such as fast pyrolysis, or gas fermentation.

But there’s another approach that might work – making F-T itself work at smaller scale. Rentech has been working hard on that approach.

Micro-reactors

One technology worth watching: the microchannel Fischer-Tropsch reactors and catalysts developed by Velocys, a subsidiary of Oxford Catalysts Group.

According to Velocys, microchannel technology is able to intensify the FT process to the extent that a plant of 500 barrels per day output (7.6 million gallons per year) can be economic, which would require around 500 tonnes per day of biomass. That's not far off the biomass requirements of the small commercial plant that KiOR has just commissioned in Columbus, Mississippi – and also in the ballpark of Ensyn's preferred 400 ton-per-day reference design.

The opportunities for microchannel FT reactors and catalysts, these days, also stretch, in the US, as a way to play cheap natural gas.

As Velocys points out:

"Without this new approach, these energy resources such as shale gas, tight gas, coal-bed methane, and stranded gas (gas fields located too far from existing pipeline infrastructure) would often be left underground. Distributed GTL plants require both technology that is economic at a scale of 1,000 – 15,000 barrels per day (bpd), and a modular construction approach to overcome logistical challenges, for example the difficulties associated with building in remote locations. Modular construction allows most of the fabrication to be done in a controlled factory environment, minimizing the work in the field."

Modular construction

In terms of modular construction, Velocys has signed with Ventech Engineers International, which specializes in the design and construction of modular refineries. Under the terms of the collaboration agreement, Ventech will design, sell and deliver GTL plants incorporating Velocys' microchannel FT reactors to customers in North America – and placed an order for the first 1400 barrel per day modular GTL plant. Furthermore, through Ventech Project Investments LP, Ventech has $200 million in available capital to make equity investments in energy projects, and expects to co-invest in initial customer GTL plants.

This is the distributed approach – large numbers of small-scale facilities, as opposed to monster-scale refineries. And, in those areas of the world where cheap natural gas is, for now, a pipe(line) dream – distributed biomass-to-liquid may well be the preferred approach.

Velocys contends that distributed BTL also can enable the reuse of a broad variety of carbon containing waste, and recycle that biomass to a highly fungible, high quality product, which will also help to satisfy the demands of both landfill avoidance and biofuels mandates around the world.

"Imagine a distributed BTL facility at the waste processing facility of every large

town or city, anywhere in the world," the company says, "and the production of a fuel that can be used by the local community or sold for its economic benefit. Meaning that an abundant resource in many oil-deficient but fuel-hungry nations can be used for transportation."

The Bottom Line

Every airline passenger or email recipient knows the drill: "use caution when opening". Technologies that look great on paper may not work in a) a given geography b) with an inferior cost of capital or c) when operated in the unruly real world as opposed to the pristine lab.

Nevertheless, Velocys' technology is well worth a look when it comes to evaluating technologies in the 400-600 tons per day range, for biomass. With all gasification technologies there are challenges – in addition to producing liquid fuel, there is char and gas production – but the opportunities to make smaller-scale biomass resources economic should not be discounted.

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