Comparing BioGTL to Larger Plants
Updated Feb 22, 2024

EMERGING FUELS TECHNOLOGY

NOTE: This paper should be read in conjunction with our white paper "BioGTL Overview - Feb 2024" which describes EFT's technology for building small scale (100 and 500 BPD) plants that convert RNG and biogas into liquid transportation fuels.

BioGTL is a "Paradigm Shift" - The "knee jerk" reaction to small scale plants is typically "Why would anyone want to build a plant that small? It could never be economical." But it can! It defies all traditional views of economy of scale. Once you understand and accept the concepts behind this approach, the surprise comes when you compare the results of building multiple small plants to the results of building only one "more traditional" large plant.

EFT has worked with project developers on several renewable fuel projects, most of which never came to fruition. A few have. The timeframe for a large plant (1,000 BPD or more) is significant. When you include project development, fund raising, cost estimates, offtake agreements, detailed engineering, construction and start-up, these plants frequently take 5 years or more to reach full operation.

Recent public data on plants of this size currently under construction suggest an average Total Installed Cost (TIC) of $400-$450 million or more for 1,000 BPD and 4-5 years to complete. At $450,000 per barrel of daily capacity this CAPEX is a steep economic hill to climb and can only be done in today's fossil fuel pricing environment with the help of government subsidies, which primarily come in the form of Renewable Identification Number (RIN) credits, Clean Fuel Production Credit and Low Carbon Fuel Standard (LCFS) credits in certain states. The value of these two credits combined with the commodity value of the fuel can exceed $10 per gallon. Without them, the plant described above has no chance of economic success.

By comparison, EFT's 100 BPD BioGTL plant, generating the same RIN and LCFS credits, can be built and installed for $30 million or less. That's a TIC of $300,000 per barrel of daily capacity, roughly two thirds of the cost of a renewable fuels plant that is 10 times bigger. How can this be?

Technology Comparison –BioGTL Advantages

To understand the significant CAPEX advantage of BioGTL, it helps to review the significant technical differences between renewable plants that handle solid feedstocks vs gas feedstocks. Here are a few:

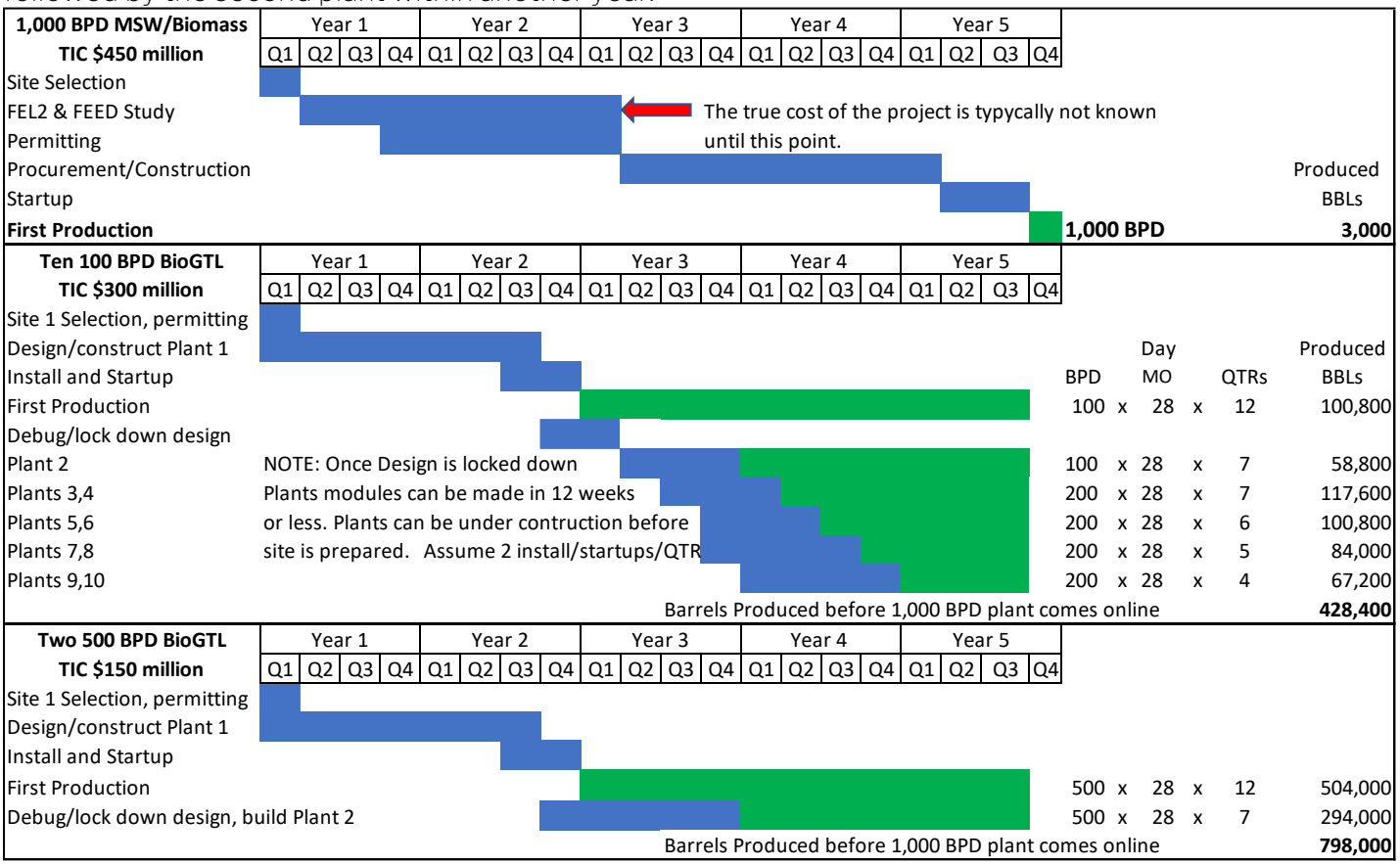
Biomass/MSW (Municipal Solid Waste) to Liquids	BioGTL
• Dealing with solid feedstock	• Gas feedstock
• Significant customized clean up	• Gas clean-up is "off the shelf"
• Significant material handling	• Minimal material handling issues
• Gasification often at low pressure	• Biogas uses standard compression
• Significant Syngas Compressor cost	• No Syngas Compression - Process downhill
• Custom engineered for site and feedstock with "stick build" on site	• Standardized, shop built modules for fast installation, low cost to repeat
• Large equipment - low volume higher unit cost, longer delivery, high cost to transport modules and cranes to side	• Only gas clean-up is unique to each site with off-the-shelf equipment. All modules fit standard trucks and assembled with standard cranes
• Operations - Full staff required onsite	• Operations can be autonomous with satellite uplink for remote monitor. Site maintenance dispatched as needed.

The drawback to biogas is that it rarely exists at any location in quantities large enough to support a 1,000 BPD plant, let alone something bigger. However, there are over a thousand sites (landfills, wastewater treatment plants and anaerobic digesters) in the US that generate enough biogas to supply one of these plants (or several in trains sharing utilities and tankage further driving down capex per barrel).

Comparing Large to Small – Size vs Speed vs Cost

BioGTL: Cost estimates provided to EFT by reputable vendors put the average Installed Cost of a 100 BPD BioGTL plant at $30 million each. It takes Ten 100 BPD plants to equal the larger plant. Allowing 18 months for Plant 1 design and installation followed by 6 months of operation (for debugging and design confirmation) before installing Plant 2, ten BioGTL plants can be installed in roughly 75% of the time (4years) while generating cash flow in month 18.

In the 500 BPD case, the first 500 BPD BioGTL plant can be designed built and installed within 24 months., followed by the second plant within another year.



Once the design of the first plant is proven and locked in, and long lead time items are scheduled, plant modules can be built in 12 weeks or less in multiple shops. The installation schedule becomes driven by the number of installation crews employed. Permitting and site related engineering can be planned and executed months in advance of an installation. Once the site is ready, an installation crew can easily install and start-up a plant in three months or less. To install two plants per quarter will require 2 installation crews. Satellite linked autonomous operation and automated custody transfer of products for shipment make it

possible to remotely operate hundreds of BioGTL plants with a small 24/7 crew at a central location with on-site maintenance done by local contractors or regional maintenance staff.

The ten plant BioGTL case will produce 428,400 barrels of product BEFORE the 1,000 BPD plant produces its first barrel while the 500 BPD case produces 798,000 barrels of product. At current product values of around $9/gal, $161 million of cashflow for the 10-plant case and $301 million cashflow for the 500 BPD case.

Call us anytime to discuss…

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About Us:
Emerging Fuels Technology (EFT) is a technology company focused on methods for producing synthetic fuels and specialty products from a variety of feedstocks such as natural gas, biogas, biomass, municipal solid waste (MSW), sources of CO2 and bio-derived oils. EFT is one of the world's foremost authorities on Fischer-Tropsch (FT) and related synthesis, licensing the core technologies and upgrade packages for projects from 50 to 10,000 barrels per day. www.emergingfuels.com