

NOTE: This paper should be read in conjunction with our white paper – “BioGTL Overview” which describes EFT’s breakthrough technology for building micro scale (58 BPD) plants that convert biogas into liquid transportation fuels.

BioGTL is a “Paradigm Shift” - The “knee jerk” reaction to a 58 BPD plant 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 of 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.

Public data on plants of this size currently under construction suggest an average Total Installed Cost (TIC) of \$300-\$350 million or more for 1,000 BPD and 4-5 years to complete. At \$350,000 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 and Low Carbon Fuel Standard (LCFS) credits, most of which come from the state of California. 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 58 BPD BioGTL plant, generating the same RIN and LCFS credits, can be built and Installed for \$10 million or less. That’s a TIC of \$173,000 per barrel of daily capacity, roughly half of a renewable fuels plant that is 18 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:

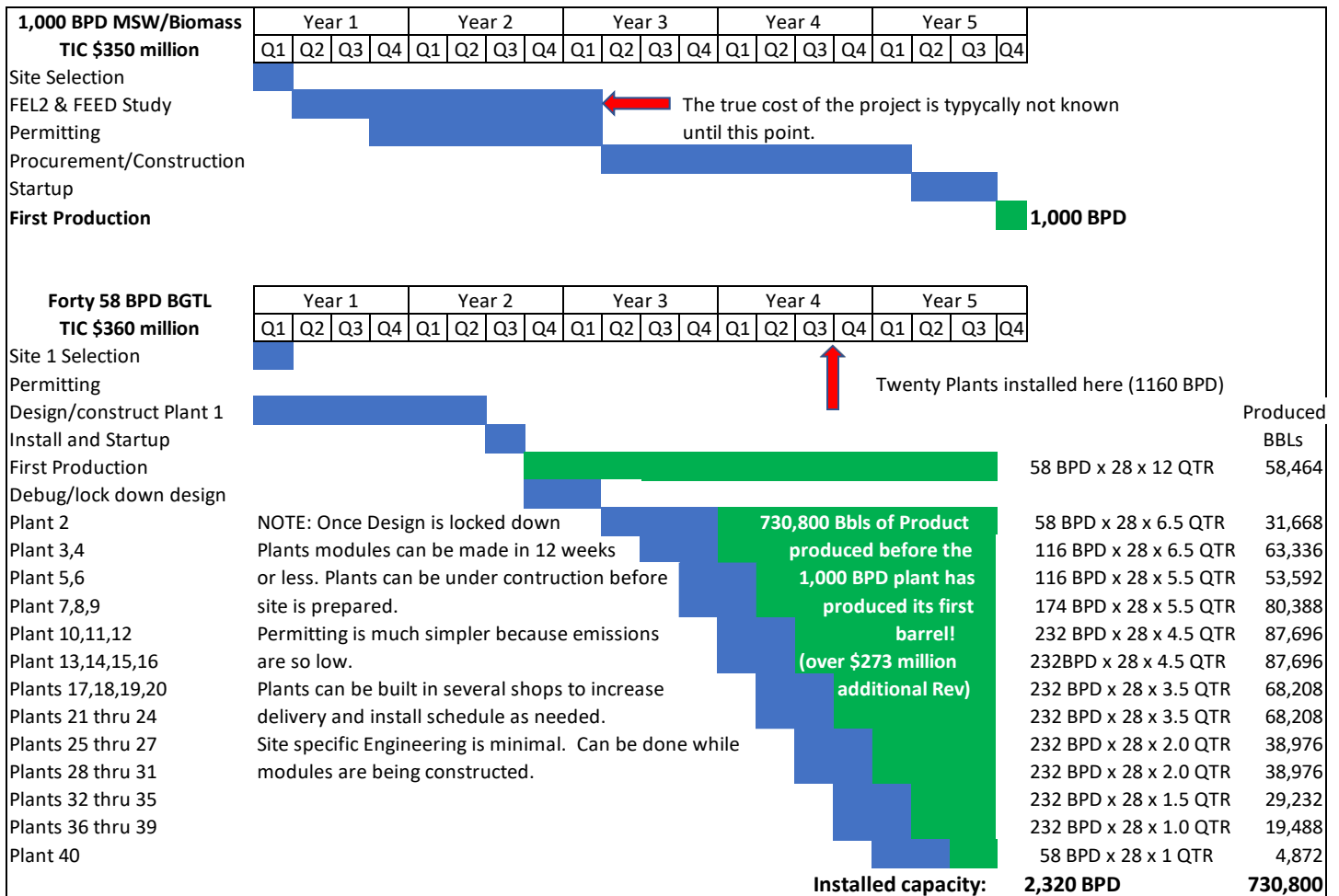
Biomass/MSW (Municipal Solid Waste) to Liquids	BioGTL
<ul style="list-style-type: none"> • Dealing with solid feedstock 	<ul style="list-style-type: none"> • Gas feedstock
<ul style="list-style-type: none"> • Significant customized clean up 	<ul style="list-style-type: none"> • Gas clean-up is "off the shelf"
<ul style="list-style-type: none"> • Significant material handling 	<ul style="list-style-type: none"> • Minimal material handling issues
<ul style="list-style-type: none"> • Gasification often at low pressure 	<ul style="list-style-type: none"> • Biogas uses standard compression
<ul style="list-style-type: none"> • Significant Syngas Compressor cost 	<ul style="list-style-type: none"> • No Syngas Compression - Process downhill
<ul style="list-style-type: none"> • Custom engineered for site and feedstock 	<ul style="list-style-type: none"> • Standardized, shop built modules for fast installation, low cost to repeat
<ul style="list-style-type: none"> • Large equipment - low volume higher unit cost, longer delivery 	<ul style="list-style-type: none"> • Only gas clean-up is unique to each site with off-the-shelf equipment
<ul style="list-style-type: none"> • Operations - Full staff required onsite 	<ul style="list-style-type: none"> • Operations-Fully autonomous with satellite uplink for remote monitor. Site maintenance dispatched as needed.

The drawback to biogas is that it does not exist at any location in quantities large enough to support a 1,000 BPD plant, let alone something bigger. However, there are several thousand sites (landfills, waste water treatment plants and anaerobic digesters) in the US that generate enough biogas to supply one of these plants.

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 BioGTL plant at \$9 million each. It only takes Twenty 58 BPD plants (1,160 BPD for \$180 million) to equal the larger plant. Allowing 18 months for BioGTL plant 1 design and installation followed by 6 months of operation (for debugging and design confirmation) before installing plant 2, these twenty BioGTL plants can be installed in roughly 70% of the time (3 ½ years).

However, if we take the full five year time window, Forty BioGTL plants (2,320 BPD for \$360 million) can be built and installed in roughly the same time and for roughly the same capital.



Once the design of the first plant is proven and locked in, plant modules can be built in 12 weeks 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 one month, or 12 plants per year. To install one plant per week will require only 4 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 forty plant BioGTL case will produce 730,800 barrels of product BEFORE the 1,000 BPD plant produces its first barrel. At a \$300/BBL average product value, this equates to over \$273 million of additional cashflow.

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

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