

## FFTechnology Conversion Companies' Data Base

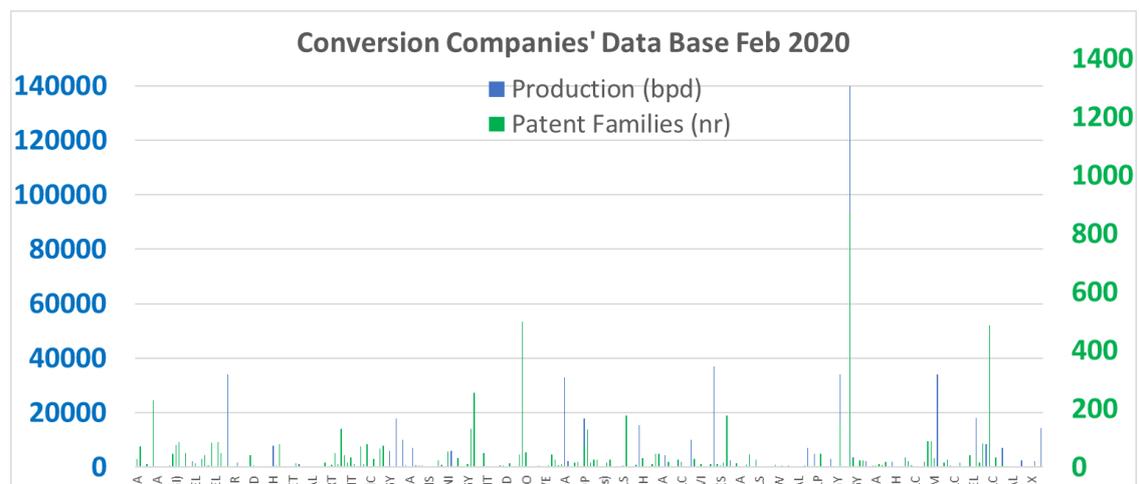
### The Position of GasTechno

#### Background

FFTechnology is maintaining a data base on companies involved in conversion technologies, mainly gas to liquids, but also including biomass, waste and other alternatives into liquids, as well as carbon dioxide capture and conversion. This has been a 10+ year effort and over 280 companies have been listed.

For the individual companies or organisation in the various areas the following aspects are covered:

- Partners & funding
- Process & technology definition
- Intellectual property exposure (patent families in past 15 years)
- Development stage size & timeline: laboratory – pilot plant – demonstration plant – commercial plant

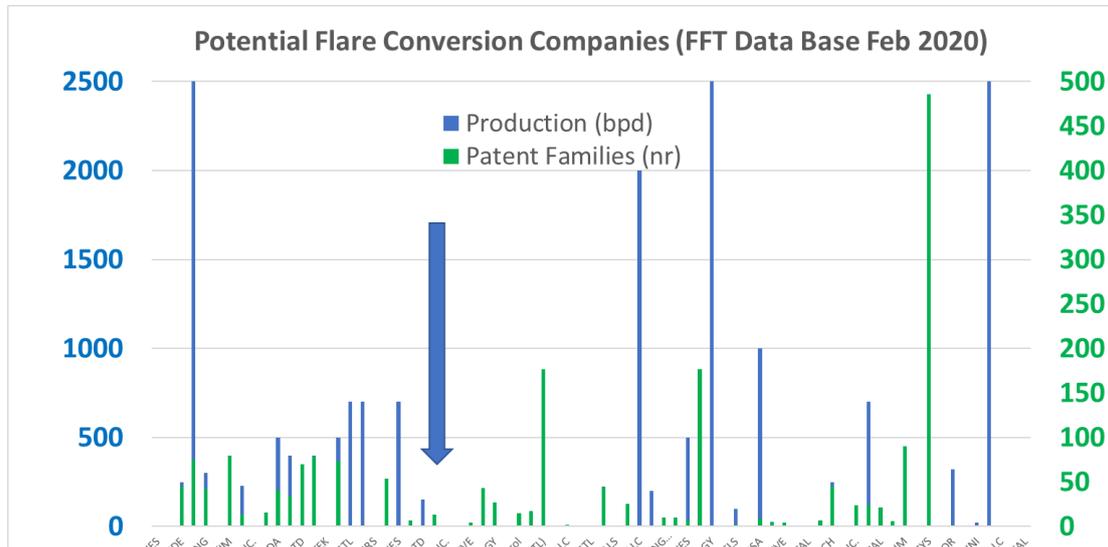


An overview of plant / operational size (barrels per day or bpd) and number of patent families applied for or recorded is shown in the graph above. The average size of operation is 3,180 bpd with on average coverage with 24 patent families. The ranges are from laboratory to 140,000 bpd and with no patent coverage to 874.

#### GasTechno's Position

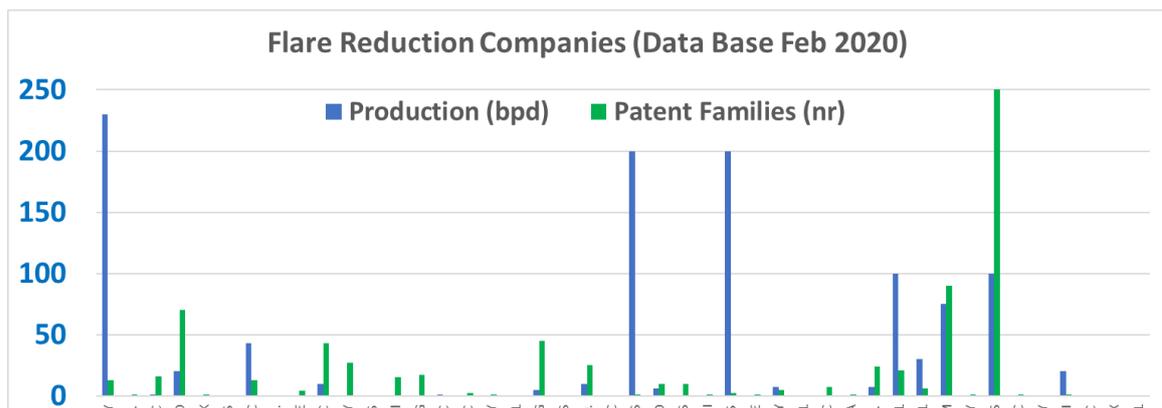
90 of them are focussing on dealing only with natural gas or methane and converting it into liquids, which can be easily transportable. Average scale of operation is 5,295 bpd with on average 40 patent coverage. Assuming that

flares are usually plenty but also small, one can then narrow it down to companies which are dealing with operations at a scale of < 2,500 bpd.



These companies are shown above, with the blue arrow indicating the Gas Techno information.

Zooming in to companies and their technologies, which will be most applicable to flare reduction qua size (i.e. < 250 bpd or 2.5 mmscfd flared gas), the picture is simpler, as shown below, with 44 companies remaining.



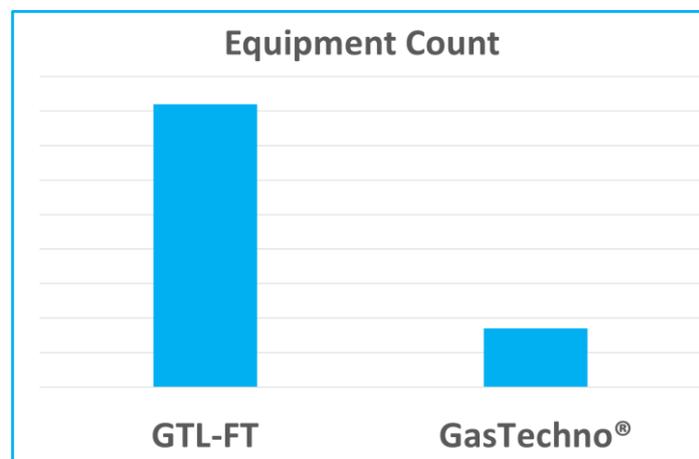
The main challengers for GT are:

- 230 bpd equivalent of fish-food produced via microbes, recently (2019) sponsored by BP to the tune of \$30 million. It is a **three step** process

of fermentation – separation – drying before the (feed) product is ready for shipment.

- 200 bpd methanol (and/or DME) production units, offered by two vendors at modular scale, but not many (if any) buyers have come along. It is a catalytic process in at least **three steps** of syngas production and syngas conversion followed by distillation and so involves several vessels and catalyst handling, which will put the price up.
- 70 – 100 bpd efforts by two companies all doing the **three step**, capital intensive Fischer-Tropsch conversion: syngas production, syngas conversion and product upgrading.
- Then there is one offering pyrolysis (proven at 100 bpd) in at least **three steps**: pyrolysis to acetylene – hydrogenation to ethylene – oligomerisation to gasoline.

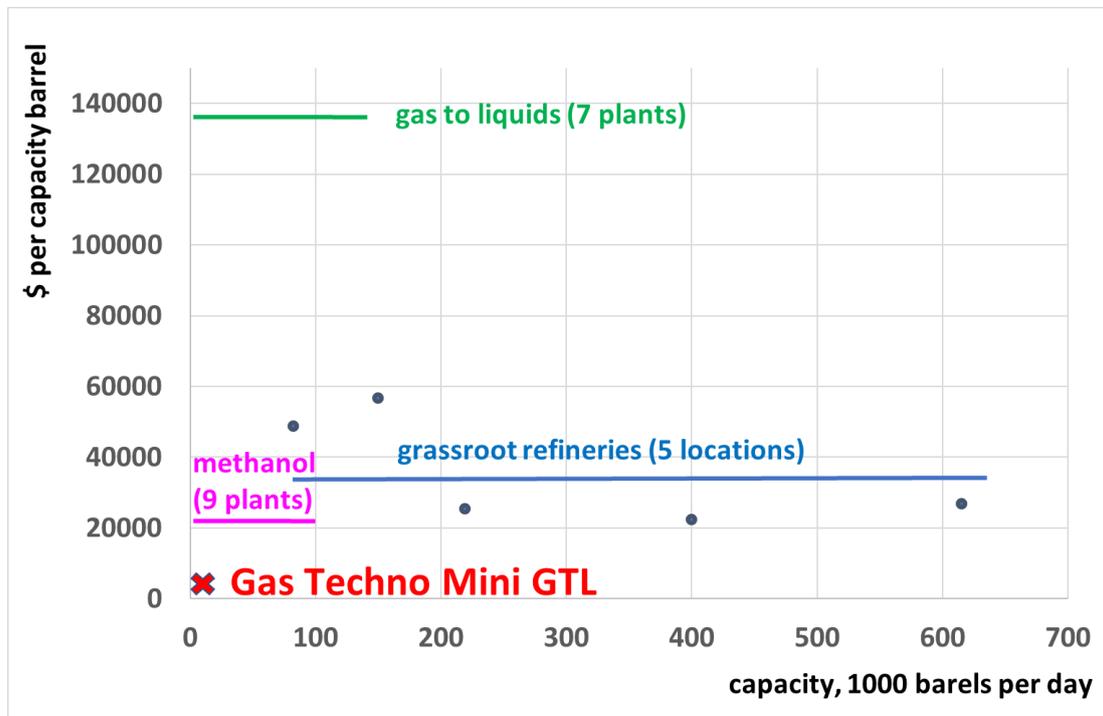
But the issue with the above based technologies is that they mainly become economically attractive at the > 15 mmscfd scale, due to economies of scale. And although several have 200-250 bpd modules, the economic costs have prevented these modules to be employed. Almost all have at least three steps in their processes, which will add to their equipment count and so increases the capital costs of the projects. A comparison with GasTechno is shown below.



Scalability is not an issue with GasTechno and it operates well at low throughputs (<1 mmscfd). This is fundamental and underpins GasTechno's technology that, due to its simplicity, it can operate at the lower flow rates, in the region of many flares. This simplicity translates itself into a reduced equipment count, a lower plant weight and smaller footprint, compared to conventional technologies.



These benefits then culminate in a lower capital cost, see figure below.



**Conclusion**

Since there are many companies in the market place, it will be hard to stand out amongst the crowd (90 companies).

Differentiation on factual data has to be on complexity (how many stages are involved), which translates into capital cost.

Credibility is key and can only be arrived at by have long operating times, in the order of a year continuous operation.