



MINI-GTL TECHNOLOGY BULLETIN

Volume 2, July 2016

INTRODUCTION

Volume 1 of our new World Bank GGFR “Mini-GTL Technology Bulletin” was issued in March of this year. We mentioned our intent of issuing 2 to 4 Bulletins a year to provide timely updates of the quickly emerging use of small scale GTL technologies to extinguish gas flares. The annual EFl/GGFR Gas Conversion Technology Conference and Site visits in May in Denver showcased not only new players and new exciting technologies but also confirmed the enthusiasm to apply GTL solutions that are specifically designed for gas flares.

STATE OF THE MINI-GTL INDUSTRY

Over the last 6 years or so, significant momentum has been building up in developing smaller and smaller GTL plants that lend themselves to gas flare monetization. This “technology push” is now strongly complemented by a “market pull” following last year’s “Zero Routine Flaring by 2030” global initiative and commitments made at COP-21 in Paris. The World Bank, GGFR and Bjorn Hamso are routinely cited by new and established players as pointing the way to gas flare reduction as a “low hanging fruit” in meeting the goals of combating climate change. Many hold the strong belief that mini-GTL technologies will be one important tool in accomplishing this goal.

The oil and gas industry is beginning to stabilize with oil prices around \$50/bbl. This more encouraging pricing scenario had a positive impact on 2 delayed commercial mini-GTL projects:

1. The 1100bpd **SGC Energia** plant in Louisiana, previously being developed by Juniper GTL, will be completed next year under new ownership (York Capital).
2. The 2500bpd **CompactGTL** in Kazakhstan (using 25MMscfd flared gas!) is moving through final engineering towards a FID with additional projects under evaluation.

PRIMUS GREEN ENERGY ANNOUNCES FIRST COMMERCIAL PLANTS

Primus Green Energy has announced a number of commercial plants in the US, each one of them consuming about 5MMscfd of gas. Congratulations to them! The 1st plant was announced on March 23, 2016 and will monetize gas in the Marcellus region. Their STG+ technology can deliver multiple products ranging from methanol to DME and gasoline. Methanol is the product of choice in the 1st few plants in North America because of the favorable economics of locally produced methanol. Primus Green Energy has signed a product off-take agreement with Tauber Oil Company. The plant is scheduled to come online in 4Q 2017

Primus has announced the FID of a 2nd plant in Alberta in the Montney/Duvernay region with an undisclosed partner. The plant will be fed by 5MMscfd shale gas. The plant uses the same standardized, modularized design of a 160t/d methanol plant. We want to emphasize again the feedstock flexibility of all GTL plants which can accommodate dry and wet associated gas, stranded ethane, raw flare gas, land-fill and waste/bio gas, etc.

Primus is pursuing a number of additional plants in North America, all fed with shale gas and ranging from 160t/d to 640t/d corresponding to a 5 to 20MMscfd of gas feed rate . We have also learned that Primus is actively developing projects across the Middle East and Central Asia, many of them targeting flared gas! Below is our growing list of commercial small scale GTL projects.

STATUS OF COMMERCIAL MINI-GTL PLANTS

Commercial mini-GTL plants 7/2016						
Name	Location	Technology	Capacity	Gas Feed Stock	Capex	Remarks
ENVIA Energy	Oklahoma	Velocys	300bpd?	Landfill gas	NA	3Q 2016 start-up
GREYROCK 1	USA	DFP--GreyCat	1000bpd?	Shale gas, ~10MMscfd	NA	2016 start-up
JUNIPER GTL	Louisiana	SGC Energia XTLH	1100bpd	Shale gas, 11MMscfd	\$100MM	Delayed start-up to 2Q 2017
COMPACTGTL	Kazakhstan	CompactGTL	2500bpd	Flare gas, 25MMscfd	\$275MM	Delayed FID
PRIMUS 1	Marcellus	STG+	160t/d methanol	Shale gas, 5MMscfd	~/< \$50MM?	4Q 2017 start-up
PRIMUS 2	Alberta	STG+	160t/d methanol	Shale gas, 5MMscfd	~/< \$50MM?	1Q 2018 start-up

This table only shows commercial projects where a customer has made a financial investment decision (FID). Therefore, demonstration plants such as the INFRA 100bpd plant in Texas or the GasTechno plant in Michigan are not included despite being exciting, final steps towards commercialization.

Before the end of the year, 2 of the above commercial plants will come on-line, with 4 more following in the next 12 months or so. These early plants are still quite large, with total installed costs from around \$30MM up to about \$300MM and project timelines from FID to plant start-up of approximately 2 years. As discussed next, new much smaller plants designed for typical small flares are being developed that can be delivered in less than a year with costs below \$5MM. This technology development will see a great acceleration of mini-GTL plants in the field.

THE EMERGENCE OF “MICRO-GTL” FOR FLARE REDUCTION

In the past few years there were only 2 technology providers targeting gas flares below 500,000scfd, namely GasTechno (now Gastechno Energy and Fuels, GEF) and Proton Ventures. In the 1st Bulletin, issued in March of this year, we reported the development of the M-class (Micro-class) flare gas units by Greyrock and introduced 2 new companies that had set their eyes on such small plants, Colver Technologies (China) and ME Resource Corporation (MEC, Canada). In addition, at the recent

EFI/GGFR symposium (see below), the Oregon based company “**Element 1**” conveyed interest in building unattended micro-GTL “machines” for gas flares having just developed a gas-to-wire system for flare reduction applications.

The common features of all these micro-units are as follows:

- Unattended “machines” rather than plants with operators
- Robust, simple, inexpensive units
- Gas/product volumes of hundreds of thousands of cubic feet per day and tens of barrels of products per day
- Easily moveable from one flare to another
- Low capex investment or 3rd party service option (3rd party owns and operates the micro-GTL units under some negotiated terms)

The current players in this field and their statuses are:

- **Greyrock Flare-to-Fuels M-class**: ready for commercial applications
- **GEF “GTL in a Box”**: final in-field demonstration in Michigan oil field (see picture of “Methanol in a Box”)
- **Colver**: in-field demonstration facility in Central Asia (unconfirmed)
- **MEC**: 1st plant in Q2 2017
- **Element 1**: technology licensing and engineering



We will keep a very close eye on the developments in this area!

GREYROCK/PERSEUS JV: TARGETING FLARE GAS IN MEXICO

On May 31, 2016, **Greyrock** announced a Joint Venture with Perseus, an independent Mexican oil and gas producer, with the goal to apply Greyrock’s Flare-to-Fuels M-class units to gas flares in Mexico.

INFRA DEMONSTRATION PLANT START-UP DELAYED

The impressive 100bpd **INFRA** demonstration plant in Wharton, Texas is progressing but the start-up has been postponed from 2Q 2016 to later this year. The plant is delivered to the site in 14 compact skids including gas cleaning, sulfur removal, steam methane reforming, syngas conditioning, Fischer Tropsch synthesis and product removal along with auxiliary equipment and utilities. The size of this plant is suitable for future commercial application using a 1MMscfd gas flare. Commercial ventures are being pursued.

GASTECHNO (GEF): FINAL DEMO/COMMERCIAL UNIT

After a long delay, **GasTechno or GEF** has completed the construction of their 1st commercial sized “Methanol in a Box” unit. A picture of the 40 foot container has been shown above. Impressive. The unit has been moved to a site in Michigan for a final technical demonstration. If successful, the plant will be moved to a gas flare in North Dakota. GEF expects to build 10 such units for gas flares in North America over the next 12 months!! They will offer 2 business models: first, a BOO (build, own, operate) model where they also buy the flared gas and sell the products and second, a joint venture/leasing arrangement with the gas flaring company.

EFI/GGFR CONFERENCE

The most comprehensive conference on mini-GTL for gas flare reduction was held by EFI/GGFR in Denver in May of this year. Mini-GTL presentations were given by: GGFR (GGFR Overview and Mini-GTL Overview), EFT/Black&Veatch, Greyrock, Velocys, Primus, INFRA, MEC and Element 1. We can provide copies of all presentations. Please contact Martyn Howells or Theo Fleisch.

We plan annual workshops to bring customers and technology providers together, and will announce the location and timing of the 2017 workshop in a forthcoming bulletin.

SUMMARY

We encourage the members of the GGFR to stay abreast of the emerging opportunities and contact the leading companies with commercial offers. We are also interested in providing more information and further guide potential customers to the most appropriate mini-GTL solution.

This report was prepared for the World Bank-Global Gas Flaring Reduction Partnership by Dr. Theo H Fleisch. The opinions and conclusions expressed in this report are those of Dr. Fleisch and do not represent recommendations or endorsements by the Global Gas Flaring Reduction Partnership or the World Bank

For more information, please feel free to contact:

Martyn Howells: hhowells@worldbank.org

Theo Fleisch: theo.fleisch@gmail.com