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## Gas Technologies LLC Product Data Sheet

# GasTechno<sup>®</sup> Mini-GTL<sup>™</sup> and Small Scale GTL Plant

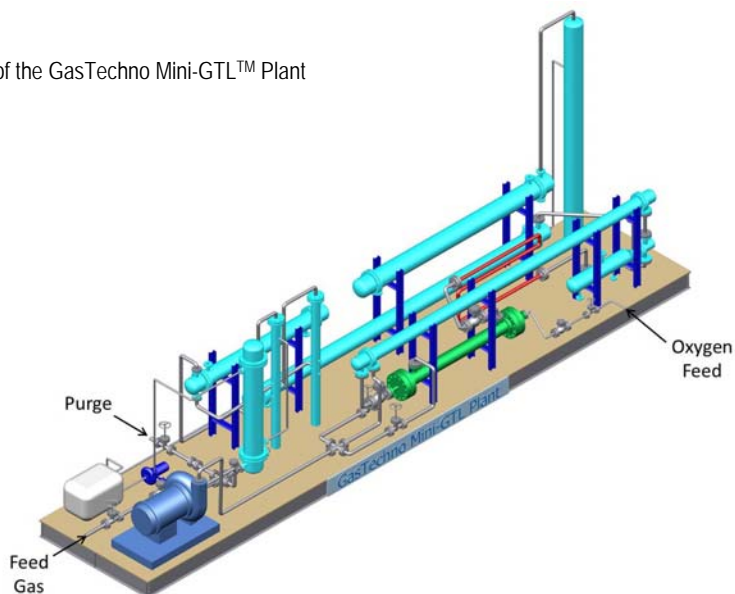
## Monetizing Natural Gas with Methanol

Designed for the small scale conversion of natural gas, biogas, landfill gas, coal bed methane, etc. into valuable liquid products such as methanol and ethanol, the GasTechno Mini GTL<sup>™</sup> plant provides a simple and low-cost solution with no known competitors.

The Mini GTL<sup>™</sup> plant operates at a nominal capacity of 200,000 scfd but can accept variations ranging from 125,000 to 300,000 scfd. This scale of operation is unmatched in conventional GTL or methanol processes, where traditional technologies require minimum capacities of 50 mmscfd to be economic, and new micro-channel reactor technology requires scales exceeding 6 mmscfd to be economically viable.

For larger applications, the GasTechno Small Scale GTL plant with a 5 mmscfd capacity, allows for unprecedented economic returns at a scale yet to be matched by the competition. The GasTechno platform is flexible, extensible and easily customized to integrate with existing natural gas systems.

Figure 1. Layout of the GasTechno Mini-GTL<sup>™</sup> Plant



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Unique Design and Engineering services for Patent  
Licensing Technologies Involving Natural Gas Processes  
& Chemical Processing Plants

■ ENERGY ■ EFFICIENT ■ RECYCLE ■

DS-01282012

*“Based on MMSA estimates using conventional methanol production technology versus GasTechno design claims, employing the GasTechno technology would place the user among the most competitive suppliers of methanol to Asia, on firm competitive basis.”*

Methanol Market Services Asia (MMSA)



## Process Overview

The GasTechno® process converts natural gas into methanol in a single, simple step. The patented process uses a proven, field demonstrated partial oxidation reactor system that is effective on high and low BTU gas. The carbon efficiencies exceed traditional Fischer-Tropsch technology without expensive pre-treatment, catalysts or complicated processing steps.

The introductory Mini-GTL™ plant further simplifies the GasTechno process by producing a raw blend of liquid alcohols. The alcohol blend is then refined at a central processing facility that services several local or regional Mini-GTL plants. The Mini-GTL™ plant is an industrial-strength field processing unit that operates automatically, requires only minimal direct observation, and can be operated and monitored remotely.

## Process Comparison

Processing Stage	GasTechno	Conventional and Microchannel GTL	Capital Cost
Feed gas compression	X	X	Medium
Gas pretreatment	Not required	X	High
Gas reforming	Not required	X	High
Partial oxidation reaction	X	Not required	Low
Process steam generation	Not required	X	Medium
Syngas compression	Not required	X	Medium
Fisher Tropsch synthesis	Not required	X	Medium
Waste heat recovery	X	X	Medium
Liquid separation	X	X	Low
CO <sub>2</sub> scrubbing	X	Not required	Low
Cooling water system	X	X	Medium
Gas recycling	X	X	Low
Product separation (distillation)	X	X	Medium

## Product Specifications

Gas Technologies provides complete engineering and design services to size and configure GasTechno plants and peripherals to meet the needs of your application.

Mini-GTL Plant (200 mscfd)	Small Scale GTL Plant (5 mmscfd)
<b>Variable flow rates and gas compositions</b>	
Minimum: 125 mscfd – Maximum: 300 mscfd	Minimum: 3.2 mmscfd – Maximum: 7.5 mmscfd
Nitrogen/CO <sub>2</sub> concentrations up to 25%	Nitrogen/CO <sub>2</sub> concentrations up to 25%
<b>Production</b>	
Methanol: 420,000 gal/year (10,000 bbls/year)	Methanol: 10,100,000 gal/year (240,000 bbls/year)
Ethanol: 63,000 gal/year (1,500 bbls/year)	Ethanol: 1,300,000 gal/year (31,000 bbls/year)
Formalin: 181,000 gal/year (4,300 bbls/year)	Formalin: 4,600,000 gal/year (110,000 bbls/year)
Total: 664,000 gal/year (15,800 bbls/year)	Total: 16,000,000 gal/year (381,000 bbls/year)
<b>Footprint</b>	
90 ft x 70 ft	Less than 5 acres

*"this one step technology of converting natural gas to methanol, when verified for commercial readiness, will alter the technology view which currently exists in the major chemical and petroleum industry..."*

Dr. Krishna K. Rao, Former Head of New Business Venture Technology (Process Division) & Technology Asset Manager, ExxonMobil Chemical"

## Next Steps For Early Adopters

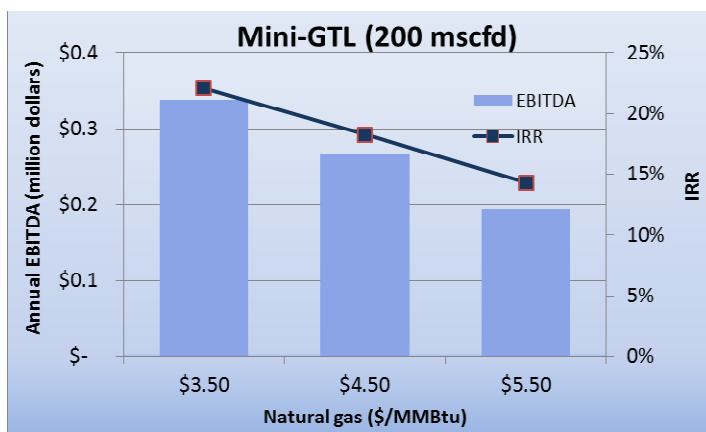
On 31 December 2011, Gas Technologies announced three services offerings for oil and gas companies interested in evaluating the GasTechno platform

Contact Gas Technologies for more information on participating in the Early Adopter Program.

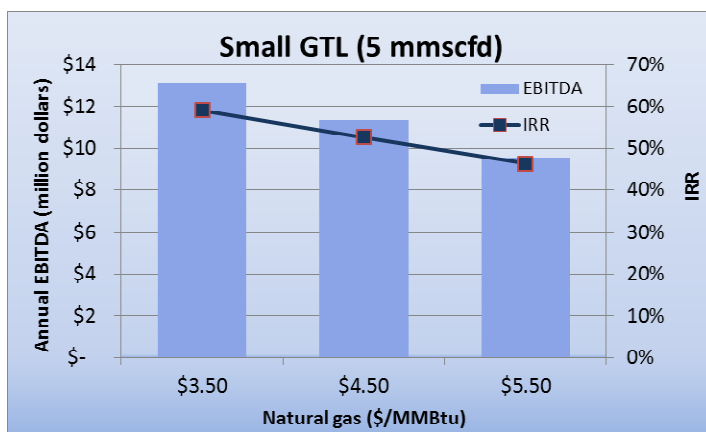
## Commercialization Economics

A complete GasTechno GTL plant can be scaled down to 1 mmscfd; the GasTechno Mini-GTL™ plant can be scaled down even further, to 200 mscfd in which case final processing of the raw liquid product is performed at a central processing facility.

Although the economic factors are positive at this mini-scale, the presence of a central processing facility is necessary for final separation of the GTL product blend. Scaling up to the 5 mmscfd GTL plant significantly improves economic indices, as the following figures indicate.



(CAPEX = \$2 million, oxygen generated on-site, pipeline gas spec)



(CAPEX = \$26 million, oxygen generated on-site, pipeline gas spec)

"...it is crucial to increase awareness of the need for economic structures that are more respectful of the environment and of future generations ... for me 'green economy' does not mean 'new conditionality' but rather 'opportunity'..."

Joseph Deiss, President  
UN General Assembly"



## 31-Month NYMEX (Henry Hub) Natural Gas Price per MSCF versus GasTechno® Product Pricing

### Table References

<sup>1</sup>Energy Information Administration. [Natural Gas Futures](#)

[Contract 1 \(Dollars per Million BTU\).](#)

(<http://tonto.eia.gov/dnav/ng/hist/mgc1m.htm>. Source key: RNGC. Release Date: 1/25/2012.

<sup>2</sup>Methanex Corporation. [Monthly Average Regional Posted](#)

[Contract Price History](#). Methanex non-discounted

reference price (MNDRP).

(<http://www.methanex.com/products/documents/MxAv>

[gPrice\\_Dec292011.pdf](#))

<sup>3</sup>Formalin Reference price = (0.8) Methanol price

<sup>4</sup>Ethanol Reference price = (1.5) Methanol price

Month	<sup>1</sup> Nat Gas Henry Hub	<sup>2</sup> Methanex Reference Price (USD/G)	Methanol Constituent (USD per Converted MCF) Conversion Factor 6.2Gal Per MCF.	<sup>3</sup> Formalin Reference Price (USD/G)	Formalin Constituent (USD per Converted MCF) Conversion Factor 5.1 Gal Per MCF.	<sup>4</sup> Ethanol Reference Price (USD/G)	Ethanol Constituent (\$/Converted MCF) Conversion Factor 0.4 Gal Per MCF.	Blended Value (USD per Converted MCF)	Value Over Pipeline Price
Jun-2009	\$3.94	\$0.60	\$3.72	\$0.48	\$2.45	\$0.90	\$0.36	\$6.53	\$2.59
Jul-2009	\$3.55	\$0.68	\$4.22	\$0.544	\$2.77	\$1.02	\$0.41	\$7.40	\$3.85
Aug-2009	\$3.31	\$0.72	\$4.46	\$0.58	\$2.94	\$1.08	\$0.43	\$7.83	\$4.52
Sep-2009	\$3.46	\$0.84	\$5.21	\$0.67	\$3.43	\$1.26	\$0.50	\$9.14	\$5.68
Oct-2009	\$4.78	\$0.95	\$5.89	\$0.76	\$3.88	\$1.43	\$0.57	\$10.34	\$5.56
Nov-2009	\$4.63	\$1.00	\$6.20	\$0.80	\$4.08	\$1.50	\$0.60	\$10.88	\$6.25
Dec-2009	\$5.34	\$1.10	\$6.82	\$0.88	\$4.49	\$1.65	\$0.66	\$11.97	\$6.63
Jan-2010	\$5.60	\$1.10	\$6.82	\$0.88	\$4.49	\$1.65	\$0.66	\$11.97	\$6.37
Feb-2010	\$5.22	\$1.10	\$6.82	\$0.88	\$4.49	\$1.65	\$0.66	\$11.97	\$6.75
Mar-2010	\$4.30	\$1.10	\$6.82	\$0.88	\$4.49	\$1.65	\$0.66	\$11.97	\$7.67
Apr-2010	\$4.09	\$1.10	\$6.82	\$0.88	\$4.49	\$1.65	\$0.66	\$11.97	\$7.88
May-2010	\$4.16	\$1.00	\$6.20	\$0.80	\$4.08	\$1.50	\$0.60	\$10.88	\$6.72
Jun-2010	\$4.79	\$1.05	\$6.51	\$0.84	\$4.28	\$1.58	\$0.63	\$11.42	\$6.63
Jul-2010	\$4.59	\$1.05	\$6.51	\$0.84	\$4.28	\$1.58	\$0.63	\$11.42	\$6.83
Aug-2010	\$4.22	\$1.05	\$6.51	\$0.84	\$4.28	\$1.58	\$0.63	\$11.42	\$7.20
Sep-2010	\$3.90	\$1.08	\$6.70	\$0.86	\$4.41	\$1.62	\$0.65	\$11.75	\$7.85
Oct-10	\$3.60	\$1.08	\$6.70	\$0.86	\$4.41	\$1.62	\$0.65	\$11.75	\$8.15
Nov-10	\$4.04	\$1.33	\$8.25	\$1.06	\$5.43	\$2.00	\$0.80	\$14.47	\$10.43
Dec-10	\$4.28	\$1.38	\$8.56	\$1.10	\$5.63	\$2.07	\$0.83	\$15.01	\$10.73
Jan-11	\$4.50	\$1.35	\$8.37	\$1.08	\$5.51	\$2.03	\$0.81	\$14.69	\$10.19
Feb-11	\$4.04	\$1.28	\$7.94	\$1.02	\$5.22	\$1.92	\$0.77	\$13.93	\$9.89
Mar-11	\$4.07	\$1.28	\$7.94	\$1.02	\$5.22	\$1.92	\$0.77	\$13.93	\$9.86
Apr-11	\$4.27	\$1.28	\$7.94	\$1.02	\$5.22	\$1.92	\$0.77	\$13.93	\$9.66
May-11	\$4.34	\$1.28	\$7.94	\$1.02	\$5.22	\$1.92	\$0.77	\$13.93	\$9.59
Jun-11	\$4.52	\$1.28	\$7.94	\$1.02	\$5.22	\$1.92	\$0.77	\$13.93	\$9.41
Jul-11	\$4.35	\$1.28	\$7.94	\$1.02	\$5.22	\$1.92	\$0.77	\$13.93	\$9.58
Aug-11	\$3.98	\$1.38	\$8.56	\$1.10	\$5.63	\$2.07	\$0.83	\$15.01	\$11.03
Sep-11	\$3.85	\$1.38	\$8.56	\$1.10	\$5.63	\$2.07	\$0.83	\$15.01	\$11.16
Oct-11	\$3.62	\$1.38	\$8.56	\$1.10	\$5.63	\$2.07	\$0.83	\$15.01	\$11.39
Nov-11	\$3.56	\$1.38	\$8.56	\$1.10	\$5.63	\$2.07	\$0.83	\$15.01	\$11.45
Dec-11	\$3.25	\$1.38	\$8.56	\$1.10	\$5.63	\$2.07	\$0.83	\$15.01	\$11.76
AVE:	\$4.20	\$1.14	\$7.05	\$0.91	\$4.64	\$1.71	\$0.68	\$12.37	\$8.17

