ABCs of GTL

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4th World Shale Oil & Gas Summit

Houston, November 5, 2013
(Selected Slides)

GTL in the News

Can Qatar's Success with Gas-to-Liquids Fuels Be Repeated in the U.S.?

South African Company to Build U.S. Plant to Convert Gas to Liquid Fuels

By CLIFFORD KRAUSS
Published: December 3, 2012

September 18, 2013

Early plans moving ahead for Canada's first gas to liquids plant

RICHARD GILBERT
staff writer

Shell considers gas-to-liquids plant

Story Comments Share Print Font Size:

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Posted: Saturday, October 12, 2013 4:00 am

By Zain Shauk Houston Chronicle

SUBSCRIBER CONTENT: Sep 14, 2012, 6:00am EDT

Gas-to-liquids plants may help relieve Marcellus gas glut

ENERGY | 1/17/2013 @ 8:01AM | 14,509 views

Gas-to-Liquids Plants: No Longer Exclusive to Larger Players

Calumet selects Oxford Catalysts' technology for GTL plant in US

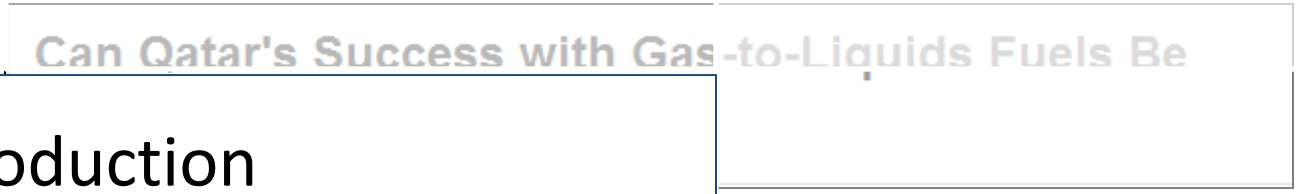
EBR Staff Writer

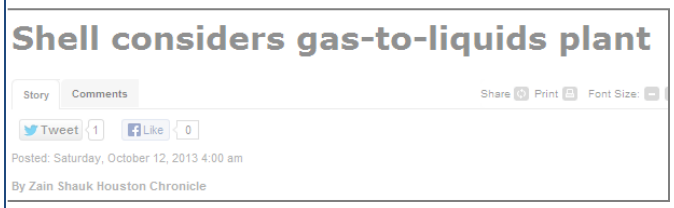
Published 10 September 2012

ABCs of GTL

Outline

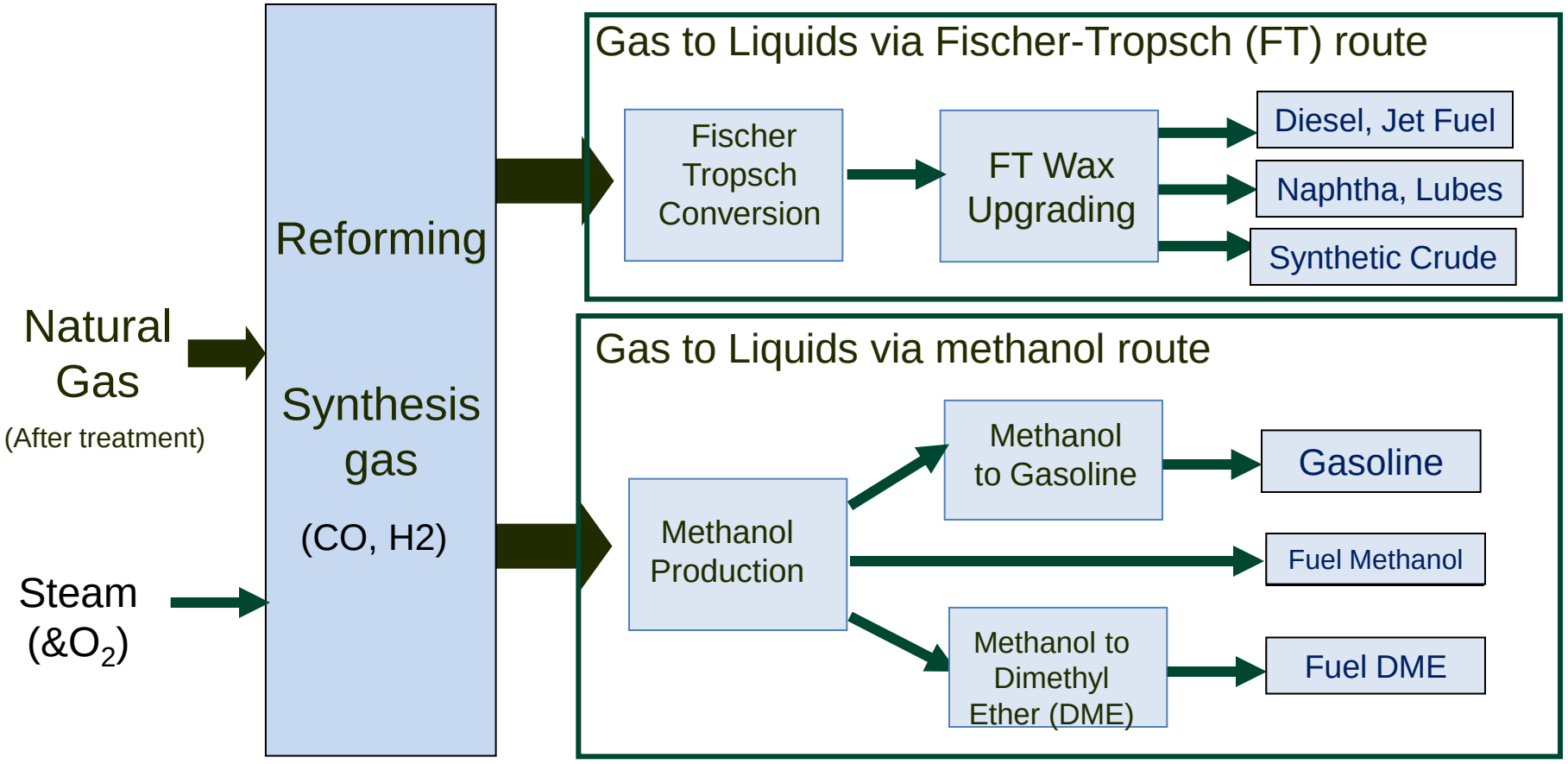
- Introduction
- Overview of GTL Industry
- Economics
- Benefits and Challenges
- Concluding remarks





Q&A via #sillsGTL13 or www.XTLinstitute.com

What is GTL



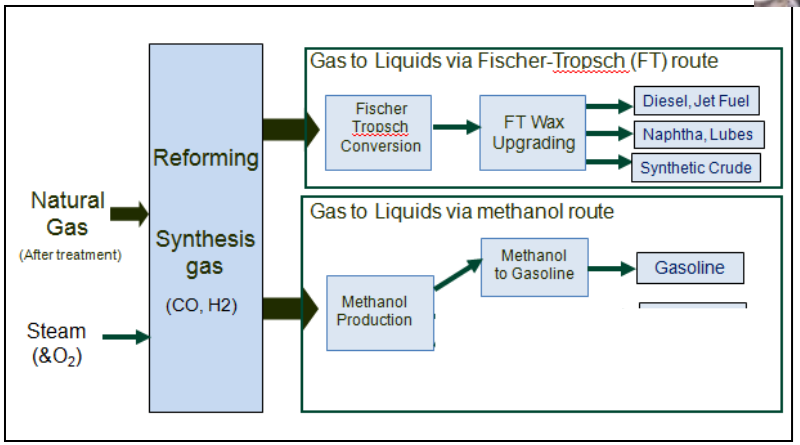
Memo: Fuel Methanol and Fuel DME routes are not included in the rest of this presentation

GTL-FT/MTG History

Shell Malaysia GTL-FT
14,700 B/D, 1993

Sasol Oryx GTL-FT, Qatar 32,000 B/D, 2007

Shell Pearl GTL-FT, Qatar
140,000 B/D, 2012



PetroSA GTL , South Africa
22,000 B/D capacity
(Sasol FT technology), 1992

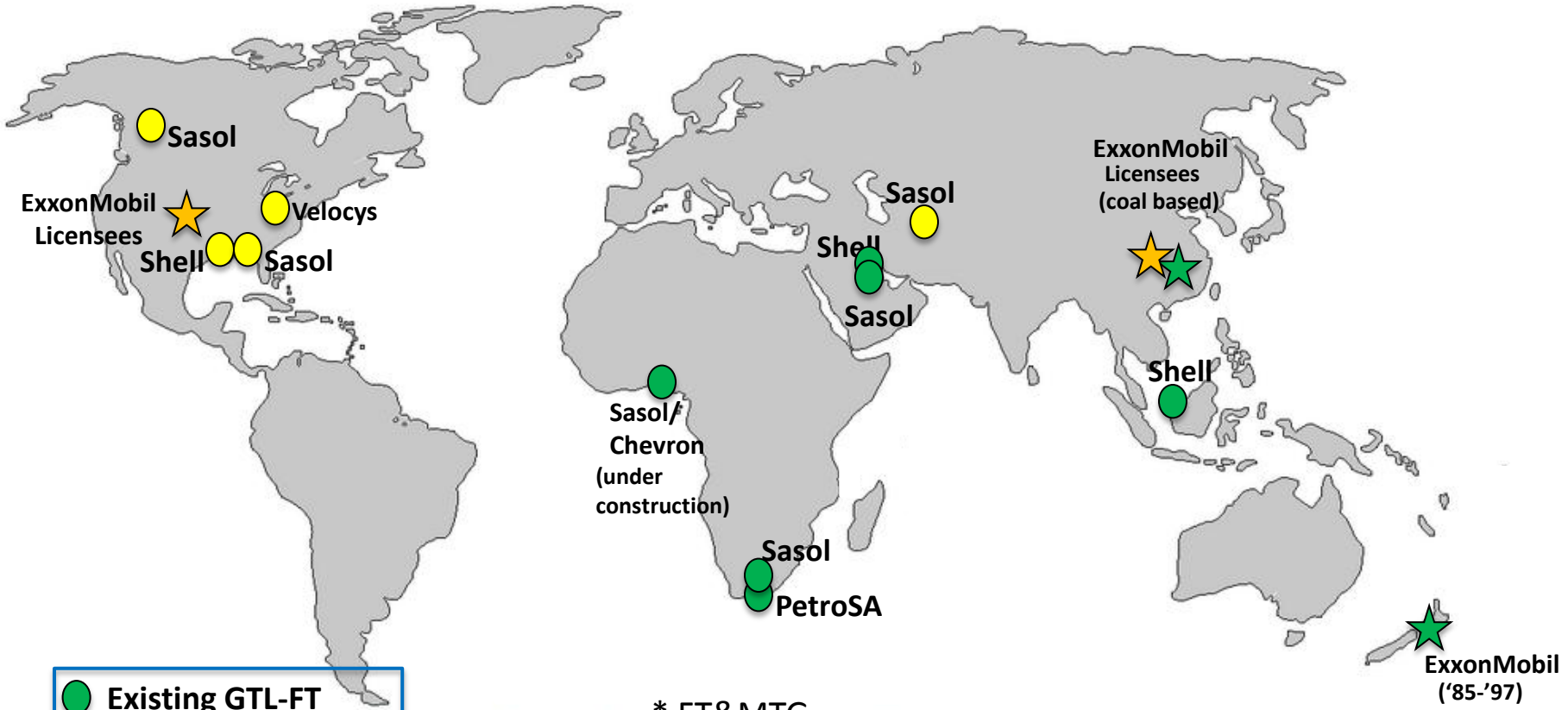
Chevron/Sasol Escravos
GTL-FT
Nigeria, 32,000 B/D
Late 2013 est. start-up,

ExxonMobil New Zealand GTL-MTG,
14,500 B/D, 1985-1997

Currently operating as
Methanex GTL-Methanol

Current global GTL* production is 200,000 b/d with significant proposals in North America

Existing and Proposed** GTL via FT and MTG



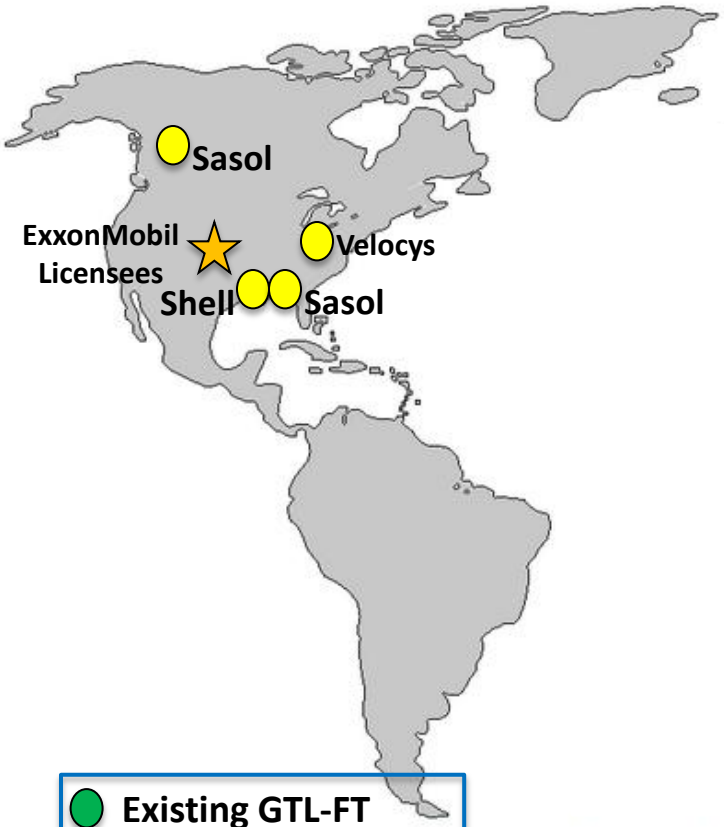
* FT&MTG

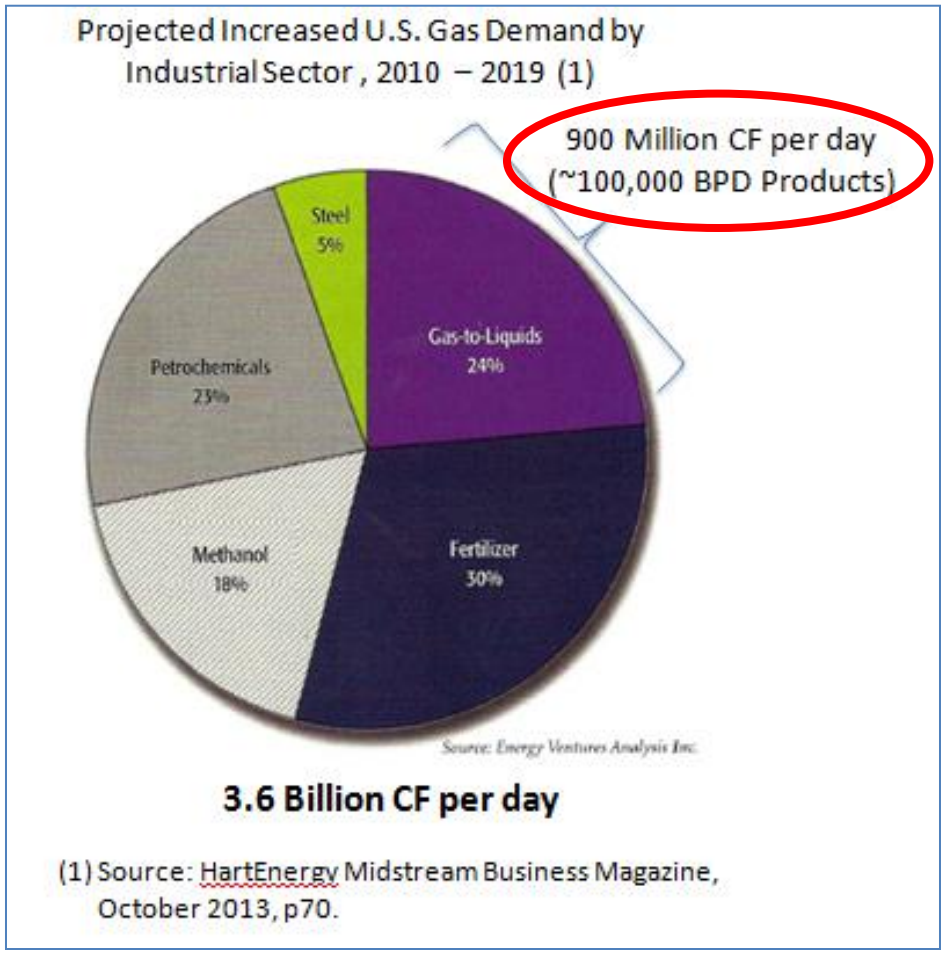
** Partial list

{CompactGTL progressing FT projects worldwide}

Current global GTL* production is 200,000 b/d with significant proposals in North America

Existing and Proposed** GTL via FT and MTG



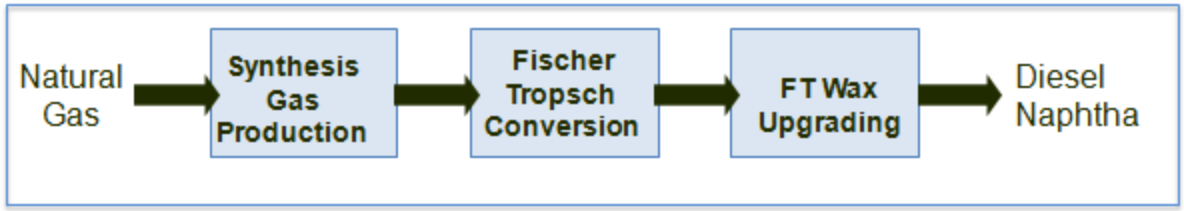


* FT&MTG

** Partial list(CompactGTL progressing FT projects in North America}

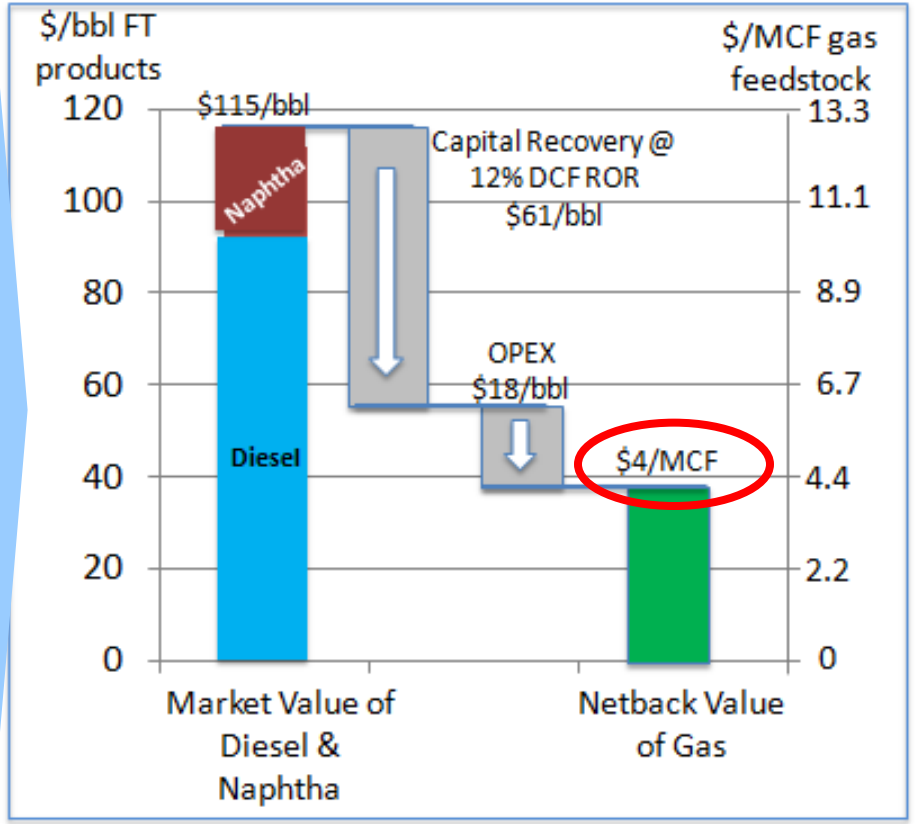
Economics

The netback value of natural gas to GTL-FT plant is $4/MCF



Bases

- FT products-75v% diesel, 25v% naphtha
- WTI $100/bbl; diesel $120/bbl, naphtha $100/bbl
- CAPEX - $100,000/bbl per day for Gulf Coast location
- Capital Recovery @ 20% CAPEX per year, 100% equity, 20 yr project life, 12% DCF ROR after taxes
- Operating Costs @ 6% CAPEX per year
- Gas feed rate – 9 MCF/bbl FT products



Memo: Illustrative economics

Large-Scale GTL Drivers, Benefits and Challenges

Key Drivers

- Monetize stranded gas
- Produce high-value, high-quality fuel and chemical products from low-value gas
- Shale gas in North America: Ample gas supply, high oil to gas price ratio, high oil prices

Benefits

- Commercially proven: Relatively low technical and project risks
- Produce valuable, fungible, transportable liquid fuels, chemicals and high-quality lubricants for global markets
- Economies of scale
- "Qatar Oryx GTL – Highly profitable venture with high returns to shareholders", Sasol quote.

Challenges

- Competition: Significant stakeholder advocacy for other gas monetization options
- High investment (CAPEX)
- Larger carbon footprint than other gas monetization options
- Future feedstock cost uncertainty: Need stable and long-term gas contracts

Large-scale = 30,000 – 140,000 B/D
(~300 – 1,400 MMSCF/D)

Small-scale GTL Benefits and Challenges

Benefits

- Several technologies ready for commercialization, one commercially proven
- An option to monetize economically stranded gas by producing valuable, fungible, liquid fuels
- Upstream: reduce gas flaring
- Downstream: refinery integration
- Modular design = shorter construction time
- Easier to permit
- Off-shore and on-shore applications

Challenges

- No economies of scale: Need low-cost, mass-produced, modular process units
- For very remote locations: delivery of bulky equipment and additional costs for utilities
- To improve fit with upstream developments:
  - ➢ Sell a commodity product as close to wellhead as possible
  - ➢ Lower CAPEX per barrel product
  - ➢ Minimal operational issues
  - ➢ Generic, flexible capacity

Small-scale = 1,000 – 10,000 B/D
(~10 – 100 MMSCF/D)

Concluding remarks

Today, the GTL, via FT and MTG, story is the Tales of Two Scales– Large and Small:

- The Large-Scale GTL story is based on the historical development of GTL to monetize large natural gas resources in locations such as Qatar, Malaysia, South Africa and New Zealand.
  - This story is continuing in North America with the announced plans by Sasol and Shell. As these companies have perfected their GTL technologies, plant capacities have increased being driven by economies of scale.

- The Small-Scale GTL story has gained prominence more recently and is driven by the need to monetizing economically stranded shale gas resources and associated gas from shale oil resources in North America, as well as to reduce gas flaring in the world.

GTL is a viable option for monetizing natural gas

Q&A via #sillsGTL13 or www.XTLinstitute.com

Acknowledgements and Disclaimer

Acknowledgments

The lecturer gratefully acknowledges the significant information provided by others used in this presentation.

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