Issues Affecting XTL Projects

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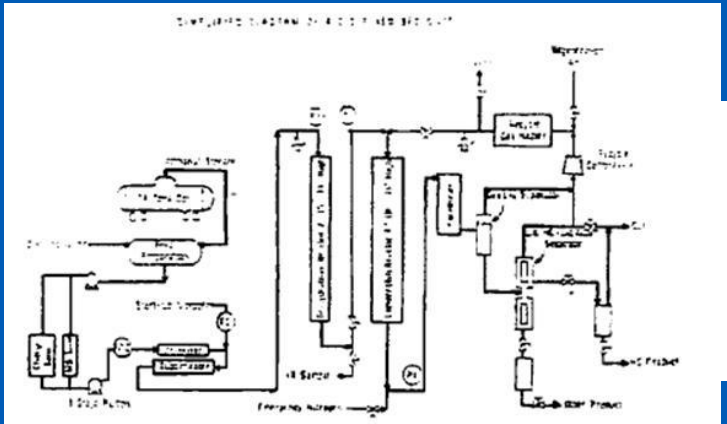
Zeus Development Corp.

North American Gas Seminar

Houston, March 6, 2012

A Story: My GTL experience….

In 1979, I joined the team at Mobil developing the Methanol-to-Gasoline technology.



Demonstration Unit

The fixed-bed MTG process has recently been scaled-up to a 4 B/D pilot plant to demonstrate the performance at commercial operating conditions (Fig. 7). The catalyst

Section 15

STATUS OF THE MOBIL METHANOL-TO-GASOLINE PROCESS

by

A. Y. Kam
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J. C. Zahner
Mobil Research and Development Corporation

Source: Mobil presentation at SRI Conference in 1981

A Story: My GTL experience…. (cont'd)

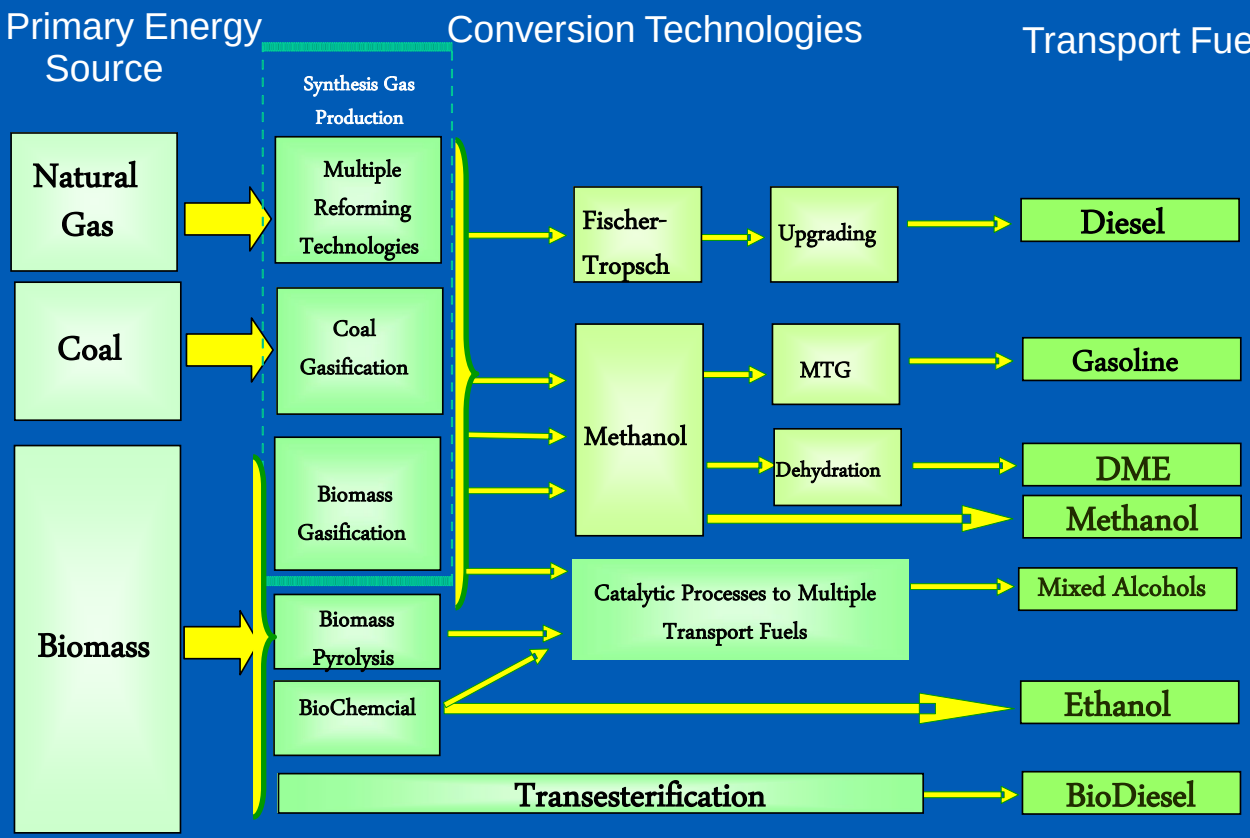
The MTG process was commercialized in New Zealand

New Zealand Gas to Gasoline Plant: 1985 Start-up

Outline

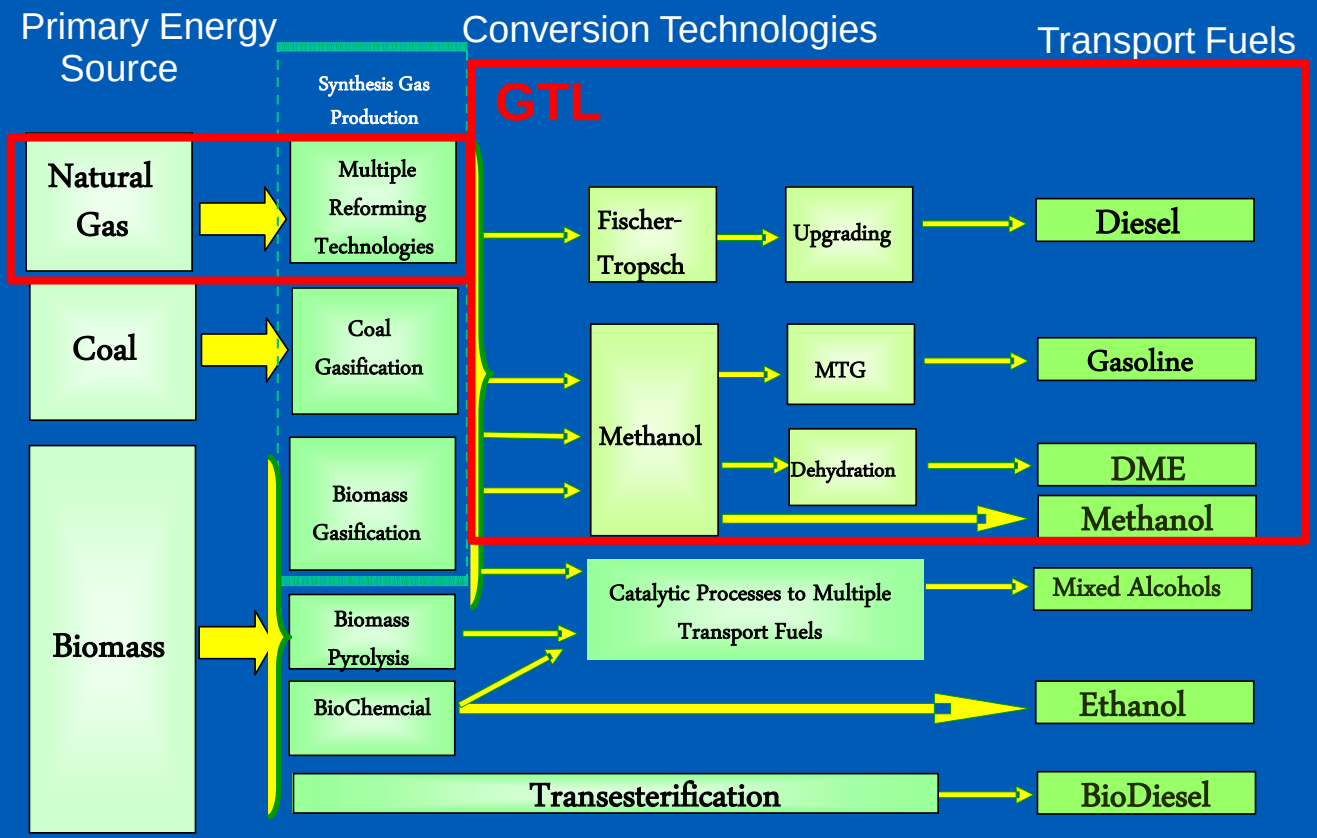
- My Story
- What is XTL
- Key Issues for XTL Projects: Scorecard for Success
  - New Zealand Gas-to-Gasoline: MTG (ExxonMobil)
  - Qatar GTL Projects: Oryx (Sasol) and Pearl (Shell)
  - Generic GTL Project X in North America
- Prospects for DME in North America
- Key Message
- Q&A

What is XTL*



•Other transport fuels include oxygenate additives (e.g. MTBE), CNG, electricity and hydrogen; direct coal liquefaction is another coal conversion route ; F-T route can also produce gasoline; oil shale is another alternative energy source

What is XTL*



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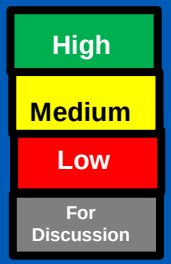
Scorecard for XTL Projects*

New Zealand Gas to Gasoline Plant - 1985

Issues \ Project	New Zealand Gas to Gasoline Plant (ExxonMobil)
Feedstock Cost and Availability	
Conversion Technology	
Market for XTL Product(s)	
Government Policy, Regulations, and Environmental	
Commitment of Project Owner/Technology Provider(s)	
Comparison vs other gas monetization options	
Economics/ Financing	

Degree of Support for Project Success*



* Success defined in terms of project execution from concept to start-up and at least 1st year operation

Scorecard for XTL Projects

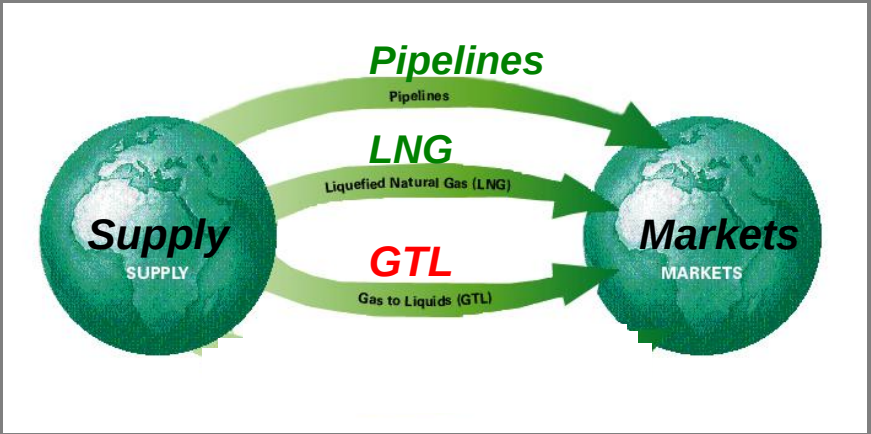
Qatar Oryx and Pearl GTL Plants - 2007 to present

Project / Issues	New Zealand Gas to Gasoline Plant (ExxonMobil)	Qatar Oryx GTL Project (Sasol)	Qatar Pearl GTL Project* (Shell)
Feedstock Cost and Availability			
Conversion Technology			
Market for XTL Product(s)			
Government Policy, Regulations, and Environmental			
Commitment of Project Owner/Technology Provider(s)			
Comparison vs other gas monetization options			
Economics/ Financing			

* In process of increasing production to design capacity

Traditional Roles for GTL

1. Moving Gas to Markets



2. Grow Existing Markets and Creation of New Markets

- ***Power Generation***
- ***Transportation***
- ***Chemicals***
- ***Fuel Additives***
- ***Syn-LPG***

3. Gas Access

GTL, creating new markets for gas, can give access to stranded gas resources

Source: BP presentations in early 2000s

Roles for GTL in North America

1. Moving Gas to Markets

Options:
- Pipelines
- LNG (export)
- **GTL**

2. Grow Existing Markets and Creation of New Markets

- ***Transportation Fuels***
- ***Chemicals***
- ***Fuel Additives***

3. Other

- Eliminate flaring

Scorecard for XTL Projects

Generic GTL Project in North America - present

Project / Issues	New Zealand Gas to Gasoline Plant (ExxonMobil)	Qatar Oryx GTL Project (Sasol)	Qatar Pearl GTL Project (Shell)	Generic GTL Project X in North America
Feedstock Cost and Availability				
Conversion Technology				
Market for XTL Product(s)				
Government Policy, Regulations, and Environmental				
Commitment of Project Owner/Technology Provider(s)				
Comparison vs other gas monetization options				
Economics/ Financing				

Degree of Support for Project Success

- High
- Medium
- Low
- For Discussion

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What are the prospects for DME in North America

- Of the 3 key global markets for DME, the most likely in N.A. is as a diesel alternative
- Transportation fuel alternative market is challenging with significant competition
- Government support is currently a work in progress.
- Vehicles for DME (neat) demonstration are not available in N.A. today.
- In the future, demo vehicles can come from abroad; for example, Volvo HD trucks.
- Early-stage efforts in North America are:
    - Oberon Fuels (USA)
    - GV Energy (Canada)
    - International DME Association's North American Affairs Committee

About the BioDME project in Sweden

BioDME consortium

CHEMREC

DELPHI

ETC

HALDOR TOPSOE
CATALYSING YOUR BUSINESS

preem

TOTAL

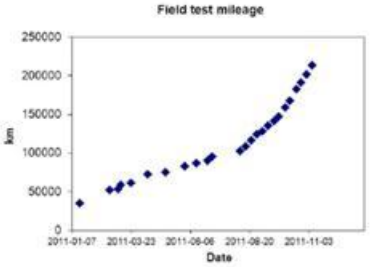
VOLVO

- **Chemrec** and **Haldor Topsøe** develop and build the DME plant in Piteå
- **Volvo Trucks** develops and builds DME trucks and a fuel injection system together with **Delphi**
- **ETC**, the Energy Technology Centre in Piteå, contributes its technical expertise
- **Preem** is responsible for Bio-DME distribution and builds fuel stations in Sweden
- **Total** is responsible for fuel and lubricant specifications
- The project is financed by the participants, the EU and the Swedish Energy Agency

Swedish Energy Agency

Field test status 2011-11-07

- Trucks at customer: 9
- Mileage last week: 11 643 km
- Average last 5 weeks 10 778 km
- Accumulated mileage: 213 069 km



BIODME

Source: Volvo Presentation, 7th Asian DME Conference, Japan, November 2011

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Key Message

Successful *integrated* GTL projects in North American will likely have high scores for each issue;

- Feedstock availability and cost
- Conversion technology
- Market for products
- Government support including environmental issues
- Commitment of project owner(s) and technology provider(s)
- Comparison vs other alternatives
- Economics and financing

Questions

About the presenter

Dr. Ronald (Ron) Sills is an Alternative Energy Consultant in conversion technologies and analyses of the natural gas/coal/biomass to products value chain. He is Co-Director of the XTL & DME (Dimethyl ether) Institute, an educational service, and is a member of the Technical Advisory Board for CoolPlanet Energy Systems, Inc (www.CoolPlanetBiofuels.com). Ron is President, Ronald A. Sills, LLC.

He is recognized internationally as an alternative energy expert , particularly in the area of hydrocarbon conversion to fuels. Ron is an honorary member of the International DME Association. In 2010, he was the GTL Peer Reviewer for the IEA World Energy Outlook. Before his retirement from BP in 2009, he was Gas Conversion Network Leader and Engineering Manager in the Conversion Technology Centre. Prior to joining BP in the 1990s, he was manager of Mobil's Research Planning Group as well as a member of the team for the development and commercialization of the fixed-bed Methanol-to-Gasoline (MTG) process.

Dr. Sills holds a PhD and M.S. in Chemical Engineering from M.I.T and a B.S .in Chemical Engineering from Columbia University.

About the XTL & DME Institute℠

Newly-created educational service (2010) provided by Dr. Theo Fleisch (Fuel Conversion Solutions, LP) and Dr. Ronald Sills (Ronald A. Sills, LLC) , Co-Directors, on all aspects of the XTL supply chain, including DME as a fuel and chemical feedstock. www.XTLinstitute.com

DME Fundamentals Tutorial at DME4 in Stockholm, September, 2010

XTL Tutorial at Future Fuels for Australia Conference in Brisbane, July, 2011

Next DME Fundamentals Tutorial at DME 5 in Beijing, September 2012
www.aboutDME.org

Acknowledgments and Disclaimer

Acknowledgments

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

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