Small Modular GTL: Commercialisation and Strategic Partnerships

XTL World Forum
7th – 8th June 2011

Iain Baxter
CompactGTL plc
Stranded Oil!
2006: Challenges for CompactGTL

- Strong project economics needed for attractive ROI
- Vision of CompactGTL as a solution provider to Upstream industry
- Partnership model necessary for successful execution
2011: Vision Realised

Delivering an associated gas solution to enable oilfield development

- Petrobras plant commissioned and now running under test
- Client commercial plant studies & pre-FEED’s at 200 bpd tp 2,000 bpd
- Volume manufacturing supply chain established
- Continuously strengthening team with World-scale GTL experience
- CompactGTL Brazil subsidiary established in Rio de Janeiro
Market Opportunity & The Modular GTL Solution
Associated gas particularly problematic at < 50 MMscf/d

E&P TRENDS
More development in deepwater
More development remote from gas markets

Satellite image of gas flaring in Nigeria
250 km

Image courtesy of Chris Elvidge, National Geophysical Data Centre, Boulder, CO, USA
Distinct market for modular GTL

- Modular GTL
- Gas to Wire
- Reinjection
- FLNG
- CNG
- Pipeline

Distance to market for converted product [km]

Associated Gas MMscf/d

© 2011 CompactGTL plc
Modular GTL:
Convert the associated gas into syncrude
Co-mingle and transport with the natural crude

- Incremental NPV of >$100MM possible
- Early production – Standalone unit
- Increased revenue from syncrude
- Savings in gas re-injection wells or pipelines
- Gas can be booked as reserves
- No separate storage, transportation or market access required for syncrude
Commercial plant conceptual design

- 10 MMscfd gas feed
- 1,000 bbl/d syncrude production
- 2,400 T operating weight
- Configurable for:
  - Aframax
  - Suezmax
  - VLCC

SMR modules

FT modules

29 m

48 m
Modular plant design gives scaleability, inherent reliability & operability

- Modules can be removed as production falls
- Modules re-furbished and catalyst replaced onshore
- Modules can go on-line and off-line to accommodate production variability
- Multiple modules provide inherent reliability

The number of active reactor modules can be adjusted to match the associated gas production profile over time.
Basis for enhanced oilfield NPV

Gas Re-Injection or Pipeline to Market

Integrated CompactGTL

- Facilities Capital Cost PV
- Gas Disposal
- Operations & Tax PV
- Penalties or Delay
- Crude Revenue PV

- Facilities Capital Cost PV
- GTL Plant
- Operations & Tax PV
- GTL Opex
- Syncrude PV
Commercialisation Route & Key Milestones Achieved
Commercialisation route

Lab Reactors | UK Pilot Plant | Brazil Plant | Commercial Plant

Commercial Plant Studies

Reactor & Catalyst Supplier Engagement

Prototype Reactor & Catalyst Evaluation

Supplier Selection

Pilot Reactor & Catalyst Manufacture

Commercial Supply Chain Establishment

Requirements

Requirements
Mini-channel CompactGTL reactors

**Catalysts:**
- Removable metallic inserts
- Established automotive mass production techniques

**Reactors:**
- High specific heat transfer
- Established heat exchanger mass production techniques
- High reactor ‘voidage’ using pressed fin plates, minimising metal content, cost & weight

Automated catalyst insertion & removal at point of manufacture
UK Pilot plant operational for > 2.5 years

Installation at Wilton, NE England

Plant commissioned July 2008

- Confirming catalyst & reactor performance from manufacturers
- Integrated operation – ‘gas in to liquids out’
- Operational stability, start-up & shut down procedures
- Variable feed gas composition & CO₂ content
- Operator training for larger plants
Petrobras GTL demonstration plant contract

- Contract confirmed with CompactGTL in July 2008
- Funded by Petrobras
- Capacity of 200,000 scf gas (20 bpd)
- Plant required to demonstrate all aspects needed for commercial application
Plant constructed in Canada & Japan

Plant constructed by Zeton Inc, Burlington, Canada

SMR & FT Reactors fabricated by Sumitomo Precision Products, Osaka, Japan
Complete set of GTL reactors despatched by air-freight to Brazil
World’s first small scale fully integrated GTL facility!

Final commissioning December 2010
Plant running and under test

- Gas pre-treatment
- Pre-reforming
- Reforming
- Waste heat recovery
- Process steam generation
- Syngas compression
- Fischer Tropsch synthesis
- FT cooling water system
- Tail gas recycling

Image shown courtesy of Petrobras
Partnership approach critical to success

- FEED Partners
- Reactor Supplier
- Catalyst Supplier
- Technology Support
- FPSO Expertise

Sumitomo Corporation
Sumitomo Precision Products Co., Ltd.
~ Advanced Heat Management ~

Bayer Technology Services

Slide 19 © 2011 CompactGTL plc
Bayer Technology Services
Technology & Engineering Support Partner
Bayer Technology Services – Technology Solutions for Bayer & External Companies

Develop Products and Processes

Design and Manage Investments

Optimize Facilities and Products

Covering the whole Plant Life Cycle

Bayer Technology Services
... a Bayer Group Company
Turnover worldwide(*) 420 EUR mill.
Employees worldwide(**) 2,600
(*)2010  (**)Dec 31, 2010

Client industries
• Health Care
• Crop Science
• Material Science/Polymers
• Chemicals/Petrochemicals

Slide 21 © 2011 CompactGTL plc
Reactor & Process Technology Development Workflow

- **Lab Reactors**
  - Reaction Kinetics
  - CFD Modelling

- **UK Pilot Plant**
  - Prototype Reactor Tests
    - Reactor Tests 50-100 Channels
  - Process Modelling
    - Heat & Mass Balances

- **Brazil Plant**
  - Option Selection
  - Commercial Plant Design

- **Commercial Plant**
  - Multiple Reactor & Catalyst Suppliers

Lab Reactor Tests < 10 Channels → Prototype Reactor Tests 50-100 Channels → Brazil Plant Option Selection → Commercial Plant Design

Bayer Technology Services
Model based reactor design & scale up methodology

Catalyst screening
Reaction modelling
Reactor modelling
Model validation
Reactor design & scale up

Lab reactors for all process steps

Fitting of reaction parameters

Computational fluid dynamics

Experimental validation of model predictions

Reactor models with detailed kinetics

Process heat and mass balances

© 2011 CompactGTL plc
Sumitomo Precision Products
SMR & FT Reactor Manufacturing Partner
Amagasaki Head Office

Overseas Offices
New York

Major Subsidiaries
STS(UK), MET(JPN), SE(JPN)
Heat Exchangers
- SUMALEX
- LNG Vaporizer

Siphorex (Thermo-siphon semiconductor device cooling equipment)

Main Heat Exchanger for Air Separation

Heat Exchanger for Helium Liquefaction Plant

LNG Vaporizer Open Rack type (ORV)
**Basic Structure**
- Parting Sheet (Tube Plate)
- Heat Transfer Fin (Corrugated Fin)
- Side Bar (Spacer Bar)

**Flow Arrangement**
- Counterflow Type
- Crossflow Type
The Result........

- ‘Standalone’ solution for oilfield development
- Strong economics where gas infrastructure or re-injection are avoided
- Manufacturing route & partners established
- UK pilot plant operational for >2.5 years
- Petrobras plant commissioned and now running under test

With special thanks to Petrobras and all our partners for their valued contribution