Unlocking Remote Oilfield Development

21st World Upstream Conference
19th – 21st September 2011
GENEVA

Iain Baxter
Director of Business Development
CompactGTL plc
Stranded Oil!

Satellite image of gas flaring in Nigeria

250 km
Options for Associated Gas (ANG)

- **Modular GTL**
- **Reinjection & Flaring**
- **FLNG**
- **CNG**
- **Gas to Wire**
- **Pipeline**

Distance to market for converted product [km]

- 500
- 200
- 150
- 100
- 75
- 50

Associated Gas MMscf/d

- 400
- 200
- 50
Emerging offshore ANG utilization options

- **CNG**
  - High infrastructure cost
  - Economics favourable at 200+ MMscfd
  - **Limitations:** High gas rate needed & sensitive to distance to market

- **FLNG**
  - High infrastructure cost
  - Economics favourable at 400+ MMscfd
  - **Limitations:** High gas rate needed

- **Gas to Wire**
  - High cost for deep water and remote fields
  - **Limitations:** Low gas rate only & sensitive to distance to market
ANG: An increasing obstacle to Oil E&P where:

- Distance to gas infrastructure
- Distance to power transmission infrastructure
- Constrained by political or commercial ‘borders’
- Difficult terrain

High ‘distance’ of oilfield to ANG market

- Low, non-commercial ANG flow-rates ($\approx$10 - 100MMscf/d)
- Production decline over field life

Low ANG flow-rates

- Local & National Government
- World Bank
- IOC environmental governance

Flaring constraints

- Reservoir susceptible to damage or gas break-through
- Cost of deep re-injection well completions & equipment
- High reservoir pressure

Re-injection constraints
Existing Fields with Problematic ANG: Market Analysis Sample 2009

Screening Factors include:

- Remaining commercial liquids reserves > 50 AND <400mmbbls
- Distance to gas market & infrastructure
- GOR / Forecast associated gas production profile
A new solution for $\text{ANG} \approx 2-50\text{MMscf/d}$

Modular GTL:
Convert ANG to syncrude then Co-mingle and transport with the natural crude

Image courtesy of SBM Offshore
Process Overview

Modular CompactGTL Plant

- Feed Water
- Gas Treatment
- SMR Modules
- Heat Recovery & Compression
- FT Modules
- Waste Water
- Optional Power
- Optional Gas for Power Gen
- ANG
- No Oxygen Required!
- Syncrude
- Separators
- Oil & Liquids Processing
- Crude Export
Why is this now possible?

Conventional Tubular steam Reform / ATR

Conventional FT reactor e.g. slurry phase

10x increase in specific throughput

Compact GTL reactors using brazed plate & fin construction
Workable ANG Solution - Requirements

- Production decline scaleability
- High availability & operability
- Gas composition variability
- Feasible utilities
- Feasible effluent streams
- Onshore: Poor infrastructure/access
- Offshore: FPSO integration & certification

Flexible, Modular Plant – No catalyst handling on site
Oilfield Development Benefits

- Creates ‘Win-Win’ for all parties:
  - Increased tax (or PSC profit oil) for the NOC and Government
  - Environmental compliance / regulatory support
- Oil Company in control:
  - No gas take-off arrangements / additional marketing
  - Project accelerator / avoids 3rd party delays
- ANG bookable as reserves
- Bottom Line: Increased oil production revenue:
  - From increased crude production (otherwise shut-in)
  - From syncrude production

Project NPV Enhancer
Enhanced Oilfield NPV
Case 1: GTL vs a feasible but high cost ANG option

Gas Re-Injection or Pipeline to Market

Integrated CompactGTL

- Facilities Capital Cost PV
- Gas Disposal
- Operations & Tax PV
- Penalties or Delay
- Crude Revenue PV
- GTL Plant
- Operations & Tax PV
- GTL Opex
- Syncrude PV

10MMscfd ANG Processed to 1,000 bpd Syncrude

Oilfield NPV

Slide 11 © 2011 CompactGTL plc
Enhanced Oilfield NPV
Case 2: GTL liberates shut-in production

Existing or Planned Field subject to ANG Flaring Cap

Integrated CompactGTL

10MMscfd ANG Flaring cut liberates 10,000 bpd Production @ GOR=1,000
Solution Delivery – World Class Partners

- Partnership currently confidential
- Reactor Modularisation
- Catalyst supplier
- FEED partner
- Partnership currently confidential
- Consultant
- FPSO expertise
- Partnership currently confidential
- Reactor supplier
- SBM Offshore
- Bayer Technology Services
- TWI
- GENESIS
- Sumitomo Corporation
CompactGTL Commercialisation History

- **Lab Scale**: 2000 - 2011
- **UK Pilot Plant**: Commissioned 2008
- **Petrobras Plant**: Commissioned Dec 2010
- **Client Studies**: 2009 Onwards

- 11 Years lab scale R&D
- 5 Years development engineering specifically as an ANG solution
- 5 Years manufacturing supply chain development
- 3rd Party scrutiny by world-class industry groups
- >3 years plant operational experience
Demonstration Plant Construction 2009/10

Plant constructed by Zeton Inc, Burlington, Canada

SMR & FT Reactors fabricated by Sumitomo Precision Products, Osaka, Japan
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
Client Conceptual Study
Example 1: 5MMscfd ANG Deepwater Offshore

- Proposed oilfield development
- Deepwater, low GOR, 15 year life
- Continuous flaring not permitted
- Re-injection prohibitive
- 100km to nearest sub-sea gas line
- Pipeline CAPEX estimate: US$ 150MM

CompactGTL Solution

- PV for CAPEX & OPEX comparable to pipeline
- Additional syncrude revenue
- No 3rd party gas take-off
- No flow assurance issues

Modular GTL Plant
Integrated with Suezmax FPSO
Client Conceptual Study:
Example 2: 10MMscf/d ANG Onshore

- Existing oilfield operation
- GOR = 1,000  15 years life remaining
- Flaring reduction targets restricting production
- Re-injection prohibitive
- Terrain & distance prevent gas gathering

CompactGTL Solution

- 10MMscf/d plant gives 1,000 bpd syncrude
- 10,000 bpd liberated crude production
- New oil revenue: US$ 150MM/yr [@ $40 oil]
- Pre-Tax IRR > 40%
- IRR insensitive to OPEX & oil price
Compelling economics achievable for numerous remote oilfield developments

- >3 Years plant operating experience
- Volume reactor & catalyst supply chain fully established
- Highly resourced market leading FEED / EPC partners established
- Engineering & operations team with World-scale GTL experience
- Several projects globally at conceptual & pre-FEED stage
Unlocking Remote Oilfield Development

21st World Upstream Conference
19th – 21st September 2011
GENEVA

Iain Baxter
Director of Business Development
CompactGTL plc