26th World Gas Conference

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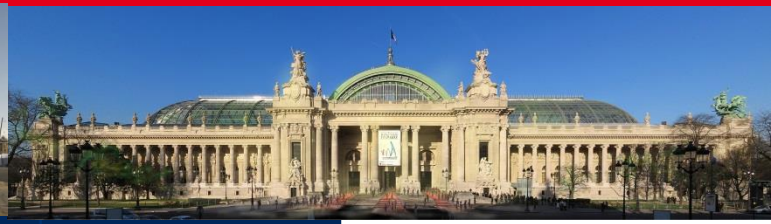

MONETISING STRANDED GAS RESOURCES ONSHORE AND OFFSHORE

- The Palette Of Enabling Technologies, Their Comparative Merits And Challenges In Commercial Application

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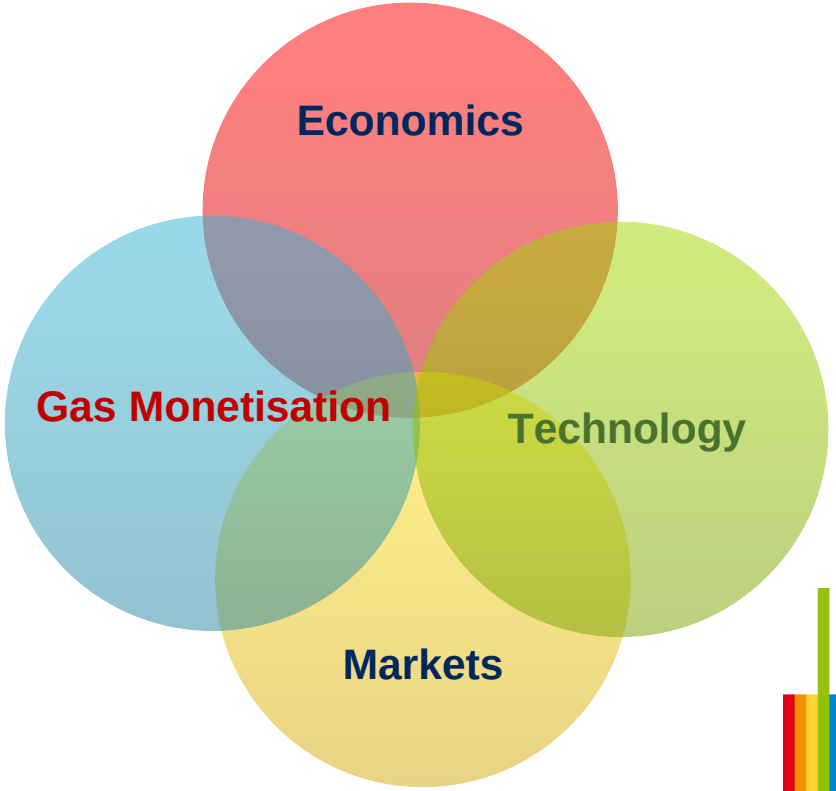
Monetising Stranded Gas Resources Onshore and Offshore

Presentation Overview

- Stranded Gas- Origins and Opportunities
- Candidate Monetisation Technologies
- Drivers for Technology Selection
- Technology Maturity and Technology Risk
- FLNG Case Study and Pathfinding Economics



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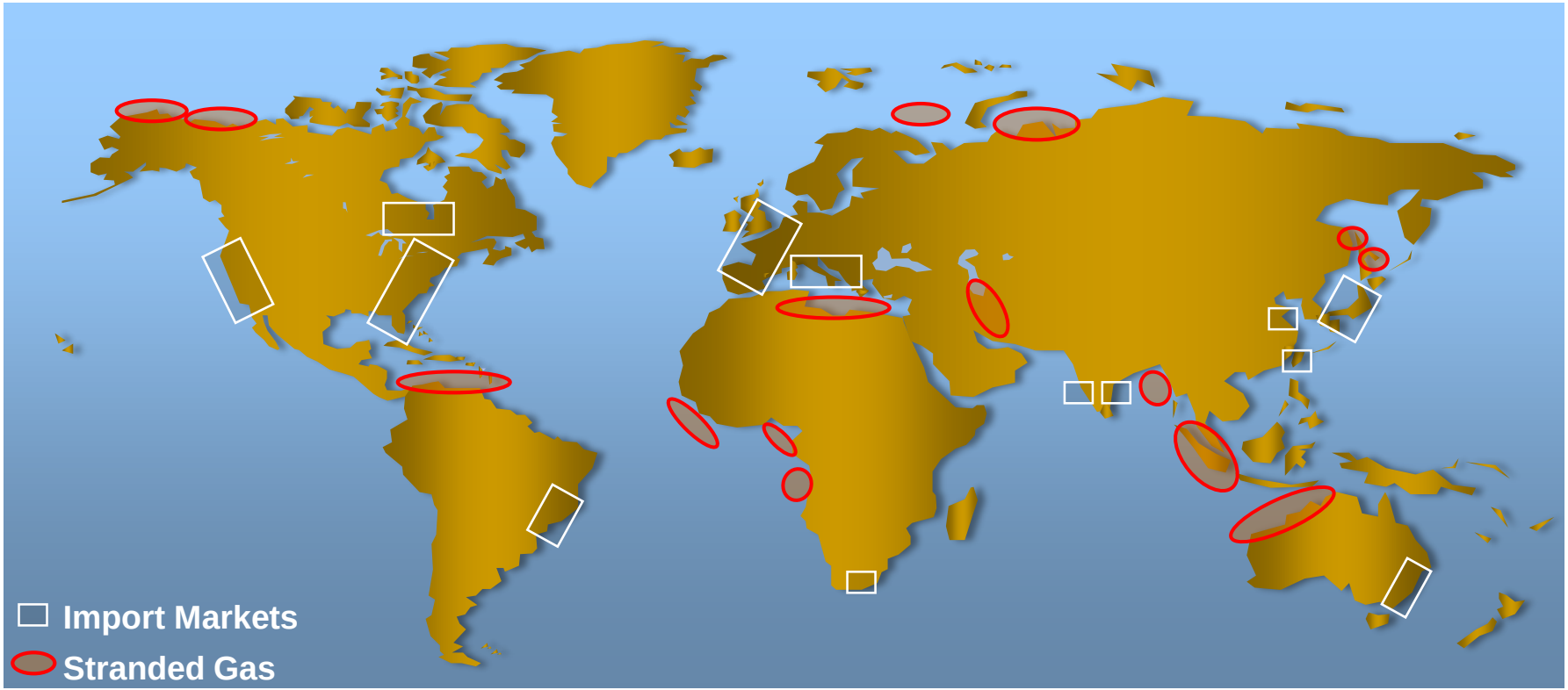
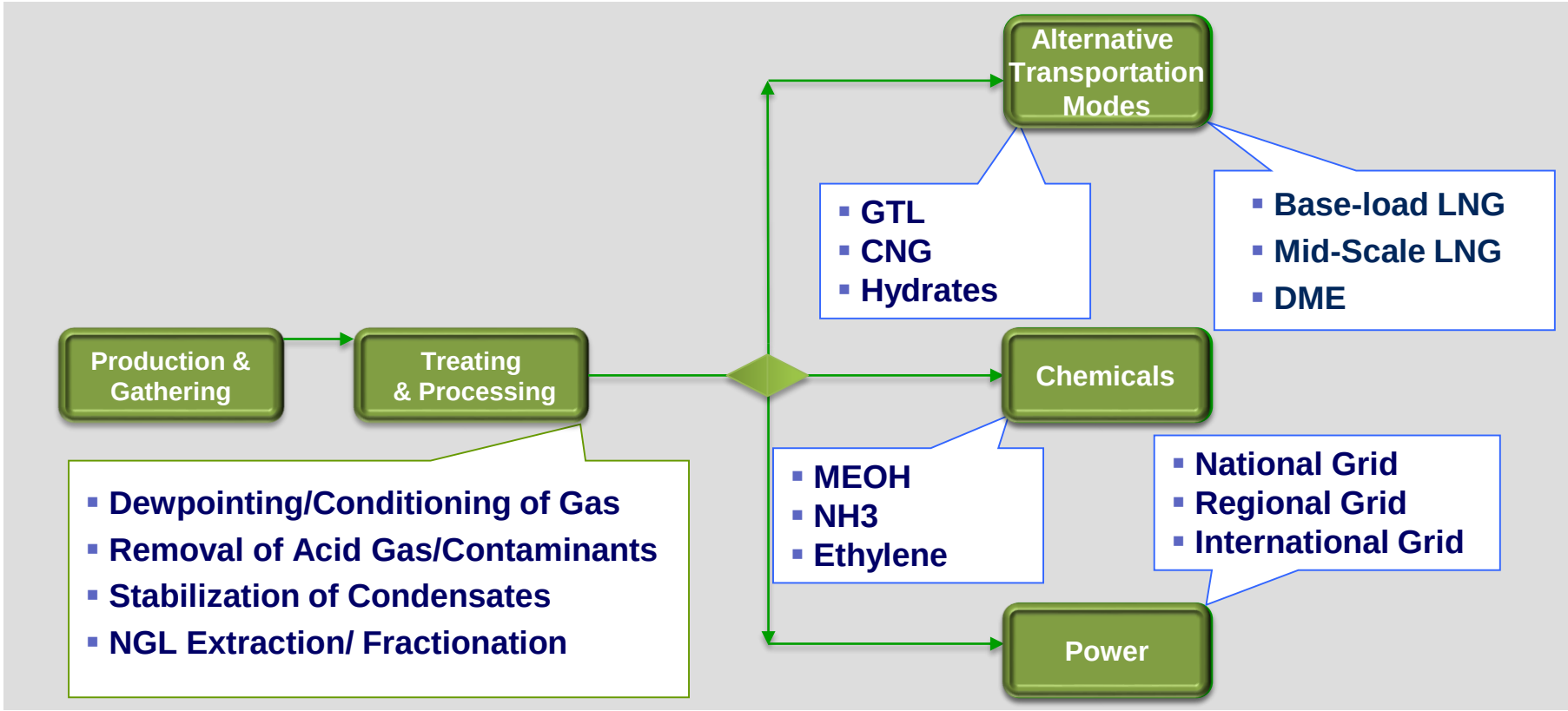
Stranded Gas and Target Markets



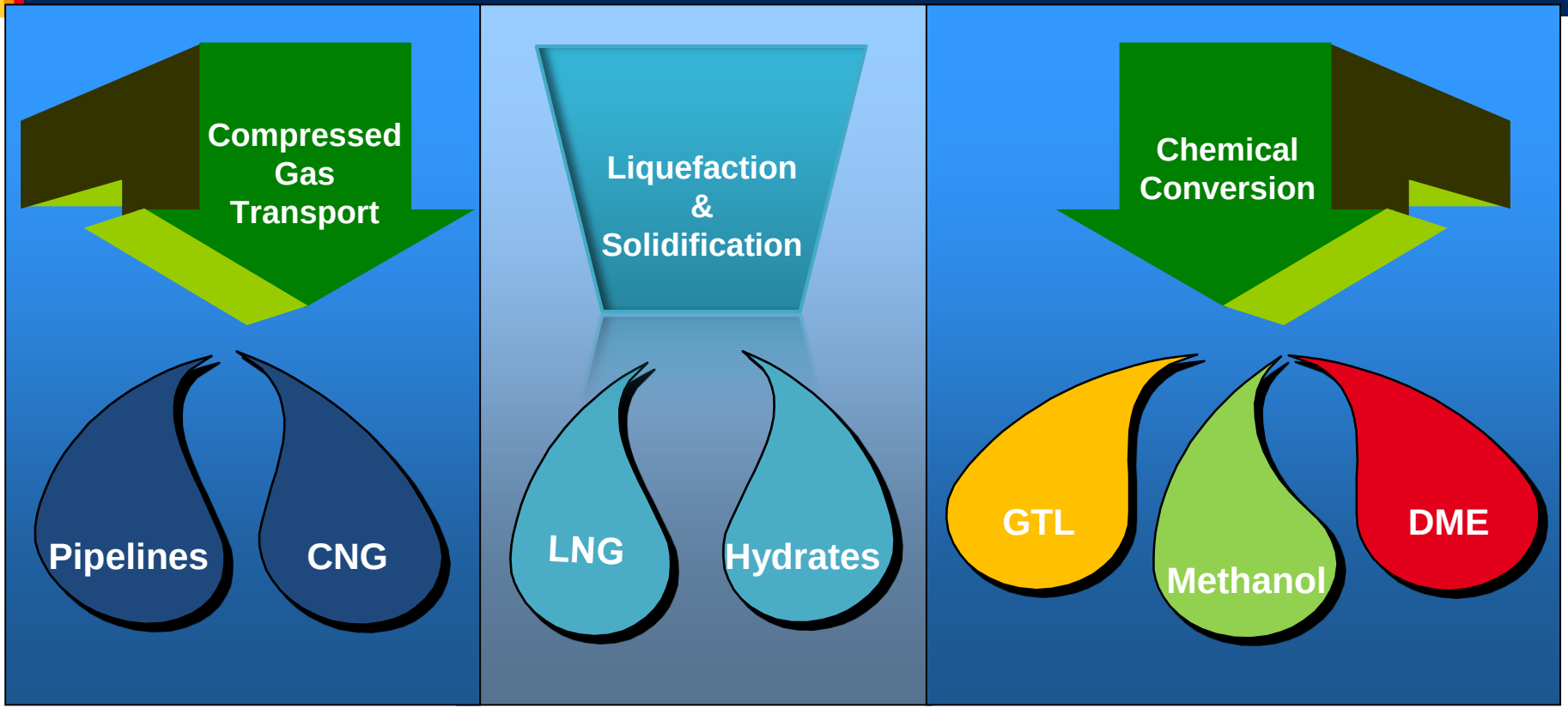
Stranded Gas and Target Markets

Non-Associated Gas	Remote from markets and pipeline infrastructure
Flared Gas	Flared from existing crude oil production operations
Associated Gas	Excess gas from new remote oil field developments

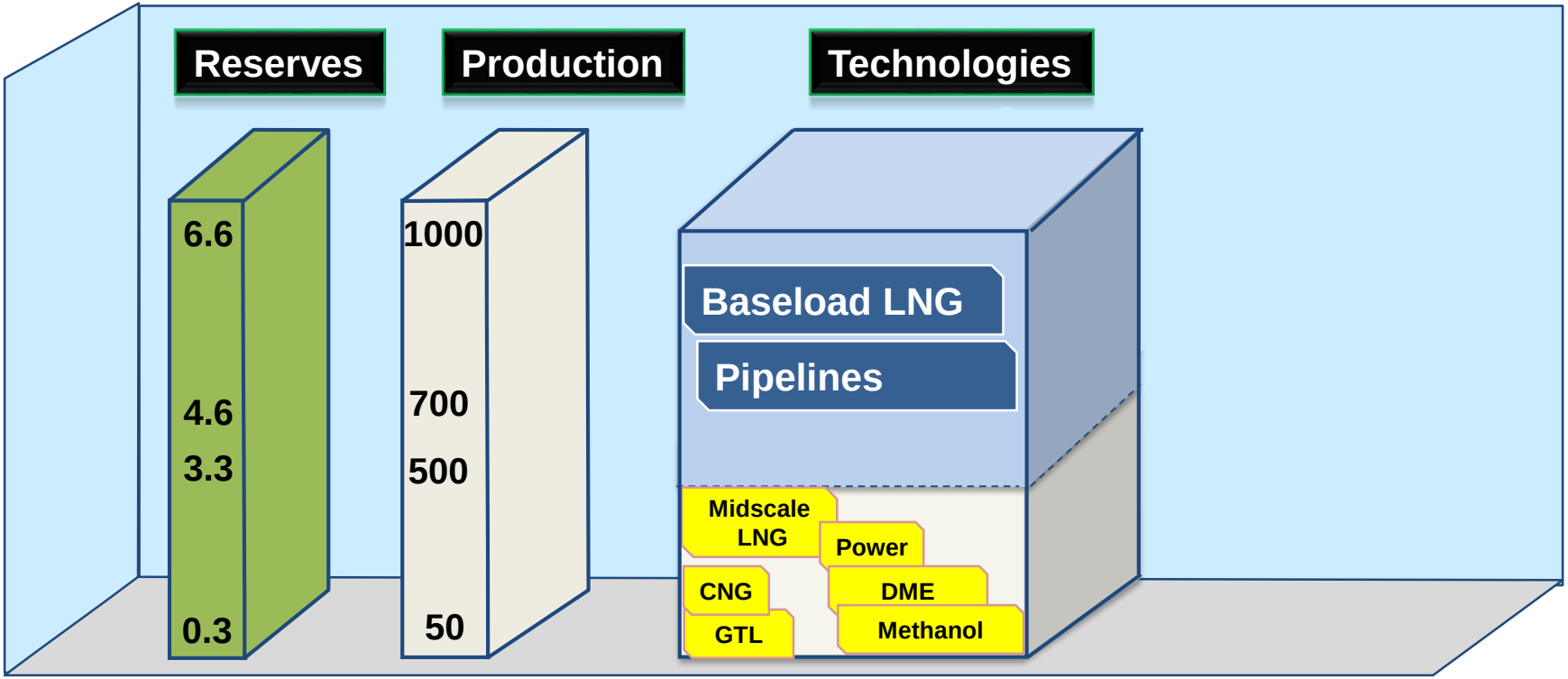
Gas Value Chain



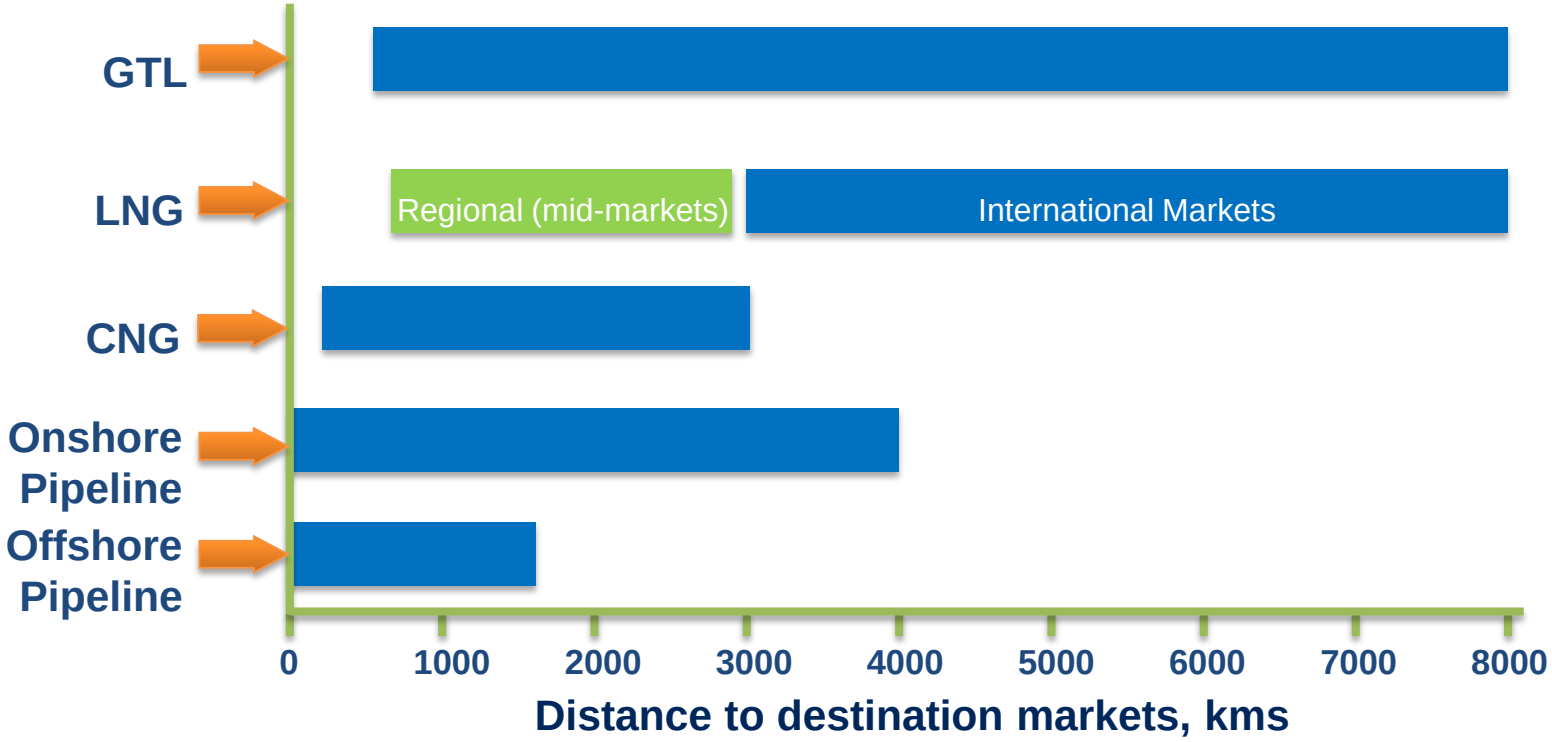
Pathways to Monetisation



Technology Application Bands



Gas Monetisation – Distance to Markets



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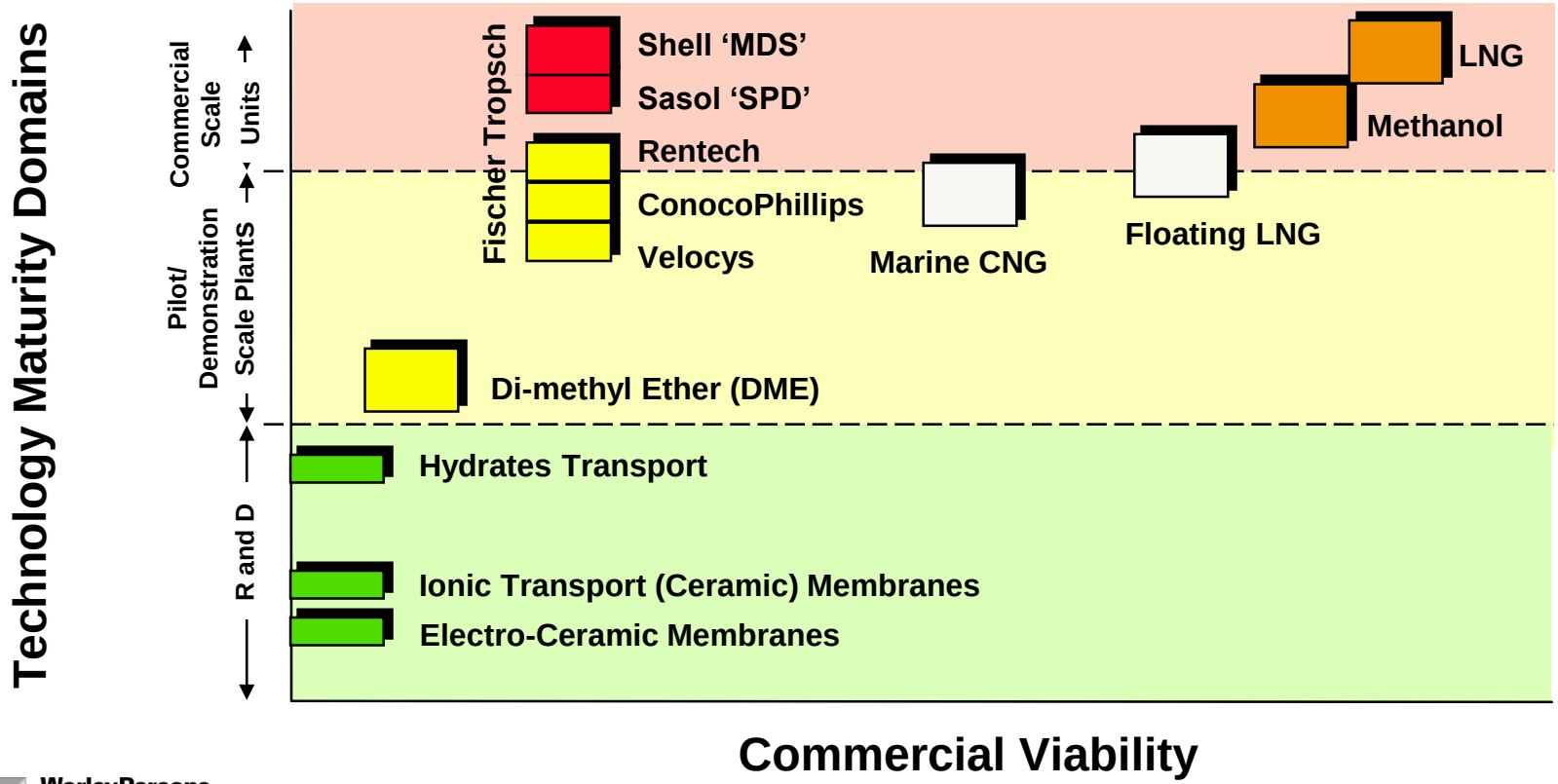
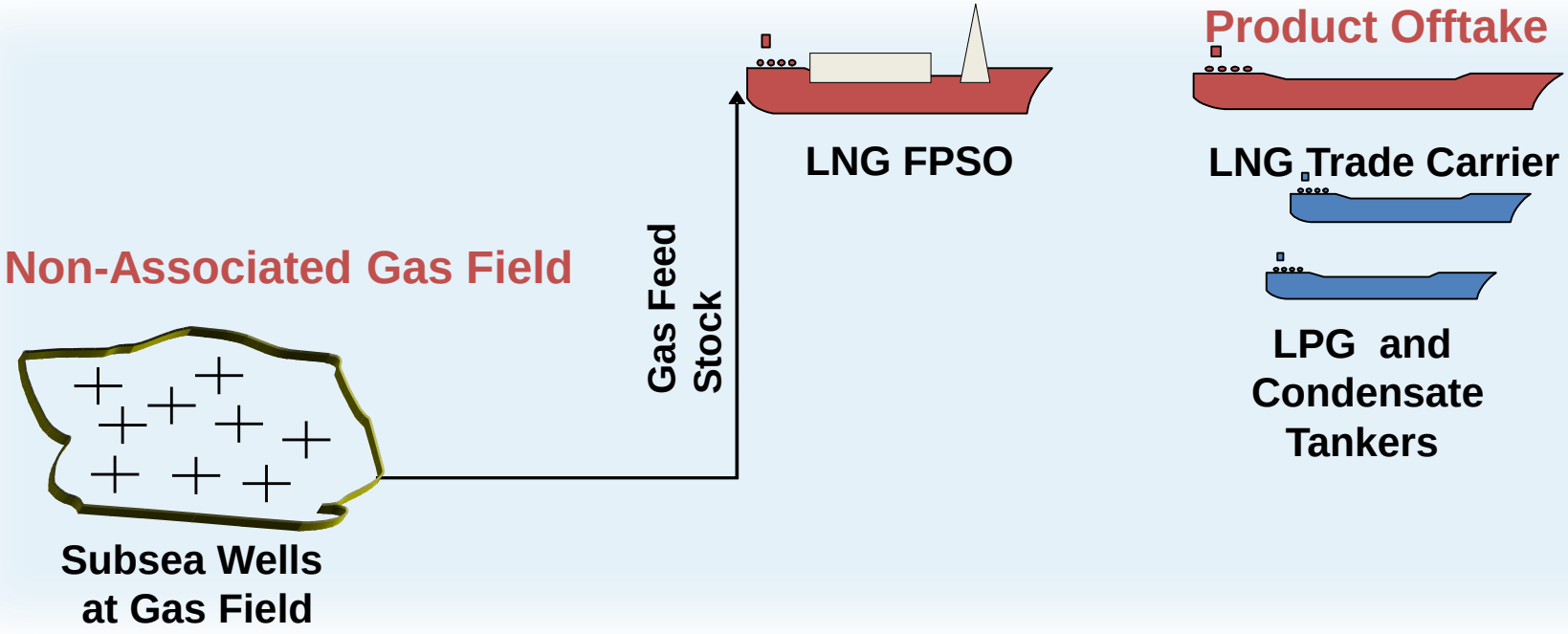
Candidate technologies and Maturity Status



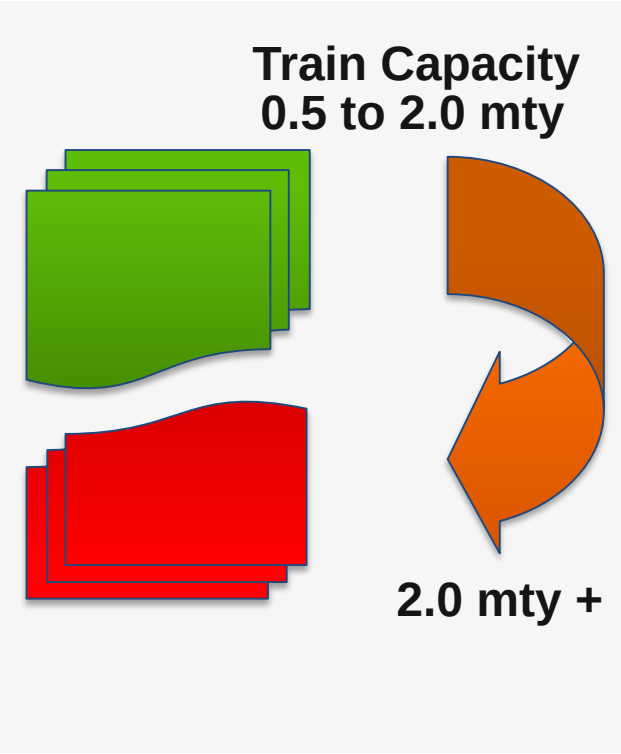
Offshore Gas Monetisation via FLNG



LNG Liquefaction Technologies

Options Relative to Capacity

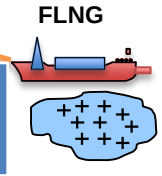
- Single Expander Cycle
- NicheLNG (dual expanders, nitrogen + methane)
- Mustang Smart® LNG (open and closed loops)
- Dual Nitrogen Expanders - BHP, Kanfa Aragon
- Single Mixed Refrigerant (SMR) - Linde, APCI
- Optimised Cascade - ConocoPhillips
- Dual Mixed Refrigerant (DMR) - Shell, APCI
- Propane/Mixed Refrigerant (C3/MR) - APCI
- Mixed Fluid Cascade - Linde, Liquefin - Axens



Case Study- Monetisation of Offshore Stranded Gas

Terminal

Component	Mol %
Methane	86.8
Ethane	6.91
Propane	3.87
i-Butane	0.40
n-Butane	0.67
Pentanes+	0.55
CO_2	0.71
N_2	0.08
H_2O	0.01
Total	100



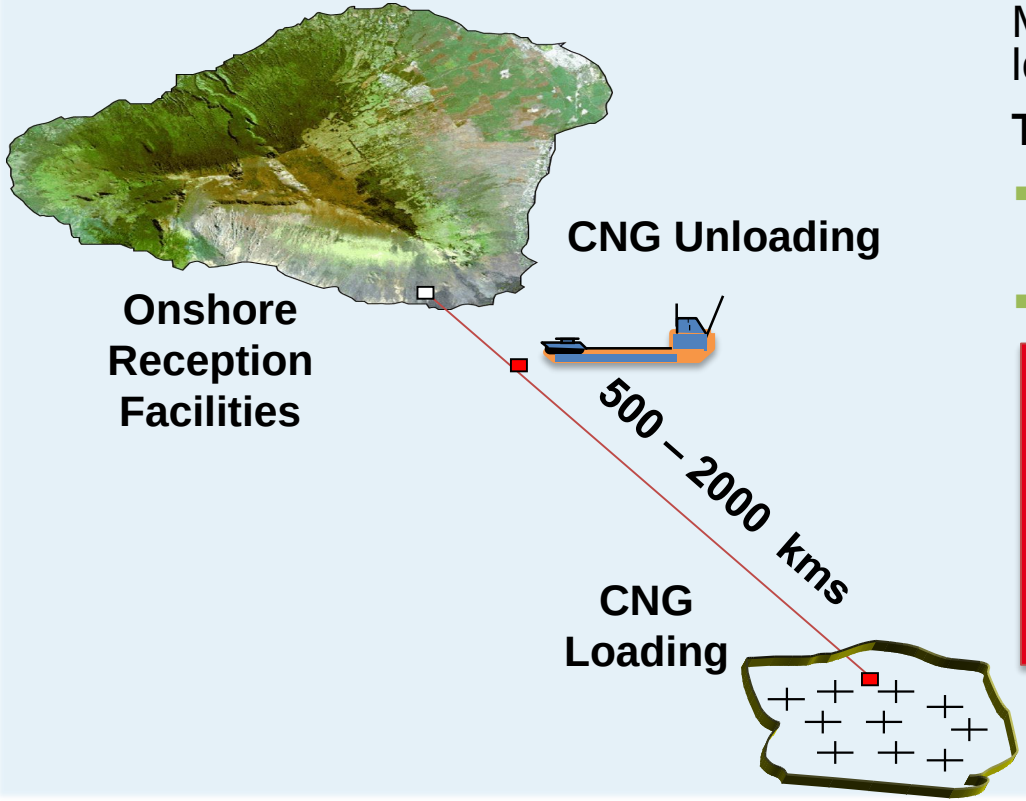
Cost of Service

Feed Gas Price	Distance to Market, 3000 km	Distance to Market, 5000 km
USD/Mscf	Delivered LNG Price, $/MMBTU	Delivered LNG Price, $/MMBTU
2	7.29	7.61
3	8.39	8.72
5	10.60	10.94

LNG FPSO located at field centre

- **Feed Gas** from subsea wells: Rate : 350 MMscfd
- Feed Gas Prices (cases): Nominally priced at $2, 3 and 5/Mscf at FLNG riser flange.
- LNG FPSO Production Life: 20 years
- Corporation Tax: 38%
- LNG price as delivered to Regasification terminal
- Required IRR: 12%
- Distance to market (cases): 3000 and 5000 km
- No credit taken for revenues generated by NGLs
- FLNG development costs exclude Subsea Capex.
- Nominal LNG production: 2.3 mtpa

Marine Transport of CNG – The Sweet Spot



Modest infrastructure at gas field location and onshore delivery location

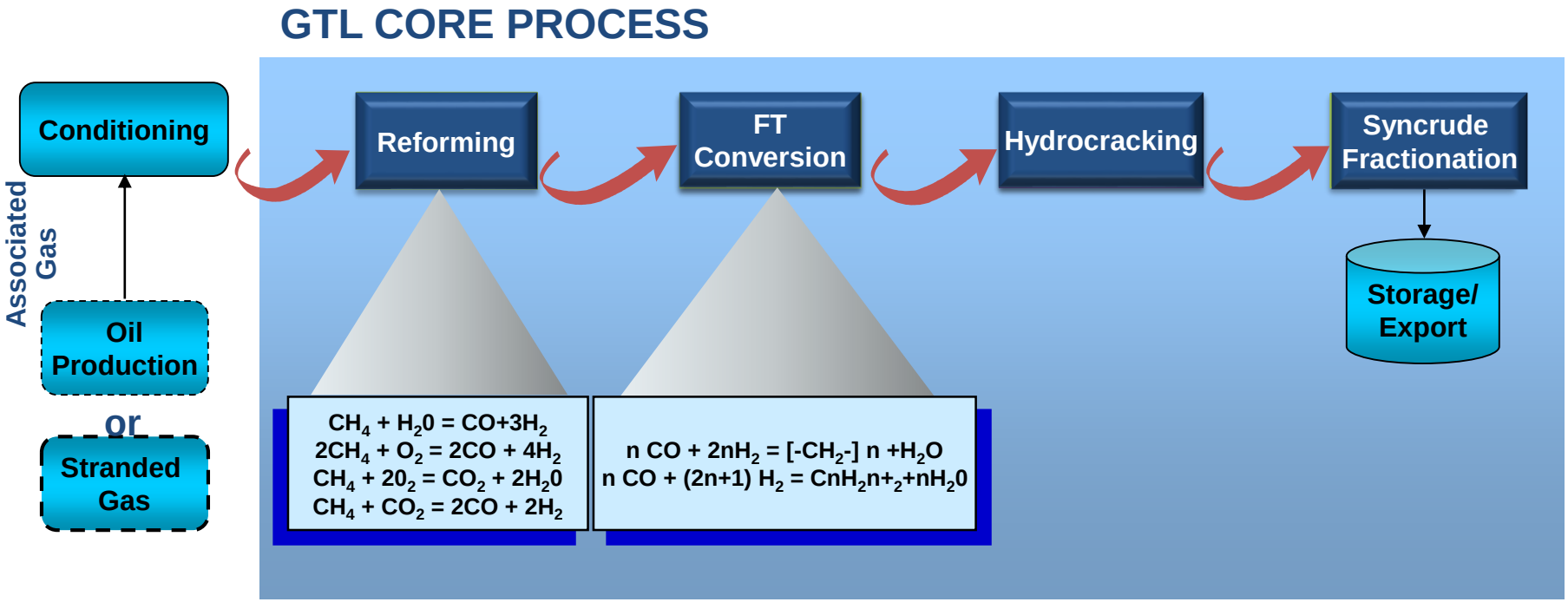
Target Market Opportunities:

- Gas Volume Rates of 200 – 500 MMScfd
- Distances of 500 – 2000 kms

CNG Fleet Size & Vessel Capacity function of

- Gas Rate
- Distance to Market

GTL Core Process



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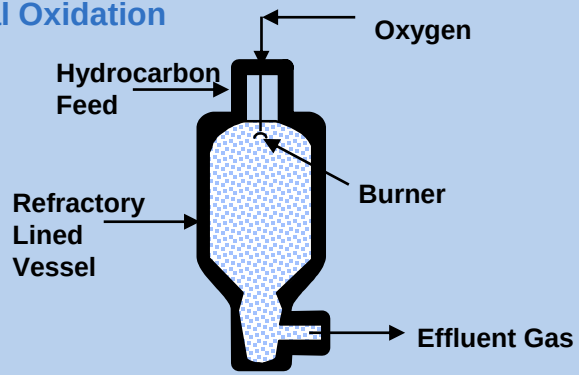
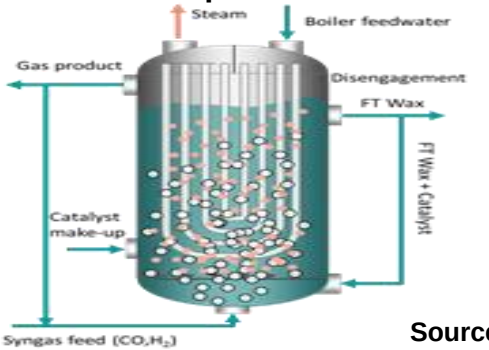
Typical Synthesis Gas Generation and Fischer Tropsch

Typical Partial Oxidation

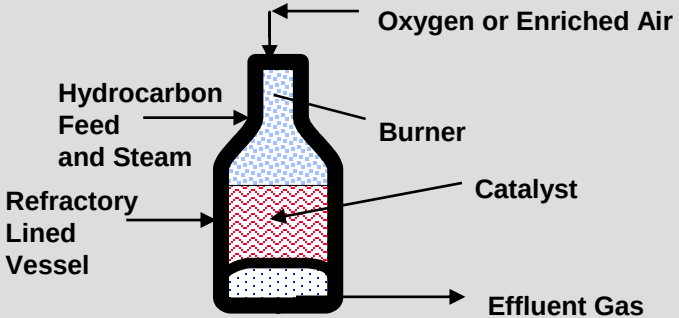


Conventional Fischer-Tropsch Reactor

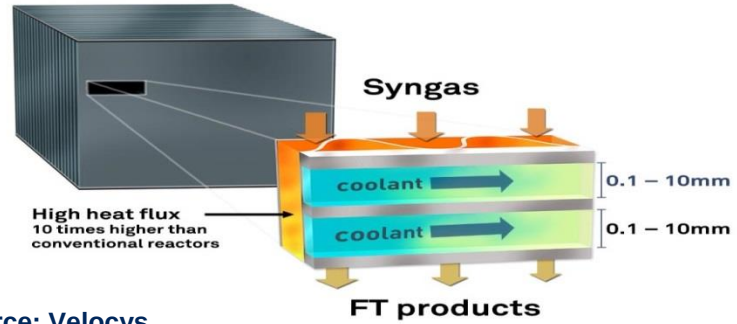


Source: PSE/Total

Typical Autothermal Reforming



Microchannel Fischer-Tropsch reactor core



Source: Velocys

GTL Challenges for Stranded Gas

Technical Complexity

- Petrochemical type operations
- Multiple integrated operations

Project Cost

- Wide variation and less predictable
- Currently perceived spread $120,000 to $180,000 per bpsd
- Investment levels challenge economics

Project Risk

- Significant over-runs in reference plants
- Technical Complexity feeds schedule risk

Concluding Observations

- Technology developments herald unprecedented opportunities for exploitation of stranded gas.
- Geography, size of gas reserves, distance to markets etc will determine the optimum mode of energy delivery
- Base load LNG is a prime contender for large stranded gas reserves.
- Mid-scale LNG technologies offer interesting options for mid-tier gas reserves.
- Marine CNG has commercial potential for gas delivery to mid-markets & regional markets.
- Conventional Fischer Tropsch GTL offers key opportunities for gas monetization. investment scale and project risk are key co-determinants of application.

- ***Horizon technology such as hydrates transport will further expand an already impressive solutions portfolio.***

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