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R E G I O N A L F O R U M



# Problem Gas Solutions

**Derek Atkinson**

**Business Development Director**



- Intro to Oxford Catalysts Group
- Background to the technology
- OCL ongoing projects and demonstrations
- Opportunity for additional projects

- Microchannel GTL – large scale economics at smaller scales
- Convert natural gas to synthetic crude (“syncrude”)
  - Eliminate flaring of associated gas
  - Enable oil production from remote fields with low gas to oil ratios
  - Monetise stranded gas
- Minimised environmental impact of crude production
- Short path to commercialisation – adapting offshore solution
  - 3 years to fully installed, operational commercial facility
  - Secure IP position
- Funding is sought for an **advantaged** commercial position

## Oxford Catalysts Group PLC

### Oxford Catalysts Ltd.

- Commercialising >20 y research at university Chemistry Department
- Largest Chemistry Department in Western World
- Company founded by Head of Inorganic Chemistry
- IPO in April 2006 (LSE: OCG)
- Developing and commercialising catalysts for production of **clean fuels**
- Based near Oxford, UK



### Velocys, Inc.

- Commercialising 15 yr research originating in **Battelle** *The Business of Innovation* US DoE National Laboratory (PNNL)
- Conducted by Battelle – world's largest independent science & technology organisation (\$4bn R&D p.a. / 20,000 staff / 130 locations)
- **Over \$160m** invested in technology to date, primarily by commercial partners
- **Global leader** – largest microchannel process technology IP portfolio in world
- Acquired by Oxford Catalysts in Nov-08
- Based near Columbus, Ohio, USA

**Battelle**

*The Business of Innovation*



Critical mass: ~90 employees



## Non-executive Directors



### **Pierre Jungels, PhD, CBE** – Chairman

- 30+ yrs in oil industry: CEO Enterprise Oil; ED PetroFina; MD British Gas
- Former President of the Institute of Petroleum
- NED: Baker Hughes; Woodside Petroleum; Imperial Tobacco

### **Jeremy Scudamore** – Non-executive Director

- Former CEO of Zeneca Specialties and Avecia Group
- Lead £1.3bn buyout from AstraZeneca to form Avecia Group
- Director of ARM Holdings PLC

### **Jan Verloop, PhD** – Non-executive Director

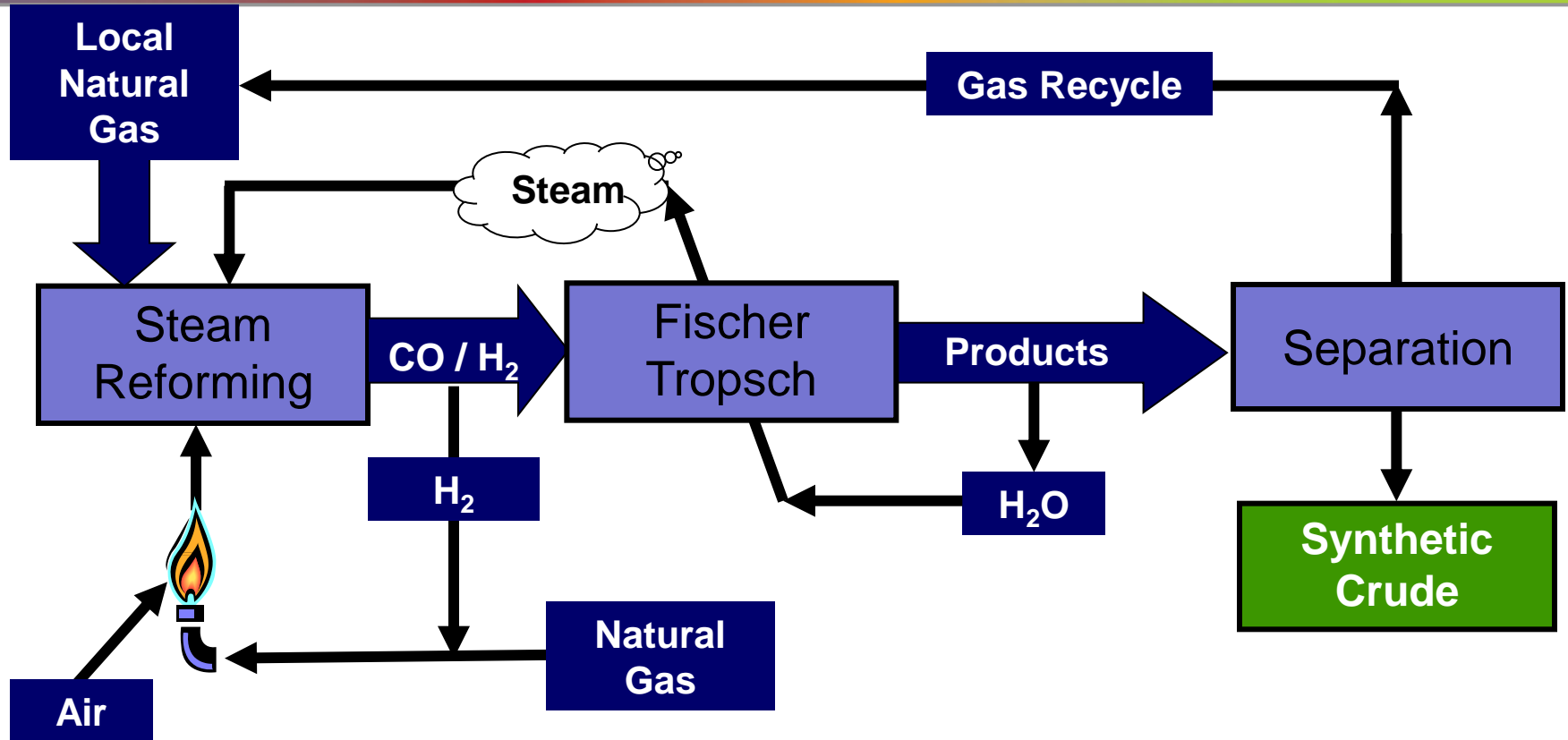
- 30+ yrs with Shell in the Netherlands, UK and Singapore
- Technical and management positions in refining, licensing and product development
- Innovation Manager at Shell responsible for strategic innovation

### **Andrew Jamieson, PhD** – Non-executive Director

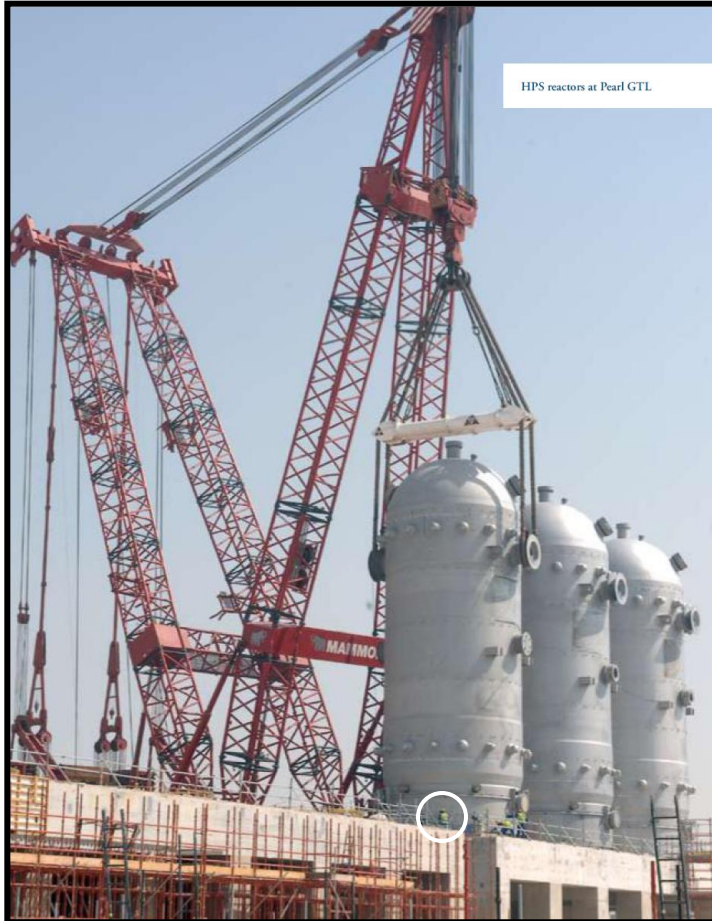
- 25 years with Shell
- Former VP Gas and Power with Shell, MD Nigeria LNG, Director Qatar Shell GTL
- NED: Woodside Energy Limited; Leif Hoegh Shipping Company Ltd.



## Synthetic Fuel Process: Gas-to-Liquids



Microchannel Technology improves key reaction steps for GTL



### • Key Reactor Stats:

- Weight: 1,200 tonnes
- Capacity: 5,800 bpd
- Diameter: 7m
- Height: 20m
- Reactor tubes: 29,000
- Tube length: 12m
- Tube diameter: 2.5cm

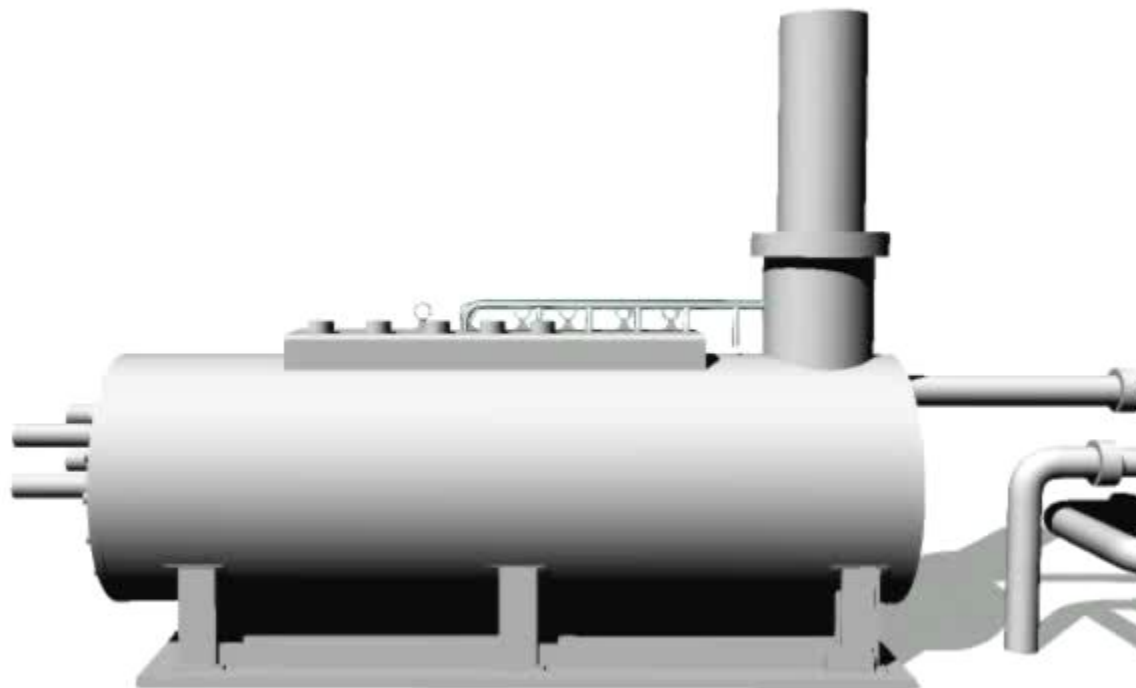
Fixed bed FT Reactors  
are massive

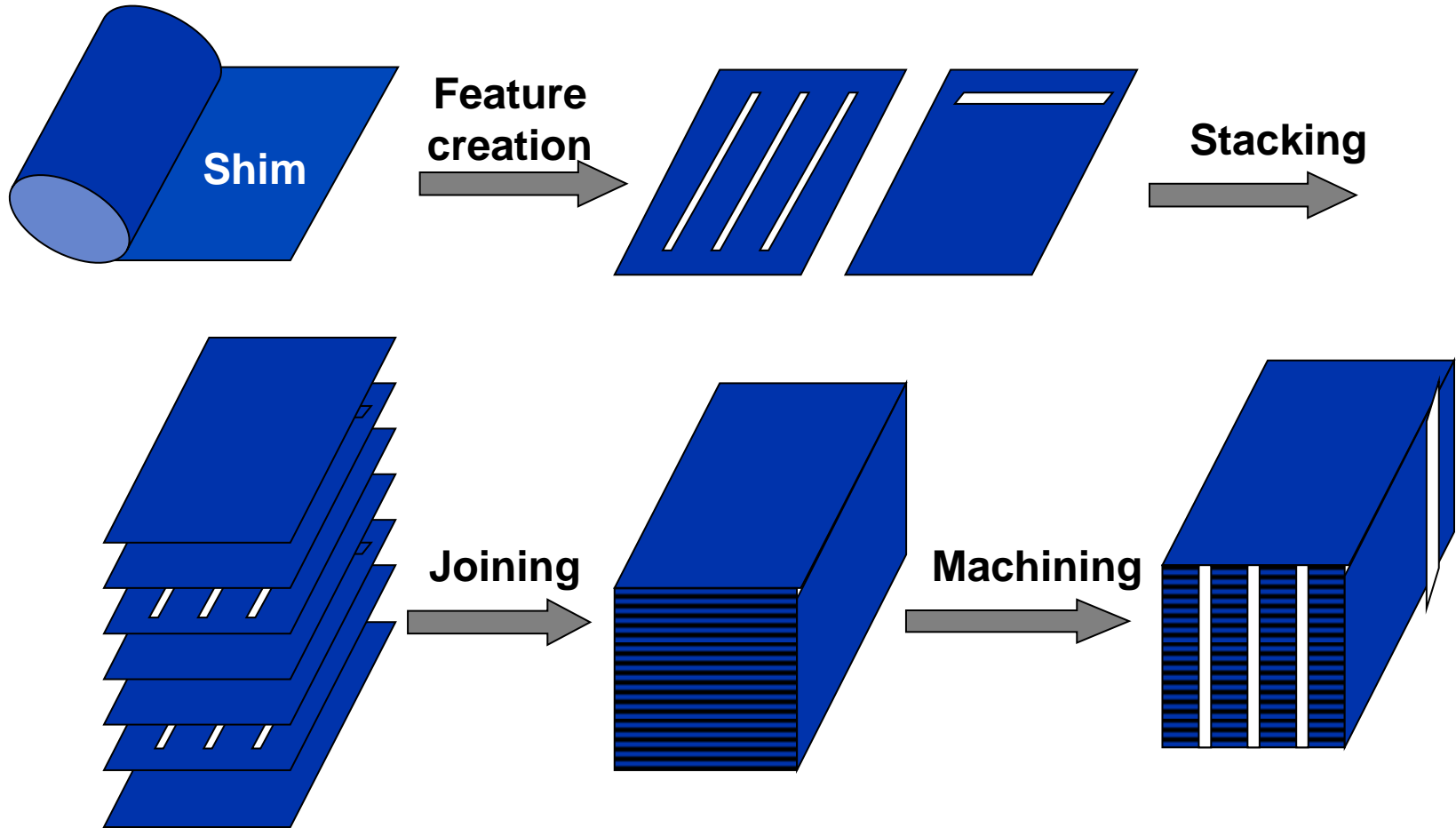
## Microchannel technology systems outperform conventional reactors

- Accelerates chemical processes by 10 – 1,000 fold
- Allows use of new, novel, more active catalysts
- Controls reactions at optimal conditions
- Enables smaller, more productive reactors

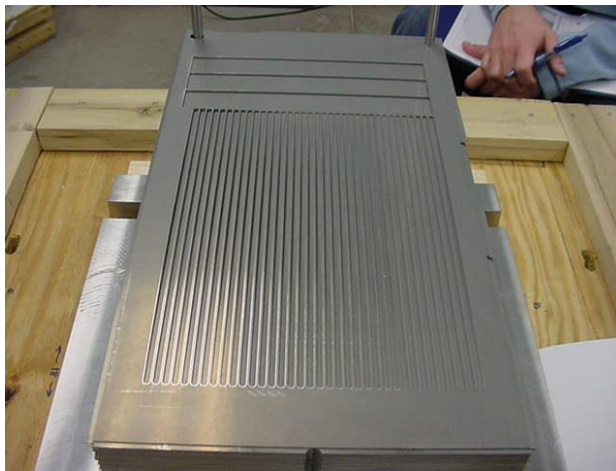
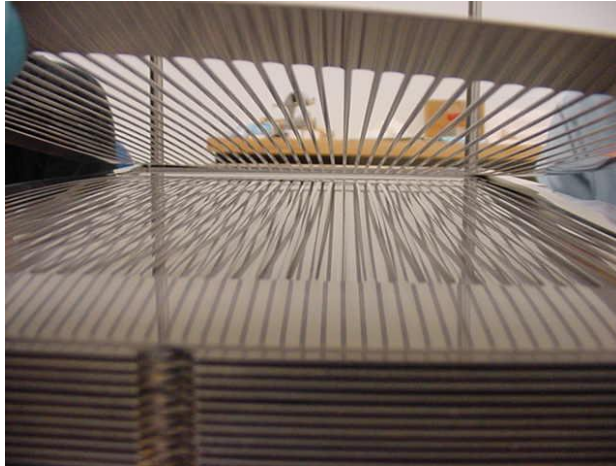


## Oxford Catalysts – Velocys GTL Process

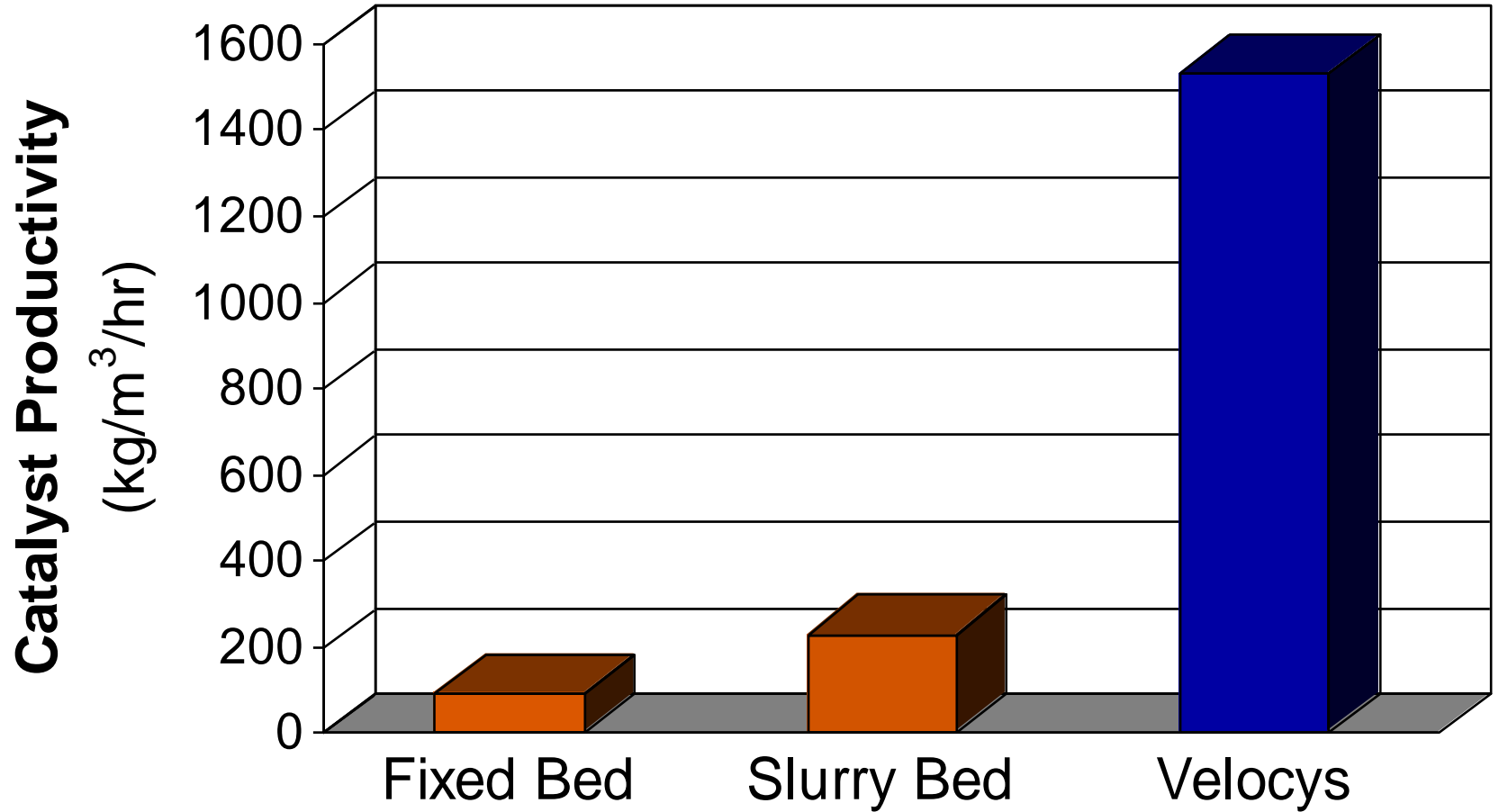




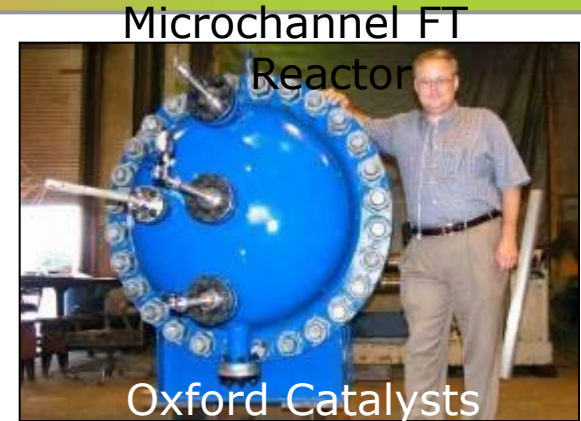
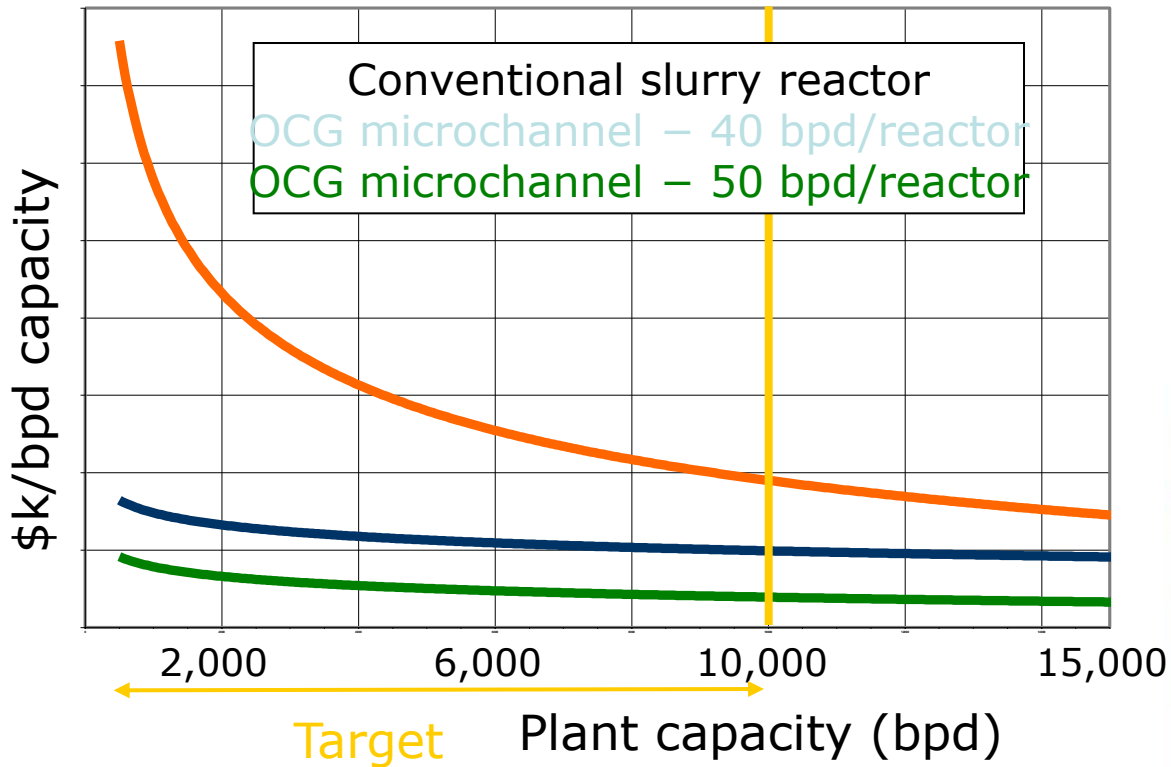
## Velocys Device Fabrication



# Catalyst Productivity Comparison

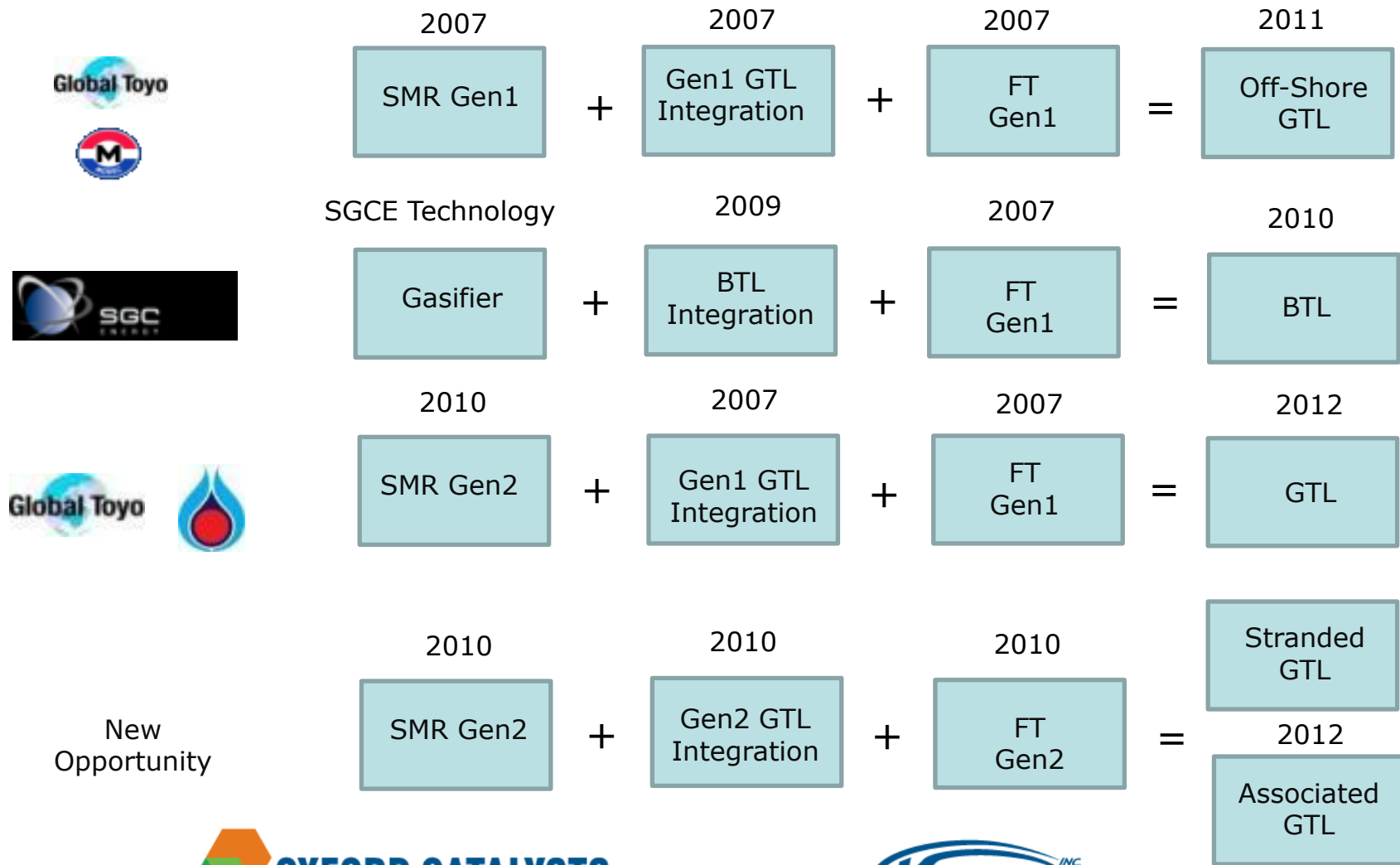


## Numbering Not Scaling is the Answer

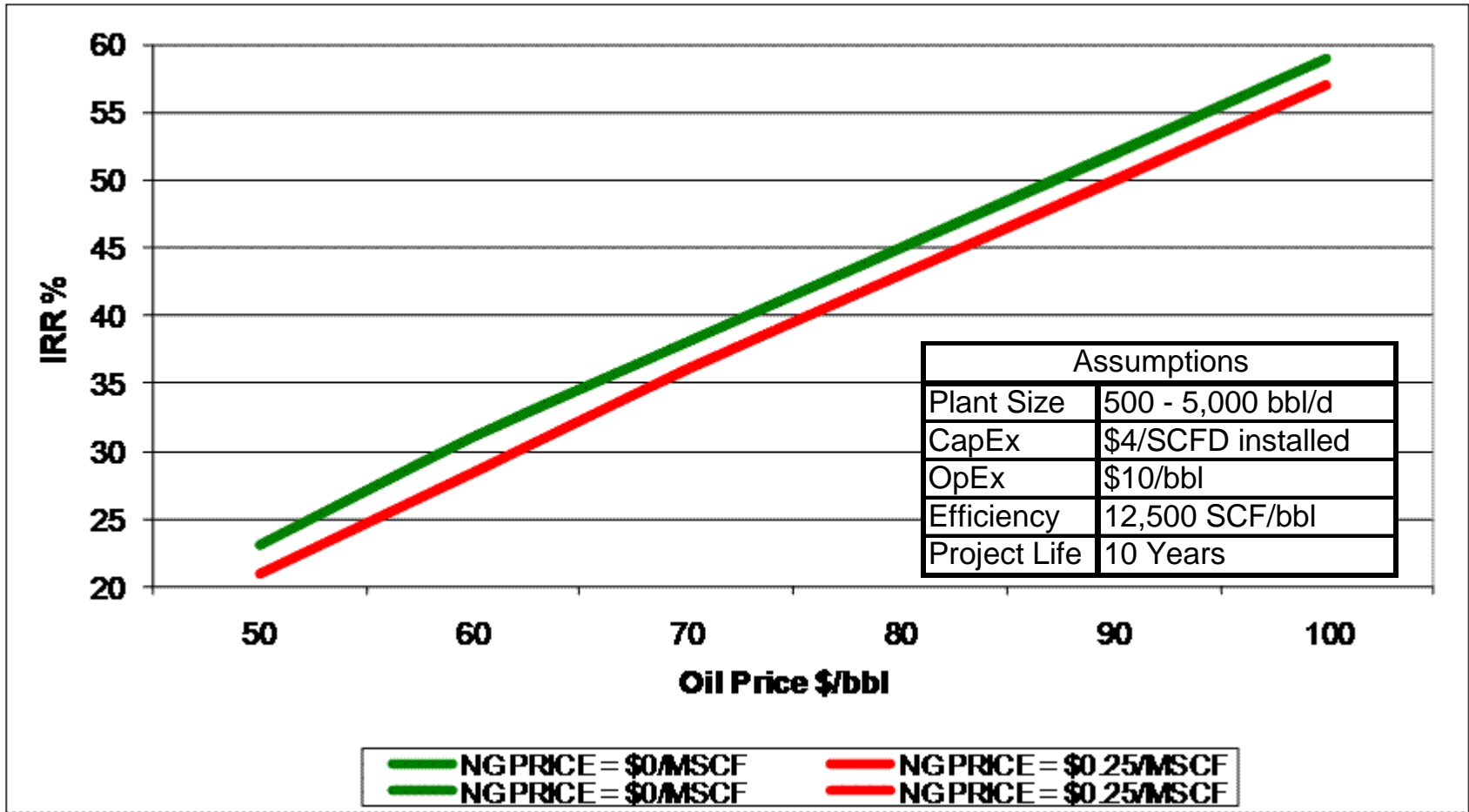


By numbering rather than scaling using microchannel technology, Oxford Catalysts can achieve the economies required at small scales for GTL

# Technology Implementation



## Associated Gas Return on Investment



CapEx \$50k/bbl  
 OpEx means cost of running GTL facility per barrel of GTL Product<sub>c</sub>

## Requirements

- \$50 million over 3 yrs (+ construction cost of commercial facility – scale dependent) to commercialise Gen 2 GTL technology
- Demonstration and commercial sites and gas feed

## Return – Advantaged Commercial Position

- Commercial GTL solution optimised for either associated or smaller stranded gas opportunities
- Early and preferential access to technology
  - Facilitates cash flow from reserves that would otherwise remain in situ
  - Strong competitive advantage in exploitation of non-domestic challenged reserves (oil and gas)
- Become leader in implementation of smaller scale GTL solutions
- Direct economic incentives
  - For own use of technology
  - Through third party use of technology

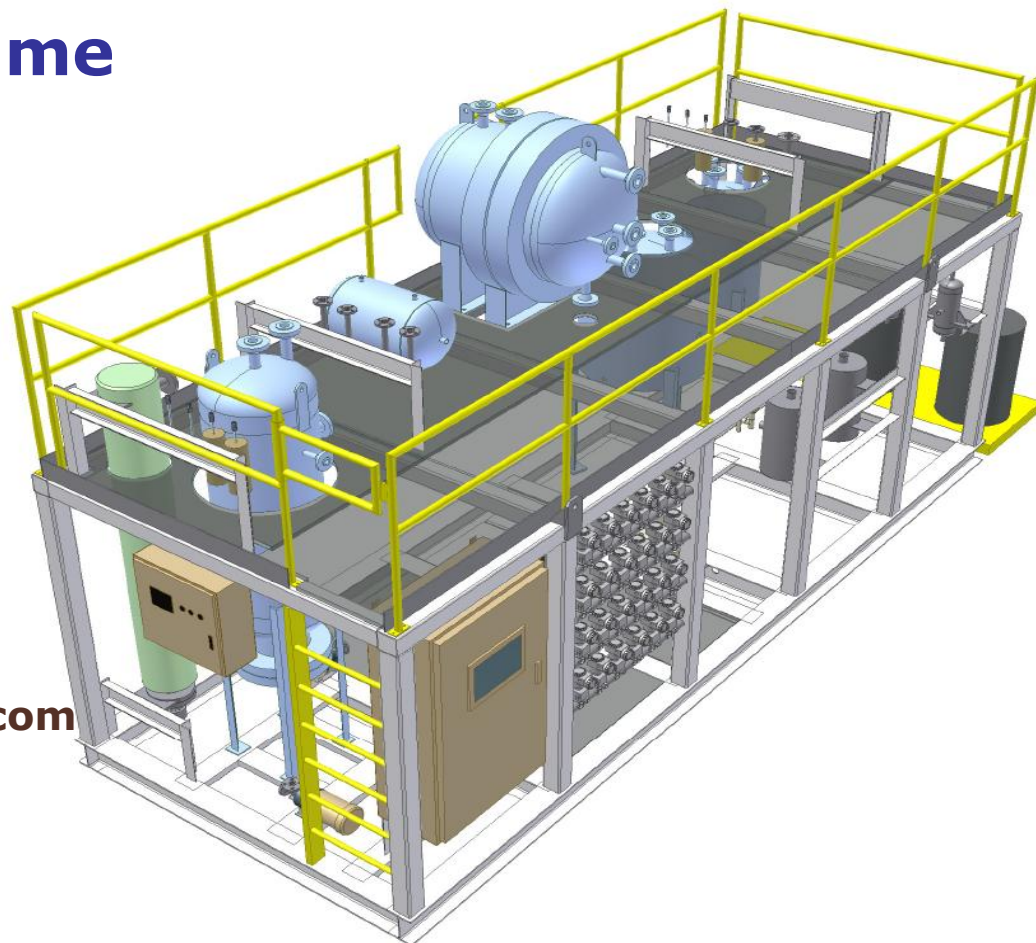


# Thank you for your time and attention

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- “Zero” Flaring
- Maximise cash flow from proven remote reserves
  - By creating a route to commercialisation
- Minimise capital expenditure
- Robust solution
  - Must be able to operate with minimum intervention
- Maintain operating licenses
  - Under pressure to stop flaring

**Microchannel GTL is **unique** in addressing all of these objectives**



## Problem...

- Remote wells
- Large variation in associated gas flow rate
- Gas flow rate does not merit standard solutions
  - Gas pipeline
  - LNG
  - Ammonia
  - Methanol
- Insufficient cluster of wells to facilitate standard solution
- EOR/reinjection not appropriate or desirable
  - Geology
  - Excessive drilling costs

Convert gas to syncrude and inject into crude handling system or collect and ship

- **Modular**

- Match facilities to present gas processing needs – add or remove modules as appropriate

- **Transportable**

- Small sized equipment facilitates construction in remote locations

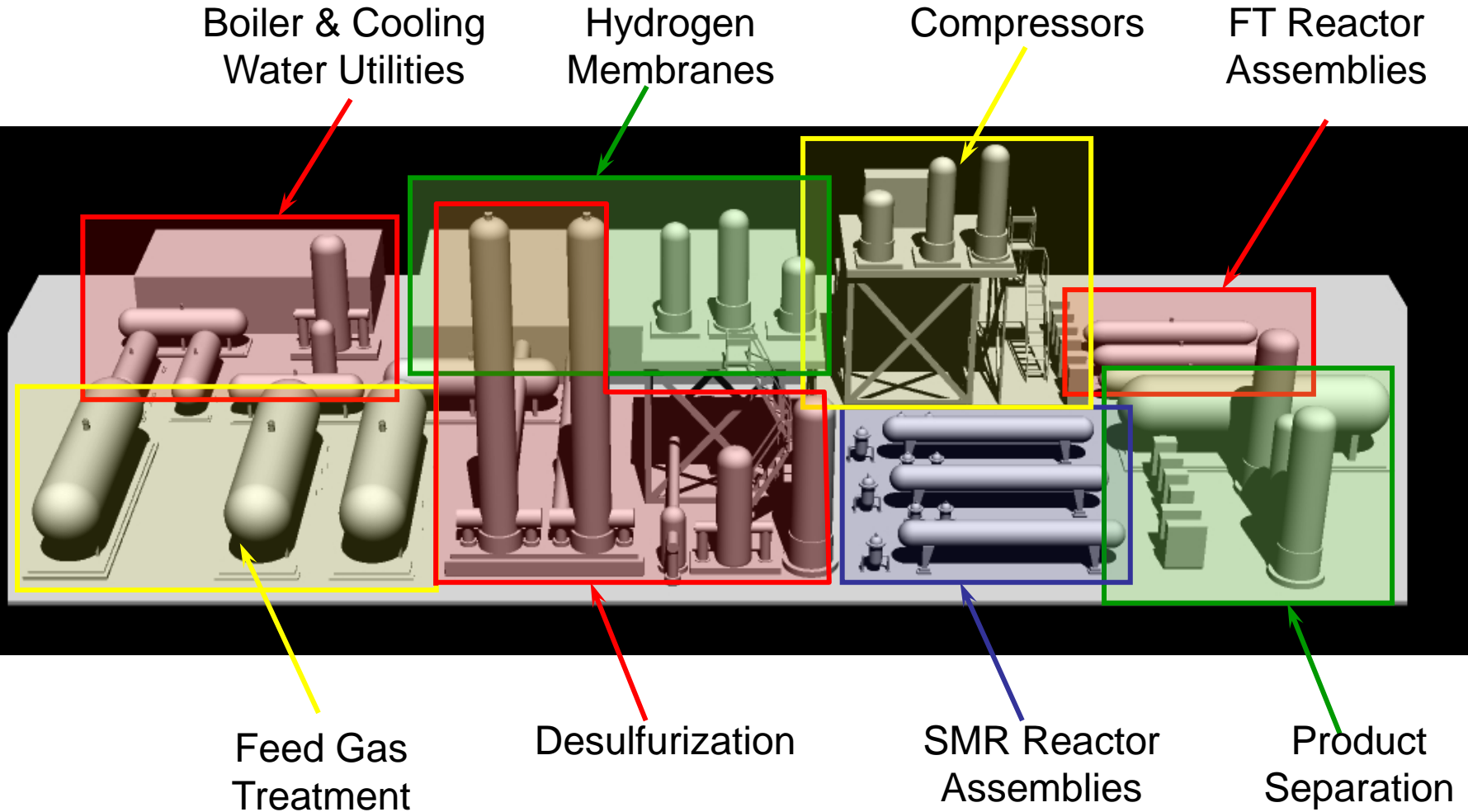
- **Robust and safe**

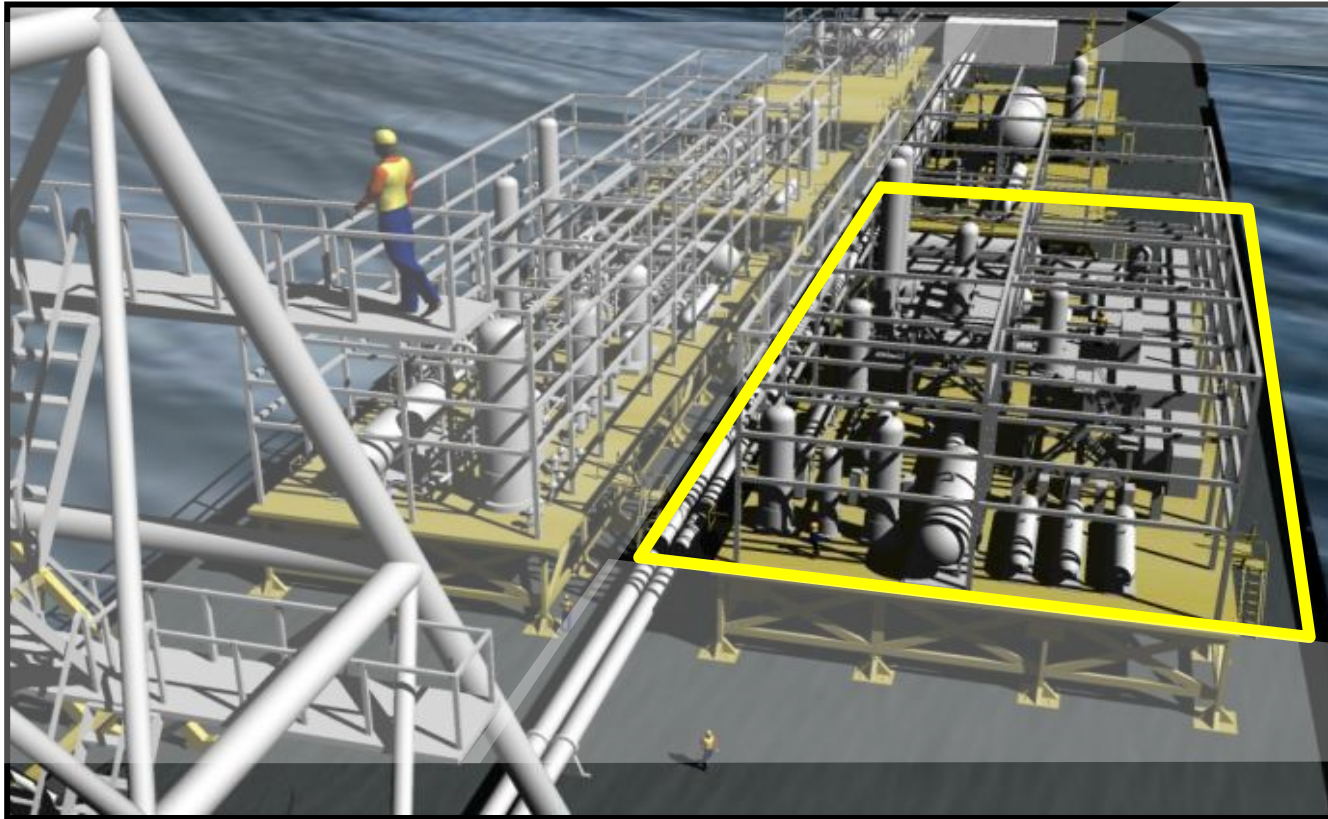
- Minimised handling and inventory of hydrocarbon gases maximises safety
- Integrated, “fixed bed” modular GTL process increases robustness

- **Economic**

- CapEx: \$4 / MSCFD (associated gas); \$60k / bpd (stranded gas)

# GTL FPSO Layout





2,000 BPD GTL Facility will occupy only ~1/4 of FPSO deck space

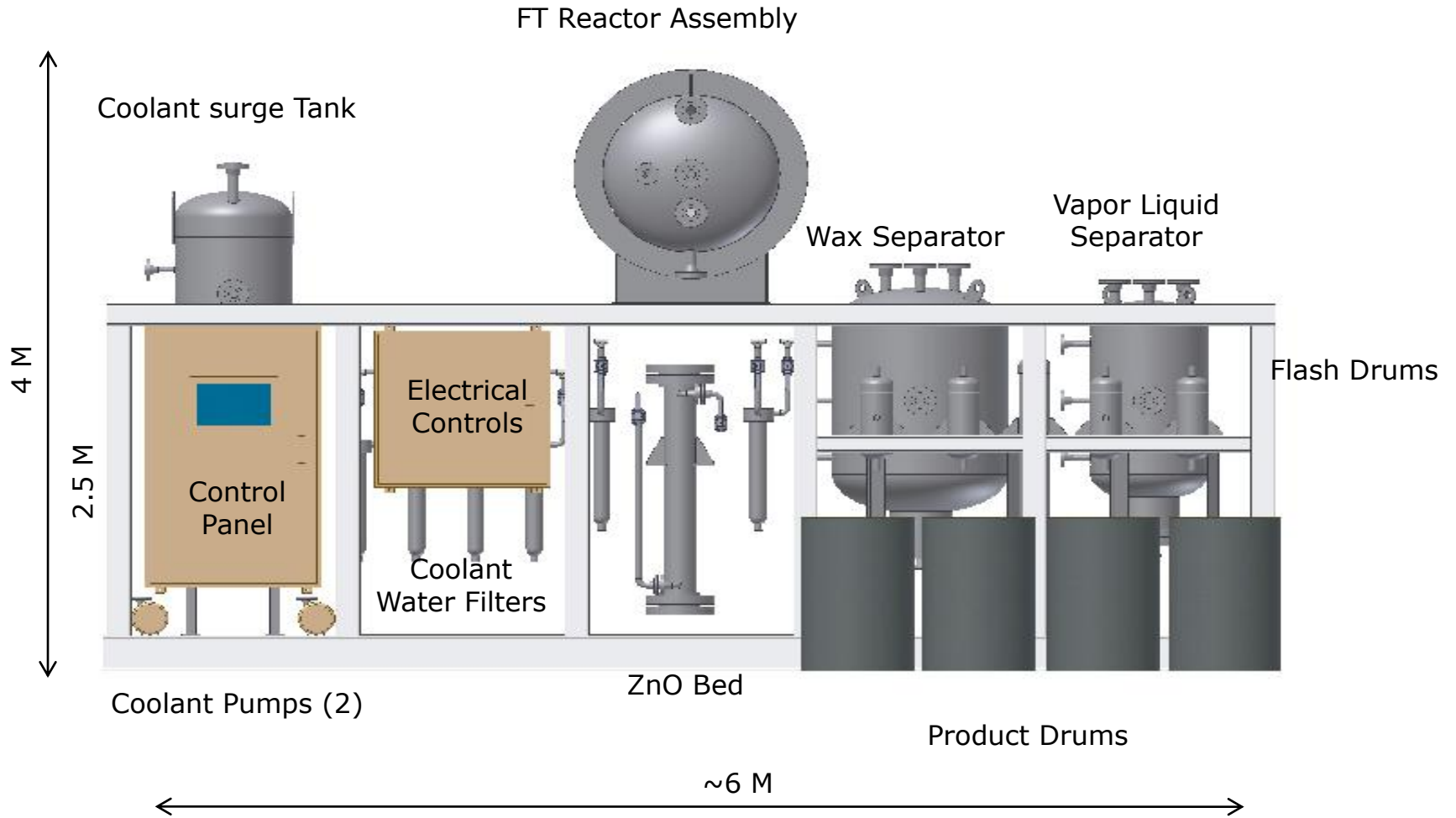


# AIR FORCE PROGRAM

- AF Goals:
  - **Accelerate development and use of alternative fuels**
  - Significantly increase use of synfuels in the next two years
  - **50% of fuel will be synfuels by 2016**
- Secretary of the Air Force request:  
Demonstration of F-T fuel in manned Air Force aircraft – accomplished in a B-52
- Air Force Materiel Command (AFMC) is lead organization
- AFMC to define steps after demo
- **Partner with industry to facilitate development of U.S. synfuel industry**



**Air Force target is ~400 million gallons/year of fuel by 2016**



## Velocys FT Demonstration Skid

MUSCAT 10-11 MAY 2010



REGIONAL FORUM





FT Demonstration Skid currently being installed at Güssing biomass gasification facility for initial operation