RGF 2013 – Offshore Gas New Technologies

New technologies, sources of supply and optimisation of infrastructure ?

- What are the opportunities ?
- What holds them back ?
- What is needed to develop them ?

Rio Gas Forum 2013
Copacabana Palace Hotel
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A brief word about SyEnergy…

- Energy consultancy focused on strategy, business development and commercial issues
- 25+ years with Shell, ENI, Saipem, Centrica, Blue Power, Hoegh LNG, and Gas Strategies
- Advised clients on energy projects located in West, East & North Africa, South America, USA, Caribbean, Europe, Caspian, Indonesia and Australia.
- Strategy formulation, market entry plans, supply procurement, commercial negotiations
- Upstream and midstream gas/LNG/FLNG business development and commercialisation
- Gas supply planning, infrastructure development, domestic and export gas market studies
- Project contracts, sales & purchase agreements, price reviews, and dispute resolution
- Advice and implementation support focused on long term sustainable value creation
- Independent project assurance reviews and commercial due diligence
- Provision of bespoke energy training

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Opportunity Screening – Asset Location

Offshore Opportunity Size by Region

Onshore Opportunity Size by Region

≈ 800 Oilfields (Discoveries & On-stream)
with Problematic Associated Gas @ <50MMscf/d

Source: CompactGTL, Wood Mackenzie, Fugro Robertson Limited, Petroleum Economist

Opportunity Screening - Solution

Offshore Gas Disposal Solutions:

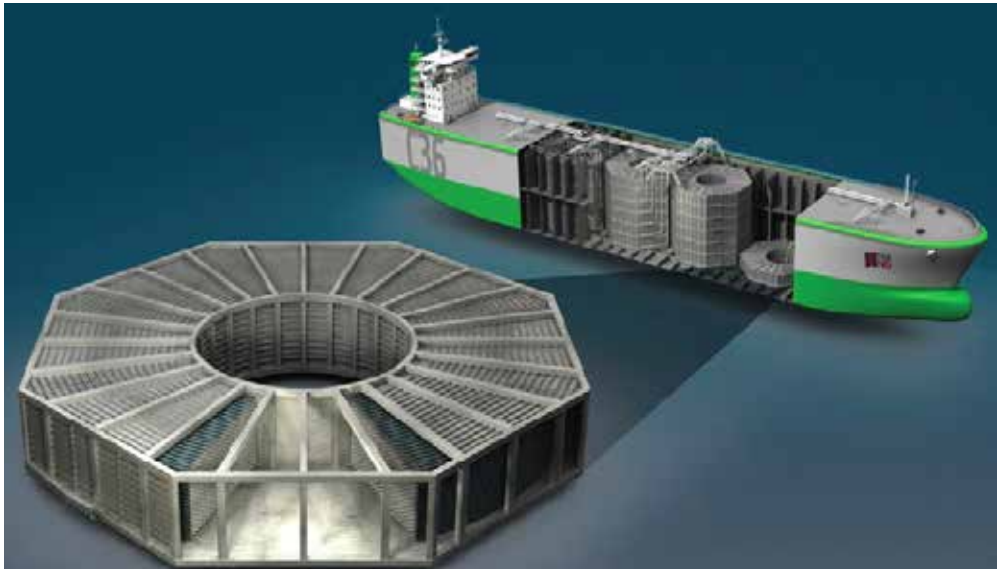
- Gas flaring: *impossible in new fields due to legislation*
- Gas injection: *not feasible everywhere and has some downsides*
- Pipe gas to shore: *costly and many domestic gas markets are commercially unfeasible*

Offshore Gas Valorisation Solutions:

- ~25 – 50 Mmscf/d — Small scale GTL (2-4K bbl/d, 32-64 Kbbl/d oil production)
- ~75 – 150 Mmscf/d — Small scale FLNG (0.5 – 1.0 Mtpa)
- ~300 – 600 Mmscfd/d — Pipeline to shore or FLNG (2.0 – 4.0 Mtpa)
- ~800 – 1,600 Mmscf/d — Onshore LNG Plant (5-10 Mtpa)
- ~1,600 Mmscf/d — Onshore GTL Plant (140,000 bbl/d)

Important stakeholder mindset change required…
valuable opportunity development vs. problem disposal

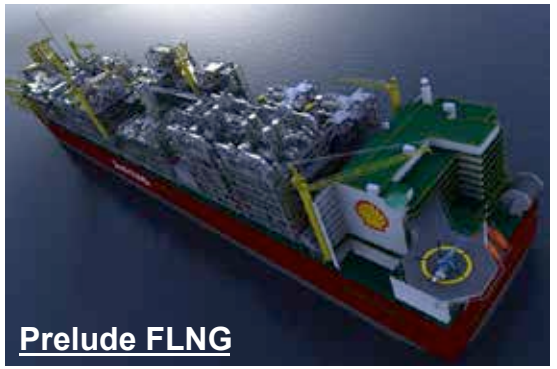
Offshore gas production & delivery systems



Source: FLNG producer, LNG tanker and FSRU ship designs provided by Höegh LNG AS, CNG ship designs provided by SeaNG Corporation, GTL FPSO by CompactGTL, Sumitomo Corporation, and SBM Offshore.

LNG Final Investment Decisions

2008	Gassi Touil (Algeria) – 5 Mtpa
2009	Gorgon (Australia) – 15 Mtpa
2010	PNG LNG (Papua New Guinea) – 6.6 Mtpa QCLNG (Australia) – 8.6 Mtpa
2011	Donggi Senoro (Indonesia) – 2.0 Mtpa Gladstone LNG (Australia) – 7.8 Mtpa AP LNG Train 1 (Australia) – 4.5 Mtpa **Prelude FLNG (Australia) – 3.6 Mtpa** Wheastone (Australia) – 8.9 Mtpa
2012	Ichthys (Australia) – 8.4 Mtpa AP LNG Train 2 (Australia) – 4.5 Mtpa **Petronas FLNG (Malaysia) – 1.2 Mtpa** **Pacific Rubiales FLNG (Colombia) – 0.5 Mtpa** Sabine Pass (USA) – 9.0 Mtpa


Prelude FLNG


Pacific Rubiales FLNG

Source: International Gas Union, PFC Energy, ICIS

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- What are the opportunities ?
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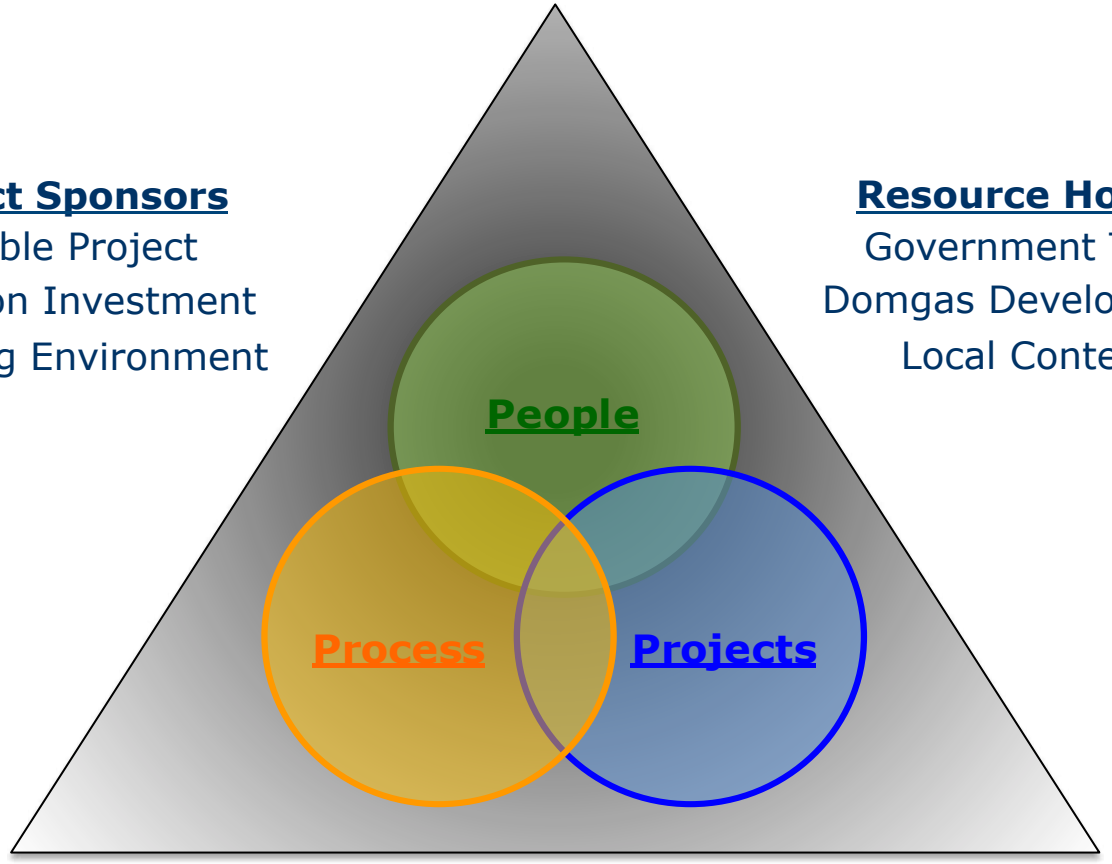
What holds back offshore gas development ?

Project Sponsors
Feasible Project
Return on Investment
Operating Environment

Resource Holder
Government Take
Domgas Development
Local Content



Financial Community
Legal & Fiscal Stability
Sustainable Development
Robust Cash-Flow

What holds back offshore gas development ?

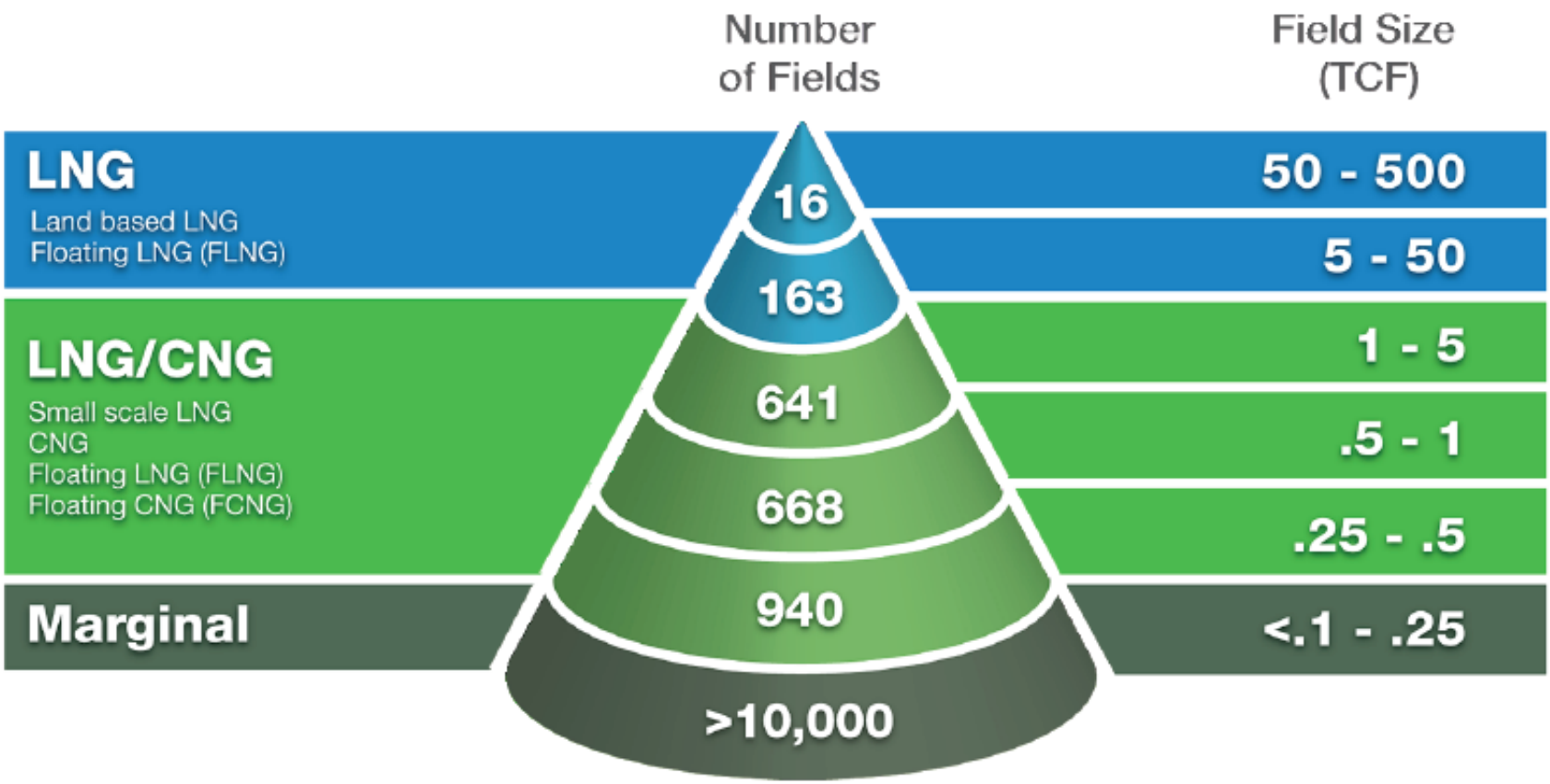
PROJECT IDENTIFICATION | **PROJECT REALISATION** | **PROJECT OPTIMISATION**

Evaluation → Selection → Definition → Execution → Governance → Portfolio Mgmnt

"Choose the right project" | **"Execute the project right"** | **"Manage right the project"**

Source: Economist

What holds back offshore gas development ?



Offshore gas project complexity is <u>not</u> a function of size…
… it is a function of the difficulty to align all the stakeholders !

Source: EIA / IEO 2011, WoodMac, ENI World Oil & Gas Review 2010-11

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Offshore Gas LNG and FLNG Toolbox

	On-shore LNG	FLNG	sFLNG
Min Size Economic Feasibility	~5 - 10 Mtpa	~2-4 Mtpa	~0.5-2.0 Mtpa
Reserve Requirement (20 years)	5 - 10 Tcf	~2 - 4 Tcf	~0.5 - 2 Tcf
Gas Supply	Upstream Portfolio (AG & NAG)	Single or Multi-field	Single
Gas Transmission System	Multi-Field System	Direct from Field(s)	Onshore or Offshore
On-Shore Facilities	Liquids, Utilities, Living, Roads, etc.	All in FPSO and/or Platform	All in Barge and/or Platform
Storage & Jetty	~2 LNG Tanks & Expensive Jetty	LNG FPSO	Barge and/or LNG Tanker
Loading / Unloading Operations	Channel Traffic, Tugs, Port Fees	Side by Side, Tandem, Flex. Hoses	Side by Side, Tandem, Flex. Hoses
Liquefaction Tech Providers	APC, CoP, Shell, Linde, Axens	APC, Shell, B&V PRICO	B&V PRICO, Nitrogen Expander
Sponsors & Business Model	Multi-Party JV, Vertically Integrated	Multi-Party JV, New Models	Single JV, New Models
Liquefaction Service Fee	Unlikely. EPC Plant. JV Ops Control	FPSO Provider Charter & Operation	Operated/Leased or Buyer Financed
Project Permitting	Large Site, Safety Contours, NIMBY	Normal FPSO	Barge
Start-up after FID	~36 - 60 months	~48 months	~36 months
Typical $/tonne	~ $1,200 - $1,800	~$1,500	~$700 - $1,000

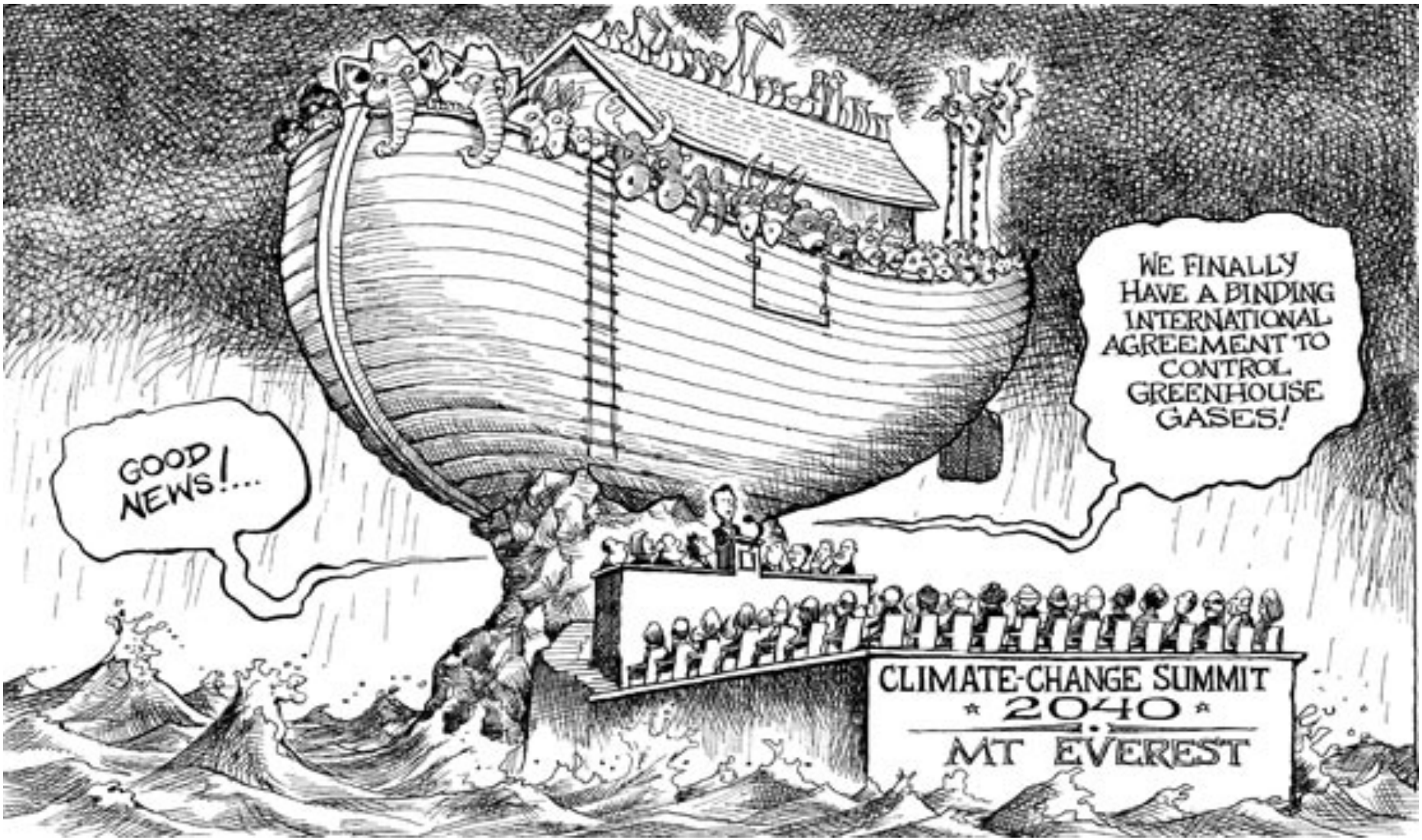
Thoughtful matching of solution to the upstream asset

Fresh thinking out of the tool box…

- Governments need to be proactive with legislation and fiscal framework
- Stability of rules and sanctity of contracts is not a luxury
- Think forwards from the asset… or backwards from the solution ?
- Get it right the first time around – limited flexibility to absorb big mistakes
- Offshore gas needs lots of KISSes… minimalist drive with safety
- Mindset change from disposal solution to opportunity and value creation
- "Insanity = doing the same thing over and over again expecting different results"
- "You miss 100% of the goals you do not kick the ball"
- "Creativity is thinking up new things. *Innovation is doing new things"*
- "Management is doing things right; *Leadership is doing the right things*"

Source: Luis Steuer/Albert Einstein, Theodore Levitt, Peter Drucker

Decision making with a sense of urgency…



Source: Economist

Conclusions

- Offshore gas growth is not constrained by lack of natural gas resources
- Stakeholders mind set needs to change to opportunity/value creation
- Invest in quality front-end conceptual design
- Develop durable solutions anticipating key issues
- Offshore gas solutions can reduce gas flaring… synergies can be developed with onshore and offshore O&G assets
- Offshore gas solutions can add value to E&P focused companies and all stakeholders by unlocking reserves… accelerating production…
- *Doing the right innovative things* = competitive advantage

Thank You !

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