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Can the SEA FLNG Approach Monetise Small Australian Stranded Gas Resources?

F. Piasentin – Facilities Consultant
SUT Technical Meeting, Perth 19th August 2015



Purpose and Disclaimer



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- + SEA FLNG projects: a different approach to gas developments
- + S2V Consulting FLNG experience in Malaysia
- + This presentation is our view on the future of FLNG
- + Information from the public domain
- + FLNG is a novel technology
- + Project references are still uncertain
- + Oil and gas market volatility

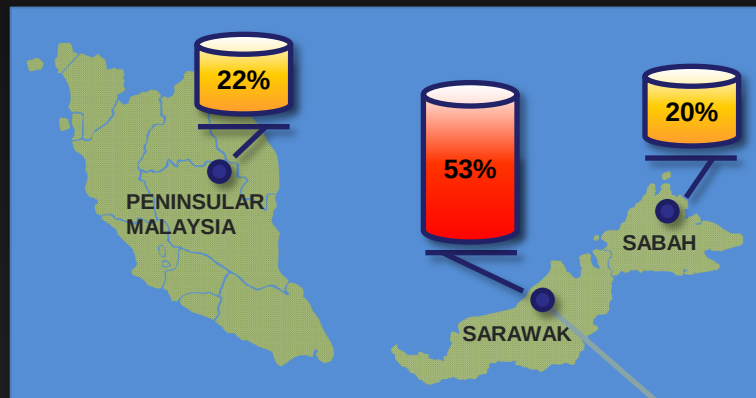
Malaysia Reserves Map



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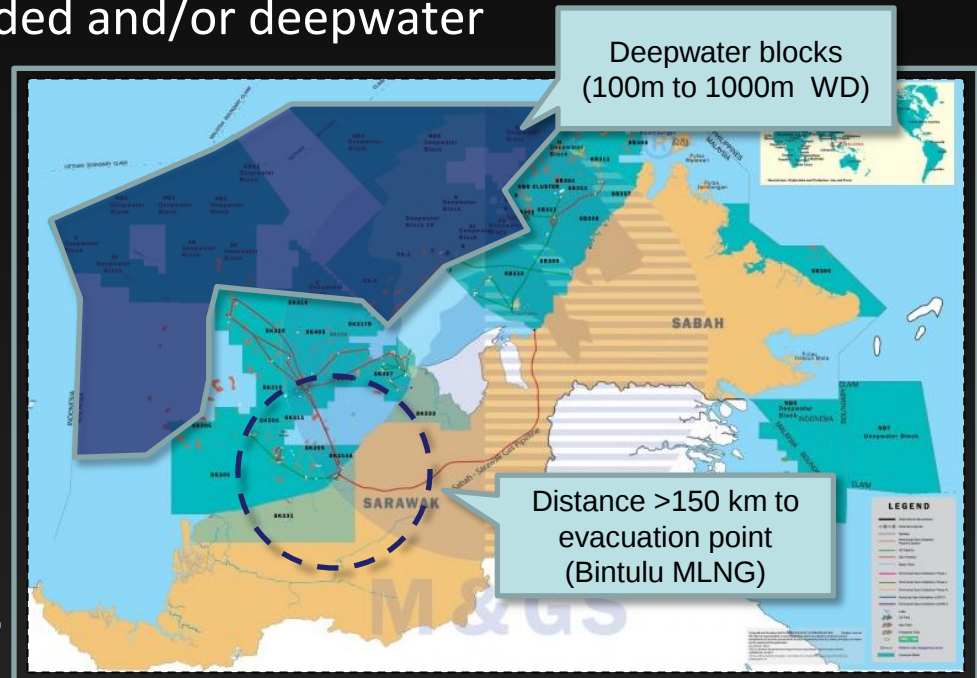
- + Remaining Commercial Gas Reserves (2P): 35 tcf
- + Sarawak holds >50% of the remaining reserves
 - ▶ Average field size: <1.5 tcf
 - ▶ 86% of these fields are stranded and/or deepwater

MALAYSIA REMAINING COMMERCIAL GAS RESERVES BY REGION



Others: 5%

Source: Woodmac Malaysia Country Overview, Feb 2015



Malaysia Gas Monetisation Challenges



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- ✓ **Small reservoir size**
- ✓ **Distance from gas evacuation infrastructure**
- ✓ **Deepwater, off shelf remaining reserves**
- ✓ **Processing complexity(sour gas)**
- ✓ **Bintulu MLNG is the only practicable gas evacuation in Sarawak**
 - All existing 9 trains are at full capacity up to 2023
 - 10th train planned but not yet confirmed (not sufficient reserves)
 - MLNG gas gathering infrastructure is strongly controlled by one Operator
- ✓ **Limited domgas demand in the Sarawak / Sabah region**
 - Sabah-Sarawak pipeline to MLNG is only a partial mitigation

Petronas sees FLNG as a solution to monetise marginal gas fields



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**SMALL GAS
RESERVOIR
(<1.5 tcf)**

+

**STRANDED
and /or
DEEPWATER**

=

**MARGINAL
GAS FIELD**

Petronas focused on small FLNG to unlock these opportunities

+ 2 FLNGs are currently in execution

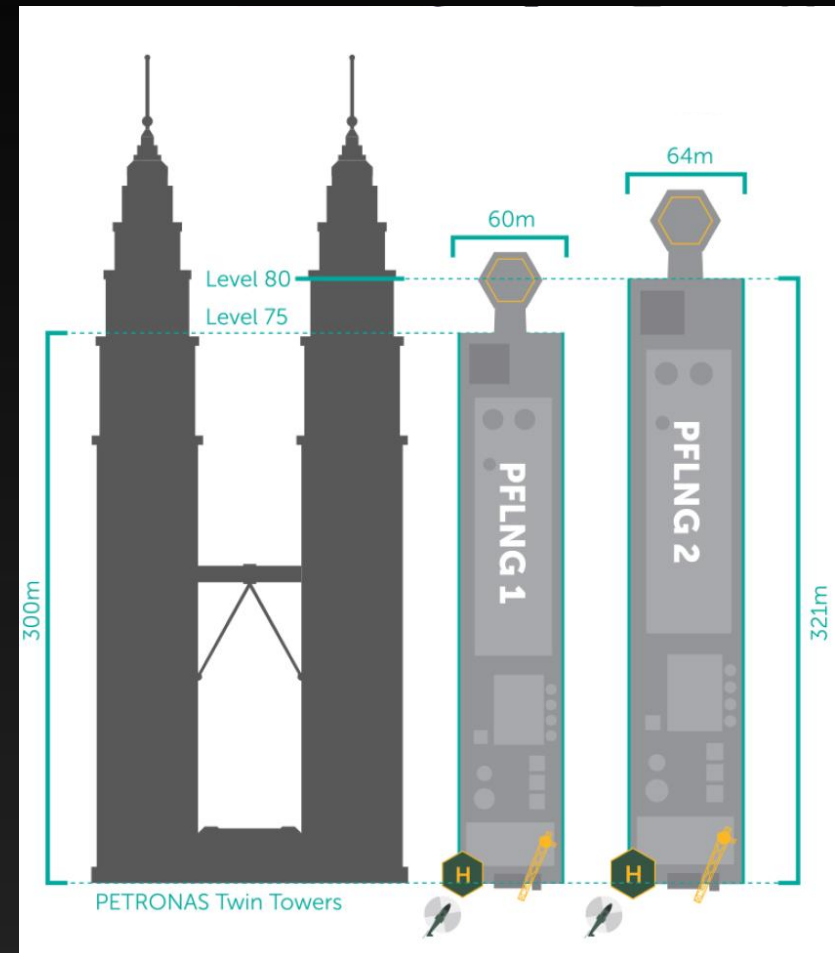


Malaysia FLNG Solution



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	PFLNG1	PFLNG2
Location	Kanowit Gas Field, 180km offshore Bintulu, Sarawak	Rotan Gas Field, 240km offshore Kota Kinabalu, Sabah
Reserves	N/A	950 bcf
Capacity	1.2 MTPA	1.5 MTPA
Award	2Q 2012	1Q 2014
Est. 1 st LNG	1Q 2016	1Q 2018
Hull Size	300m (L) x 60m (W) x 33m (D)	321m (L) x 64m (W) x 31m (D)
LNG Storage Capacity	177,000 m3	177,000 m3
FLNG Mooring	External Turret	External Turret
Loading	Side by Side	Side by Side
Water Depth	70m-200m	500m-1500m
Design Life	20 years	20 years
LQ	100-150 pax	100-150 pax



Source: Petronas Press Releases

A step change in the marginal field development landscape



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CONVENTIONAL GAS UPSTREAM DEVELOPMENT PHASES

GATHER



PROCESS



EXPORT TO SHORE



LIQUEFY / DOMGAS



FLNG

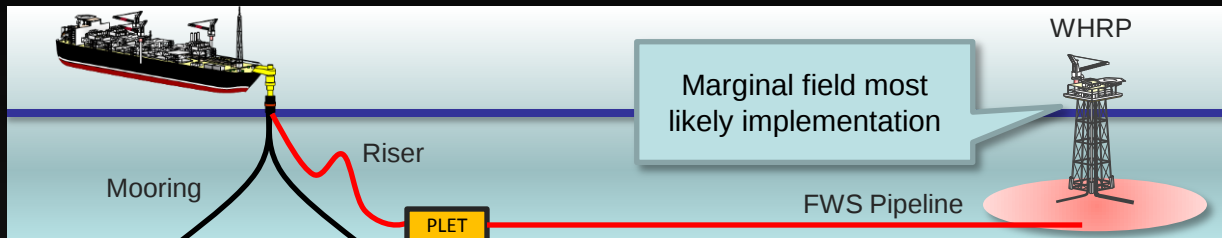
An integrated facility merging process, export and liquefaction functionalities into one single asset.

Field Development Configurations

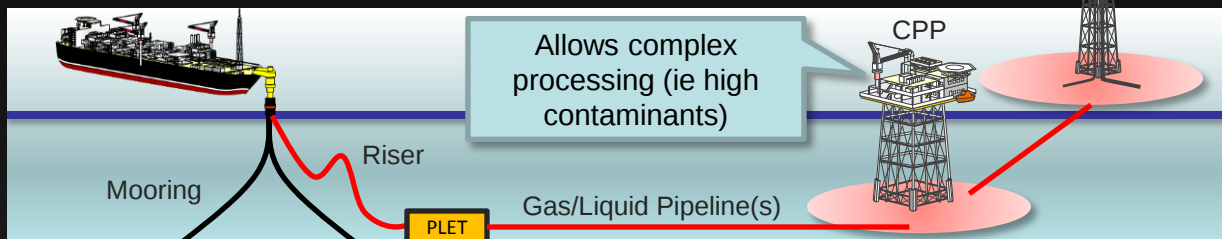


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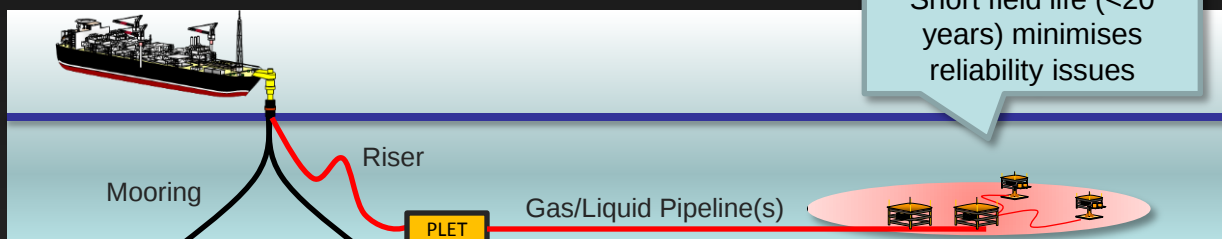
1 FLNG + WHRP/Subsea Gathering



2 FLNG + CPP + WHRP Gathering



3 FLNG + Subsea Processing



A SIMPLIFIED DEVELOPMENT

NO 3RD PARTY PROCESSING OR EVACUATION

STORE/SELL BOTH GAS AND LIQUIDS

PROCESS FACILITIES ARE CLOSER TO WELLS

- Less dependence on chemicals
- Reduce slugs and liquid hold-up risks
- No need for compression
- Allows implementation of alternative hydrate management technologies (DEH)

REDUCE ENVIRO IMPACT AND DECOMMISSIONING LIABILITIES

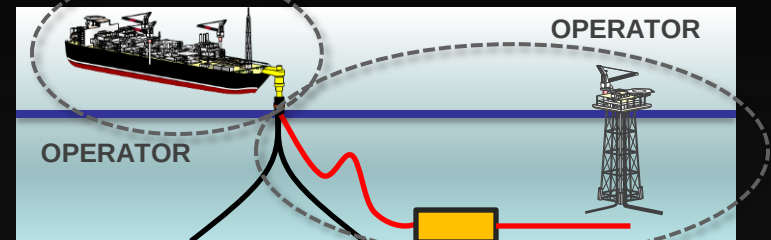
New contracting strategies for gas developments



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1 OPERATOR FULLY OWNED

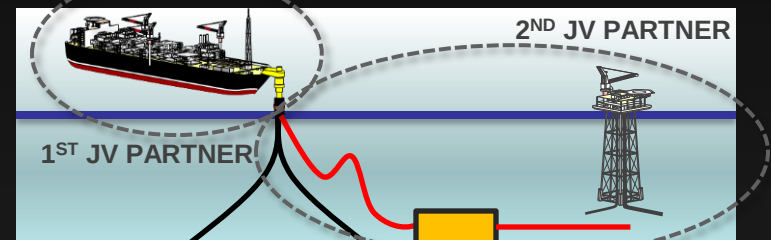
Operator owns and operates the FLNG + gathering infrastructure



2 JV MODEL (PFLNG 1 & 2)

1st JV partner owns and operates the FLNG. Gathering infrastructure is owned and operated by a 2nd JV-partner

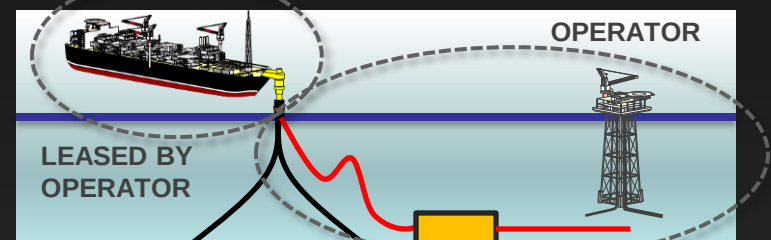
- 2nd JV partner responsible for exploration and development drilling
- Battery limit at the turret
- 2nd JV partner sells gas at the battery limit
- FLNG operations commoditised & paid via adjusted gas price



3 LEASED MODEL (GOLAR)

Operator leases FLNG (bare vessel + O&M) + owns and operates gathering infrastructure

- Operator responsible for exploration + development drilling
- FLNG operations commoditised
- Similar to FPSO model



Golar Leased FLNG Solution



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✓ **WORLD'S FIRST-OF-ITS-TYPE
CONVERSION OF A LNG CARRIER**

✓ **FIRST LEASED FLNG**

KEY BENEFITS

- + -50% CAPEX vs new built FLNG
- + -30% execution duration vs new built FLNG
- + Leased option minimises upfront investment

Golar has recently awarded on speculation a third vessel (Gandria) to Keppel shipyard for conversion



Source: Golar / Ophir Press Releases, 2015

	Hilli	Gimi
Location	Kribi Project, Cameroon	Fortuna Project, Block R, Equatorial Guinea
Operator	Perenco	Ophir
Reserves	500 bcf	2.5 tcf
Capacity	1.2 MTPA	2.2 MTPA
Award	3Q 2014	3Q 2016 (est.)
Est. 1 st LNG	2Q 2017	2Q 2019 (est.)
Vessel	Converted LNG tanker (Keppel shipyard)	Converted LNG Tanker (Keppel shipyard)
LNG Storage Capacity	125,000 m3	125,000 m3
Field Life	<10 years	<20 years (est.)

6 Reasons to choose small FLNG for marginal developments



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1 Access remote fields

- No pipelines
- No dependency on 3rd party tie-backs, ullage constraints
- Floating facility fits deepwater scenarios

4 Deliver cheaper and faster

- Monetise reserves otherwise non-economic
- Reduce upfront CAPEX and cashflow
- Faster schedule vs grass root facility
- Get enviro approvals more easily

2 Design one, build many

- Modular, standardised design
- Build in smaller yards
- Economy of scale
- Avoid Gold Rush

5 New contracting strategies

- JV-model facilitates small/mid cap operators
- Broadens range of involved service providers
- Lease opportunity
- Commoditise technology

3 Use over multiple fields

- Relocate FLNG, produce multiple fields
- Develop spread reserves
- Allow project phasing
- Early production system for large fields

6 New commercial options

- No 3rd party tariffs or O&M liabilities
- Avoid gas export infrastructure - offload directly to LNG tanker
- Control gas price and marketing

Malaysian vs Australian FLNG Concepts: A matter of scale



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	Small Scale FLNG	Large Scale FLNG
Capacity	<2.0 mtpa	>3.0 mtpa
Required Gas Reserves	0.5-2.0 tcf	>3.0 tcf
Field Life	5-10 years	> 20 years
Storage Capacity	<180,000 m3	<250,000 m3
Fab. Yard Scale	Small/Medium	Large
Est. Total Project CAPEX	< US\$ 3.0 billion	> US\$ 10.0 billion
Est. Project Duration (FID to 1 st LNG)	3.5-4 years	>5 years
Employment	Marginal fields	Giant fields
Participants	O&G small/mid cap	O&G large cap only
Examples	PFLNG, Golar	Prelude

Gas Processing and Liquefaction Capacity

3.6 mtpa

Prelude FLNG



Petronas PFLNG 1



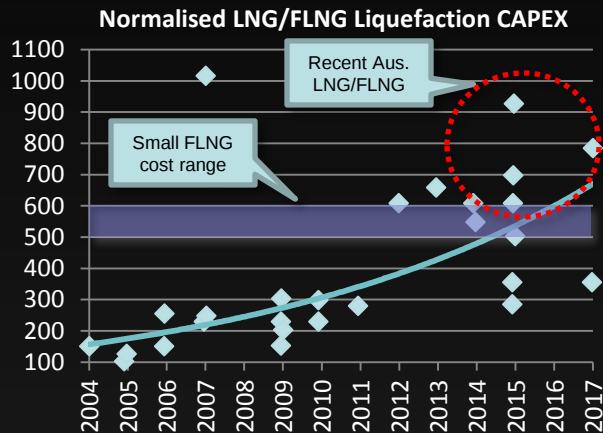
1.2 mtpa

Malaysian vs Australian FLNG Concepts: Three key differences



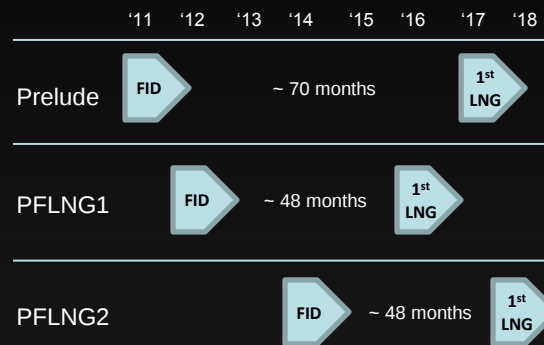
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1. CHEAPER LIQUEFACTION COST



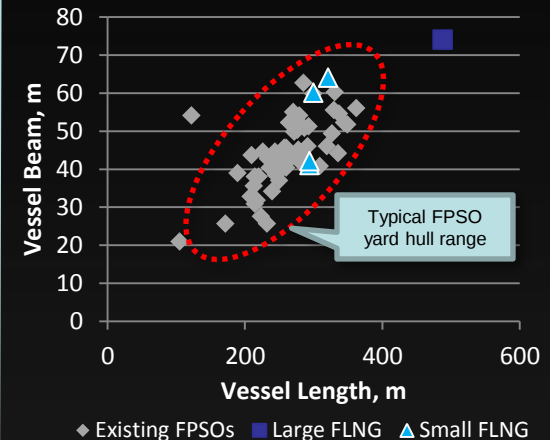
- **Gold-rush effects:** Liquefaction CAPEX increased more than average upstream cost escalation (UCCI)
- Australian LNG & FLNG projects are on the **upper cost band**
- Estimated Small FLNG cost (US\$/tpa) is **below recent assets range**, 30% cheaper

2. FASTER EXECUTION SCHEDULE



- **30% shorter execution schedule**
- Smaller size reduces design and fabrication complexity
- Allows use of modular, standard liquefaction equipment
- Transfer of lessons learned
- Uncertainty over commissioning and start-up phases

3. ACCESS MORE FABRICATION YARDS



- Small FLNG vessels fit within a **wider range** of fabrication yards
- Opportunity to use yards with **experience in FPSO & LNG tankers** fabrication
- **Risk reduction** due to less complex construction practices, predictable productivity and better established safety performance

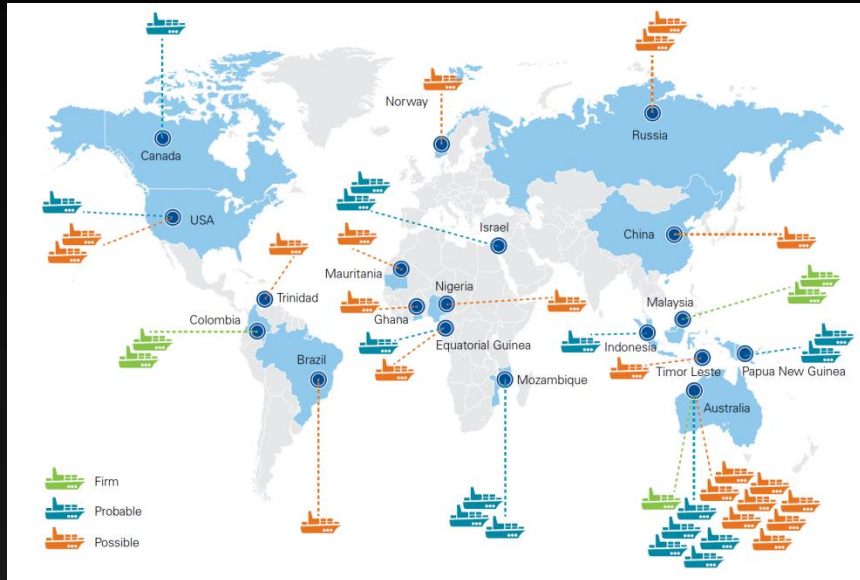
Sources: Oxford Institute for Energy Studies, 2014

Look Ahead



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FLNG PROJECTS WORLDWIDE



168 mtpa

**Total proposed
FLNG capacity**
as of early 2015

8.0 mtpa

**FLNGs Under
Construction**

Africa, Australia, Colombia,
Malaysia

FUTURE IS BRIGHTER FOR SMALL SCALE FLNGs:

- More marginal fields than giant fields
- Commoditised technology (FPSO model)
- More operators and service contractors involved
- Possible financing of FLNG as a standalone asset

RECENT OIL PRICE COLLAPSE IS NOT EXPECTED TO CHANGE THIS SCENARIO

- Petronas claims PFLNG can be economic on a 500 bcf field at 60 US\$/bbl
- FLNG re-use opportunity: rely on long term economics based on multiple marginal fields
- Need to control current liquefaction cost escalation but CAPEX will reduce with experience and increased number of projects

Sources: International Gas Union, World LNG Report 2015 Edition; KPMG International, Floating LNG Report 2014

4 Risks of FLNG projects



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1 As-yet unproven concept

- Novel design
- No robust cost/schedule basis
- Risk of budget / schedule escalation
- Know-how in the hands of few service providers
- No operating history

3 High production downtime

- Complex commissioning phase
- Lack of operations experience

2 Smaller means higher safety risk

- All processing equipment in close proximity
- Susceptible to escalation
- Safety risk will increase operations complexity

4 Global gas market instability

- LNG demand and price
- Operators less inclined to novel concepts
- Ability to establish long term sales contracts due to small reserves and plateau production

Australia has the conditions to implement the small FLNG model



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Stranded gas

- Fields with <2tcf reserves
- Spread >2tcf fields that could be phased



LNG and future FLNG operating know-how



Deepwater fields

- Established subsea technical know-how



LNG sales intelligence

- Developed by local operators and partners (WEL, Chevron, Inpex and other Japanese companies)
- Easier to market smaller LNG quantities



Operators will favor more cautious investments in the future

- Many recent projects experienced severe budget overruns



First agreements for 3rd party upstream tie-backs are appearing

- 3rd party Hess feed stock into Woodside Karratha
- Woodside Julimar/Brunello field tie-back to Chevron Wheatstone

Conclusions



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- 1** | **SMALL FLNGs ADD VALUE TO MARGINAL AND STRANDED OFFSHORE GAS RESOURCES OTHERWISE UNECONOMICAL TO DEVELOP**
- 2** | **AUSTRALIA APPEARS AN IDEAL REGION TO EMPLOY THE SMALL FLNG MODEL**
- 3** | **NEAR TERM FLNG OPERATIONS WILL DETERMINE FURTHER INVESTMENT CONFIDENCE**



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THANK YOU