

#### **ASX/MEDIA RELEASE**

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#### CHINA INTERNATIONAL LNG CONFERENCE TECHNICAL PRESENTATION

The Directors of Liquefied Natural Gas Limited ("*Company*") (ASX Code: LNG) are pleased to provide a copy of the Company's presentation to the China International LNG Conference, held in Beijing last week.

The Conference was hosted by China National Petroleum Corporation and its wholly owned subsidiary China Huanqiu Contracting & Engineering Corporation ("*HQCEC*"). The Company will shortly complete the placement of 53,250,000 fully paid ordinary shares to HQCEC, which will result in HQCEC becoming the Company's largest shareholder (~19.9%).

The presentation was co-authored by the Company's Director and Chief Technical Officer, Mr Paul Bridgwood, and Senior Process Engineer, Dr Nimalan Gnanendran.

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# LNG Processing Efficiency in Next Generation LNG Plants

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Liquefied Natural Gas Limited, Perth, Australia.



LNGCHINA – China International LNG Conference, Beijing, China.

- Company Background.
- Liquefaction Technology Comparison.
- LNG Limited's OSMR<sup>®</sup> Technology.
- Mid Scale LNG Economics.
- Current Project Fisherman's Landing LNG, Australia.
- Questions.

# **Overview of LNG Limited**



- Australian Stock Exchange Code LNG
- Shares on Issue 267 million
- *Market Capitalisation* \$ AU 107 million (at \$ AU 0.40/share)
- Cash Reserves \$ AU 28 million, no debt
- Top 5 Shareholders 45.1% ownership
- Major Shareholder
  - HQCEC (Technology and EPC arm of CNPC) 19.9%

The above figures are post the HQCEC placement which is expected to be settled in early July 2011

# What does LNG Limited do?

- Develop mid-scale LNG projects to the global market.
- 'Energy-Link' concept:

Identify and then supply "fast-track" energy solutions to both gas suppliers and energy users.

### • In-house liquefaction technology:

#### **Optimised Single Mixed Refrigerant - OSMR® LNG Process**

- Iower capital cost;
- improved energy efficiency;
- shorter development and construction schedule; and
- Iower carbon emissions and reduced overall environmental impact.

### • Technology Patents:

Two provisional patents on liquefaction and Boil-off gas handling.

LNG Limited is a Mid-scale LNG Project developer <u>AND</u> a Technology provider

### LNG Plant Size & Liquefaction Technology

- Large Scale LNG Plants (> 3 mtpa)
  - ConocoPhillips Cascade Process
  - APCI C3/MR Process
  - Shell Dual MR

### Mid Scale LNG Plants (1~3 mtpa)

- LNG Limited OSMR<sup>®</sup> Process
- Small Scale LNG Plants (< 1 mtpa)</p>
  - Black & Veatch PRICO SMR Process
  - Hamworthy N<sub>2</sub> Expansion

### Liquefaction Technology Comparison



# **OSMR<sup>®</sup>** Process Schematic



### Main features of the OSMR<sup>®</sup> Process



The OSMR<sup>®</sup> LNG plant fuel gas usage is < 7%, for a low inert - methane rich Feed gas. This is 30% better than conventional LNG plants.

# 1. Aero-derivative Gas Turbines

- Improves fuel efficiency of gas turbine by 25%.
- No gear box, no helper motor, single-stage (no inter-stage cooler/scrubber).
- Smaller foot print and weight.
- Higher reliability and availability.
- Compact modular design reduces installation and commissioning time and ensures ease of maintenance.
- Aero-derivatives used in Darwin LNG Project in Australia and proposed for Floating LNG projects.

For OSMR 1.5 mtpa LNG Plant:

•GasTurbine: 2 x GE PGT25+G4 (site rating: 33.5 MW)

•Compressor : 2 x GE BCL805 (polytrophic efficiency: 87.7%)

# Thermal Efficiency vs. Specific Work of commonly used Frame drivers and Aero-derivative engines



Based on Frame 5C, 5D, 7EA, and 9E frame type drivers and GE PGT25+, LM6000, RR 6761, and RR Trent aero-derivative units.

# 2. Combined Heat and Power (CHP) Plant

Waste heat recovery using a OTSG from Gas Turbine exhausts.

Steam Turbine drivers for Ammonia Refrigeration Compressors.

Steam Turbine driven power generation.

Process Steam for heating:

- Amine re-boiler
- Mol. Sieve regen gas heater
- Fuel gas heater

Auxiliary boiler - End Flash Gas utilized as fuel.

Steam Turbines for OSMR 1.5 mtpa LNG Plant:

•Ammonia Compressor: 2 x 7.5 MW





CHP plants have been used in the Power industry for several decades

# 3. Ammonia Auxiliary Refrigeration

- Ammonia is commonly used for,
  - Industrial and commercial refrigeration.
  - Direct inlet air cooling of gas turbines in power industry.
- In the OSMR<sup>®</sup> Process,
  - Refrigeration power is provided by CHP plant so is substantially "free".
  - Cools MR and feed gas streams to increase LNG production by 20% - substantially "free".
  - Direct Cooling of GT inlet air to improve GT power output by 15%.

# The impact of ambient air temperature on the Gas Turbine LM2500 power.



# Why Ammonia?

• Higher latent heat allows smaller flow rates:

	Ammonia	Propane
Mass Flow Ratio	1.0	1.90
Volume Flow Ratio	1.0	1.30
Power Input	1.0	1.20

- Low swept volume in compressors, small piping and pumps.
- Higher heat transfer coefficients (twice as propane), reduces Cold Box and Condenser sizes.
- At -5°C/45°C, Ammonia has a higher Compression Co-efficient of Performance than Propane, requiring 20% less power.



At mid-scale, the best features of the large and small scale LNG plants can be implemented.

## LNG Plant Costs

Conventional LNG Plant costs vary depending on location but are exceeding \$ US1000/tpa.



 Mid-Scale OSMR<sup>®</sup> LNG plants provide better cost/tpa of LNG.

1.5 mtpa LNG Plant Cost	\$ US (m)
Engineering	29
Procurement	210
Construction	374
Other (incl contingency)	107
Total LNG Plant EPC	720

\$US 480/tpa of LNG for 1 Train
\$US 340/tpa of LNG for 2 Trains

# LNG Limited: Current Project

Fisherman's Landing LNG, Gladstone, Australia.

- 1.5 mtpa x 2 Trains.
- Environmental and site approvals completed.
- FEED review with HQCEC.
- Gas Supply and LNG offtake agreements in progress.
- FID by December 2011.\*
- First LNG Shipment July 2014 (30 months).

(\* Subject to gas supply)

Similar Mid-Scale project feasibility work being carried out for various parts of Australia and around the world.



# In Conclusion

- LNG Limited is an Australian mid-scale LNG developer and Technology provider.
- HQCEC (subsidiary of CNPC) has a shareholding of ~20% in LNG Limited.
  - Main features of the OSMR® LNG technology,
    - 1. Aero-derivative Gas Turbines and Efficient compressors;
    - 2. Combined Heat and Power (CHP) Plant;
    - 3. Ammonia Auxiliary Refrigeration System.
- LNG Limited is currently working on FEED for its Fisherman's Landing Project, with HQCEC.



### Disclaimer

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