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THE UNIVERSITY OF WESTERN AUSTRALIA

FLNG THE FLOATING PHENOMENON

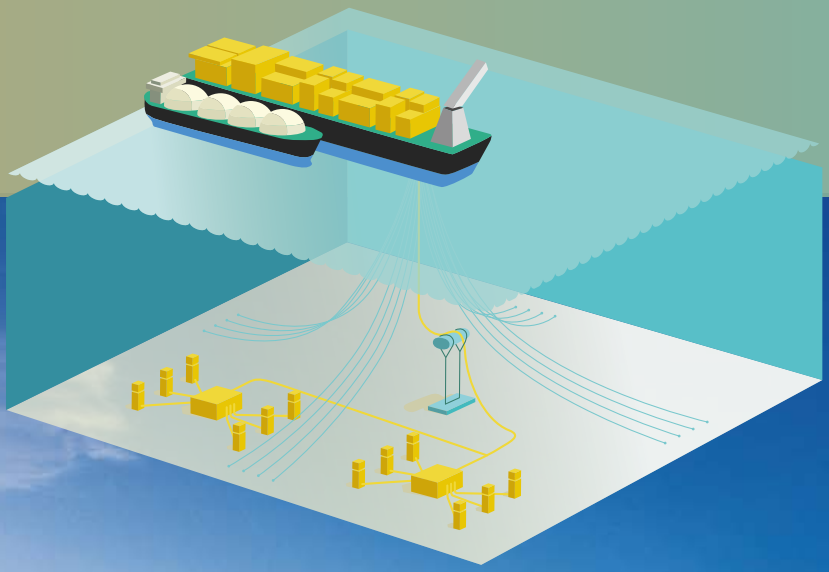
ECONOMIC IMPACTS, SUPPLY CHAIN OPPORTUNITIES AND WORKFORCE SKILLS

When we think of innovation, we typically think small scale incremental steps that improve productivity and reduce costs. Floating Liquefied Natural Gas is innovation on a grand scale and introduces a new development option for offshore gas production in the 21st Century.

FLNG is not the single solution to meet increasing global energy demand, but it will be an important option for future LNG developments. For Australia to maximise the potential benefits from FLNG we need to understand better the anticipated impact on our economies, the business opportunities available at all stages along the supply chain, and how best to prepare our workforce for the generational changes to come.

The University of Western Australia partnered with the oil and gas industry's peak body the Australian Petroleum Production and Exploration Association to commission a study that consolidates available industry information and analyses the potential benefits to the community stemming from the FLNG revolution.

The outcomes of the study, summarised here, will help governments, business, universities, and workforce planners build on Australia's growing global significance as an LNG producer and implement the continuous improvements essential to the sustainable growth of the sector.



AUSTRALIA WELL POSITIONED TO TAKE ON THE WORLD

The $200 billion investment in Australia's LNG production capacity over the past decade has put Australia at the forefront of global LNG supply. FLNG remains a strong candidate for the next generation of gas projects across our northern offshore basins.

Innovation and continuous improvement are critical to the Australian oil and gas industry's current position and its future competitiveness. In addition to the development of large scale production infrastructure in often remote locations, there is a healthy oil and gas research and development community in Australia with elements of global standing.

Our challenge is to ensure we remain at the forefront of innovation where we can be most competitive along the LNG supply chain. Collaboration is fundamental to success – with universities, industry and governments working together, each participant knowing their role, delivering better outcomes and supporting others to do their bit. It is through this collaboration that we will remain competitive.

Australia will soon host the world's largest floating LNG facility, Shell's Prelude FLNG project. As Prelude moves into production there will be ongoing opportunities for further innovation, research and technology development. As a nation we will also build a pool of expertise in the operation and optimisation of these facilities.

Australia's global standing as an LNG production hub will be a solid foundation for the further development of FLNG technology for deployment around the world. Our collaboration with APPEA on the FLNG study is an important one. From the findings we can increase our understanding about FLNG and use this information to plan effectively for the future and cement Australia's position as an industry world leader.

Professor Dawn Freshwater
Vice-Chancellor, The University of Western Australia

GAS EXPANDING AS A KEY PART OF GLOBAL ENERGY MIX

Australia is fortunate to have large reserves of gas available for development over the next century. While oil and coal usage are predicted to decline as a proportion of global energy supply, gas is likely to enjoy increasing demand – approximately 2% each year to 2040 according to the US Energy Information Administration.[1]

EIA forecasts natural gas consumption worldwide will increase from 120 trillion cubic feet (Tcf) in 2012 to 200Tcf in 2040. To meet demand, natural gas production is forecast to increase by nearly 69% to 2040.

LNG is an important part of this growth pattern, with global production predicted to more than double, from 12Tcf in 2012 to 29Tcf in 2040.

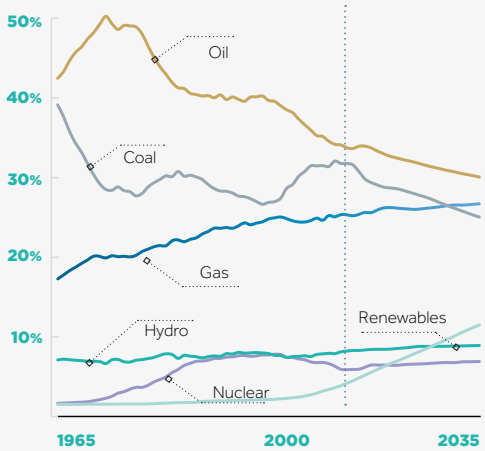
BP forecasts that 40% of the increase in global LNG supply is expected to occur over the next 5 years - equating to a new LNG train coming on stream every 2 months. By 2035, LNG will surpass pipeline imports as the leading form of internationally traded gas.[2]

Almost all of the projected increase comes from investment decisions already taken. Without any new final investment decisions on the horizon, LNG supply is expected to tighten by the mid-2020s.[3]

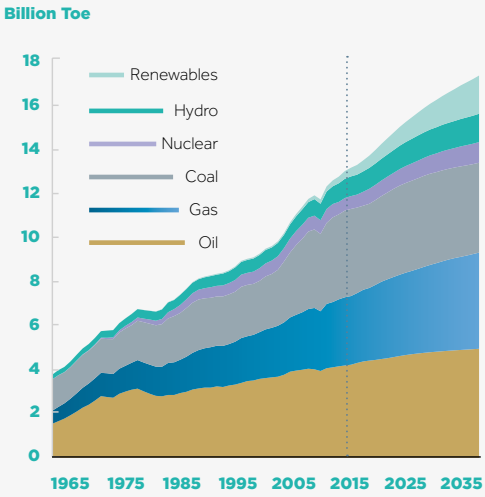
In a fluid and competitive global LNG market, FLNG offers proponents flexibility in development options for remote and smaller offshore gas fields.

While there has been a decline in oil prices and related cuts in oil and gas industry budgets, Douglas-Westwood forecasts global capital expenditure for FLNG vessels to be US$24.5 billion from 2015 to 2022.[4]

Share of primary energy



Primary energy consumption by fuel



Source: *BP Energy Outlook 2017*, Base Case: Primary energy

FLNG developments

Globally there are 13 FLNG facilities under construction, planned and under consideration.[5] The current downward pressure on prices has led to some projects being delayed rather than abandoned. There are 4 FLNG facilities under construction for waters offshore Australia (Prelude), Malaysia (PFLNG2), Colombia (Caribbean) and Cameroon (Cameroon).

In November 2016, the Petronas FLNG1 began the commissioning process and looks set to become the world's first commercial FLNG vessel. The 360m long, 60m wide PFLNG-1 is deployed at the Kanowit field offshore Sarawak, Malaysia.

The Shell operated Prelude FLNG project off the north-west coast of Australia is expected to be the next FLNG project to come into production. Prelude FLNG is the largest, both in terms of production (3.6Mt/a) and size. At 488m long it will be the largest floating production facility in the world.[6]

References:

1 *International Energy Outlook*, US Energy Information Administration, May 2016, p.37. http://www.eia.gov/forecasts/ieo/pdf/0484(2016).pdf
2 *BP Energy Outlook 2016*, p.35. https://www.bp.com/content/dam/bp/pdf/energy-economics/energy-outlook-2016/bp-energy-outlook-2016.pdf
3 International Energy Agency, *Medium-Term Gas Market Report 2016: Market Analysis and Forecasts to 2021* http://www.iea.org/Textbase/npsum/MTGMR-2016SUM.pdf
4 *World FLNG Market Forecast 2015-2021*, Douglas-Westwood July 2015, p.11. http://www.douglas-westwood.com/report/oil-and-gas/world-flng-market-forecast-2015-2021/
5 *Floating LNG: Evolution and Development Wallchart*, Petroleum Economist, March 2016. http://store.petroleum-economist.com/Wallchart-Floating-LNG-Evolution-and-Development-p/mpem313.htm
6 http://www.shell.com.au/aboutshell/who-we-are/shell-au/operations/upstream/prelude/by-numbers.html

WHAT IS FLNG?

FLNG combines proven upstream, LNG and marine technologies to allow for the production, liquefaction, storage and transfer of LNG at sea. FLNG offers proponents flexibility in development options for remote and smaller offshore gas fields.

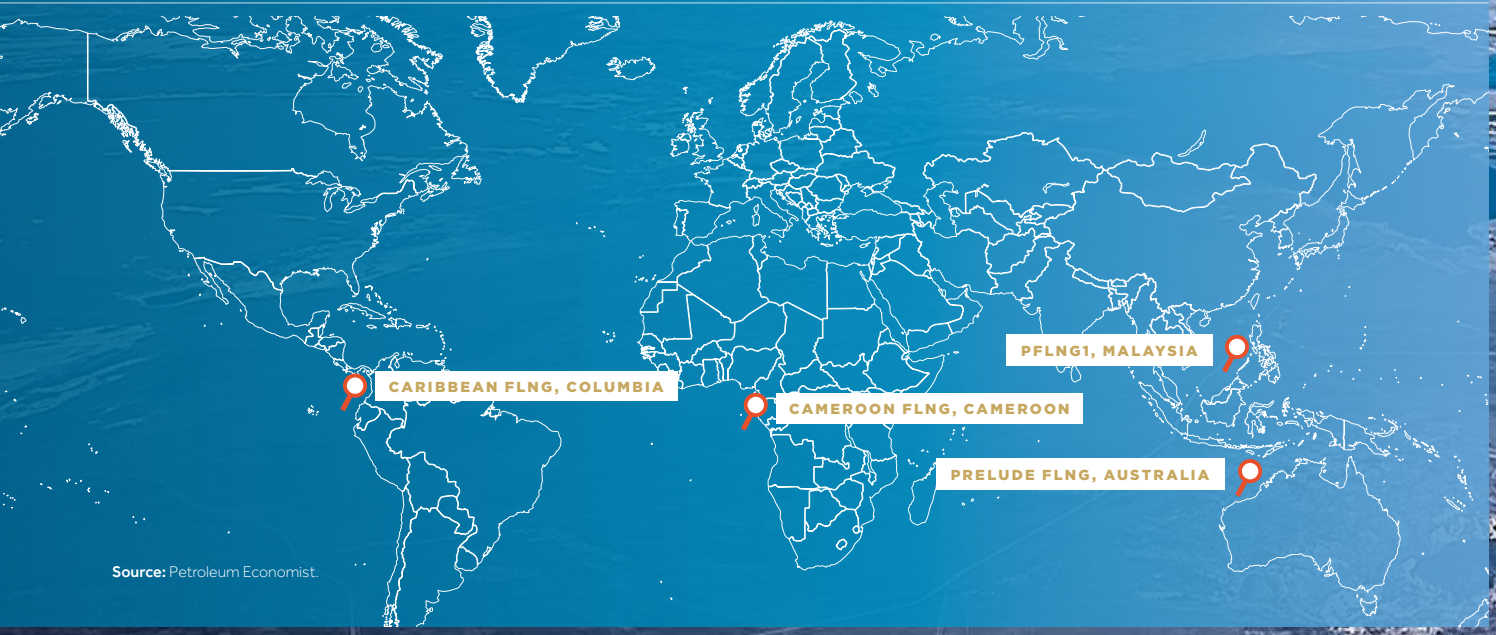
An FLNG facility is typically cheaper to develop than an onshore project of comparable size.[1] Major savings can be achieved by avoiding export pipelines and costly environmental issues faced by onshore plants in some locations. Generally an FLNG project has a significantly smaller environmental footprint arising from the reduced scope of the facility.

FLNG units can potentially be transferred to another location, for example, once a field is depleted.

References:

1 Lazson N. Edwin[a]; Ikiensikimama S. Sunday[a], *Economic Analysis of Liquefied Natural Gas Floating Production Storage and Offloading Plant (LNG FPSO) Using Probabilistic Approach*, p.43-44. http://www.cscanada.net/index.php/aped/article/view/j.aped.1925543820130501.100

FLNG PROJECTS UNDER CONSTRUCTION/COMMISSIONING



Source: Petroleum Economist.

MAXIMISING THE OPPORTUNITIES FROM A SHIFT IN WORLD ENERGY DEMAND

As a global first-mover, Australia has the opportunity to be a world leader in the development of FLNG design, execution and deployment knowledge, and be able to export this knowledge and expertise to the world.

The study found that within Australia we have most of the services and skills necessary to support the installation and operational phases of an emerging FLNG industry.

While longer term opportunities from the deployment of FLNG in Australia are becoming clearer, there are a number of medium term opportunities that will require further local investment in skills, facilities and research. There will also be longer term opportunities that are yet to emerge.

24-7-365 operational demands

An FLNG facility requires around-the-clock attendance by operations and maintenance personnel just like any refinery or LNG plant. A typical FLNG facility is expected to have up to 350 personnel working offshore across 2 shifts on a rotating basis. An additional 250-270 are required during major maintenance activities.

As well as the rotation of personnel on and off the facility, there would be a constant flow of equipment and consumables along the supply chain, including repaired and replacement parts/equipment, food, personal safety equipment, hygiene and medical supplies and waste.

Highly technical and specialised material – such as subsea, cryogenic and product unloading equipment – have tightly controlled supply chains. This is no different for FLNG compared to conventional LNG Projects.

The rigour in certification required of suppliers for 'mission critical' equipment means there is an arduous qualification process aspiring suppliers must complete to be considered capable of meeting the exacting requirements. The qualification process is both lengthy and expensive. The rewards, however, are substantial, with opportunities to enter global supply chains.

What is different for FLNG is that the supply chain is much longer, with often long sea transport voyages by supply vessels to deliver and return equipment and supplies. A conventional LNG project will have a warehouse on site and can more easily tolerate any mistake in bringing the required spare parts to site for a repair or overhaul. This means FLNG projects will run stringent quality systems to ensure the supply chain always delivers what is required first time.

Underlining the critical role logistics play in FLNG projects, the study found air, road and sea transport is expected to account for 25% of the total operating cost of an FLNG facility in Western Australia.[1]

For organisations supplying either less technically demanding equipment, or who supply consumable goods and services, the preselection process is less intensive but the supply chain challenge is just as rigorous.

Operators often consolidate similar services into large aggregate contracts. For example, catering, cleaning, laundry, waste management and minor maintenance may be combined. Companies wishing to supply to these consolidated contracts can negotiate with the successful tenderer.

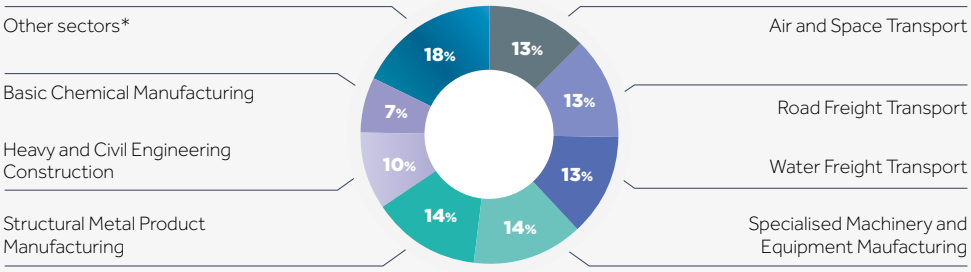
These diverse opportunities provide multiple ways for non-resource based businesses to participate. Long term contracts in the operational phase will allow businesses involved to invest in plant, staff development and in their communities.

Many suppliers will establish a support centre close to the FLNG's onshore supply base to undertake

Reference:

1 Deloitte Access Economics, *FLNG Uncovered - Economic Impact Assessment*, March 2016, p.17.

FLNG operating spending to 2040 as a pecentage split across:



Source: Deloitte Access Economics, *FLNG Uncovered - Economic Impact Assessment*, March 2016, p.17.

*Other sectors include Specialised Industrial Machinery and Equipment Wholesaling, Fuel Retailing, and Architectural, Engineering and Technical Services.

maintenance, training and replacement as needed. Others will opt for a large scale regional hub and rely on long haul logistics to deliver efficiencies.

As is already the case for conventional LNG projects, it is likely the manufacturer and product range selected for the design and build phase will remain the chosen one for the rest of an FLNG's operational life. This 'locking in' gives supplying companies the confidence to invest in local support for their products, to establish a manufacture or maintenance facility and warehousing of spare parts.

Large numbers of overseas technology manufacturers are now represented in Australia, making it relatively straight forward to obtain new equipment, spares and maintenance support.

Engineering research and support

As they come on line, new FLNG facilities will require ongoing engineering services, generating a steady stream of smaller projects. Operators will engage either a single engineering contractor or a panel to perform most of this work, but there will be opportunities for others to participate, especially niche or specialist providers and those with specialist equipment.

Different challenges will emerge during the operations phase which require specific research support. Debottlenecking and incremental expansion will occur along with asset management to improve performance. Data technology and predictive analytics will be involved at an unprecedented level and we will see more research in this area.

A cultural shift within the global economy is underway that rewards collaboration and innovation, giving subcontractors incentives to introduce new more efficient ways of delivering on their scope of works. Embedding these objectives within the contracting strategy is likely to become a key driver of success in the future, in the same way safety and the environment are core values today. This is about much more than technology and includes innovation in change management, workplace design and staff training.

Australia is recognised as a world leader in the operation of remote and complex industrial facilities. The necessary skills and experience are available but will need to be globally competitive to ensure the effective and efficient life-cycle support to future FLNG facilities.

ONGOING SERVICES REQUIRED BY A TYPICAL FLNG FACILITY

- *Condition monitoring equipment and inspection services*
- *Fuel, lubricants and chemicals*
- *Industrial cleaning*
- *Waste management*
- *Medical services*
- *Entertainment, exercise equipment and various other non-technical services*
- *Personnel training*
- *Safety equipment*
- *Scaffolding*
- *Sample analysis and reporting*
- *Transport - of equipment, consumables, waste and personnel - via truck, helicopter, fixed wing aircraft and supply vessels*
- *Weather forecasting*
- *Subsea inspection*
- *Subsea equipment maintenance (wells, manifolds, flowlines, risers, umbilicals)*
- *Tug services for berthing LNG, LPG and condensate tankers*
- *Surveyors/inspectors for product loading operations*
- *Routine Maintenance*
- *Shutdown turnaround maintenance/inspection*
- *Engineering design services for minor capital projects*
- *Facilities management – catering, cleaning, laundry, administration*

SUPPLY CHAIN CASE STUDIES #1

Innovation and excellence are driving Australian businesses to capture more FLNG work, building on a long history of successful LNG and FPSO experience.

MONADELPHOUS MAINTENANCE AND MODIFICATIONS

Shell awarded a $200m maintenance and modifications services contract for Prelude to Perth-based engineering group Monadelphous. The contract is for an initial 5 years and includes maintenance, brownfield modifications, and turnaround services to the processing plant, support utilities, hull and non-process infrastructure including accommodation and control rooms. The contract also includes the delivery of fabrication services from the Darwin supply base.

Source: Monadelphous ASX RELEASE, Monadelphous Secures Shell Prelude FLNG Maintenance Contract, 23 November 2015. https://www.monadelphous.com.au/news/2015/11/monadelphous-secures-$200m-shell-prelude-services-contract/

RUSCA GROUP TAKES ON WASTE

Indigenous-owned Rusca Environmental Solutions will provide disposal of waste and industrial cleaning services to Prelude, including container provision, storage handling, transport and tracking. The contract will make use of Rusca's indigenous employment and training capability to provide job opportunities for local Indigenous people in the Northern Territory.

Source: http://www.energynewsbulletin.net/energynewsbulletin/news/1101333/indigenous-firm-s-prelude-bet-pays-off

Image: Indicative side by side offloading from Prelude FLNG facility.

SODEXO FACILITIES MANAGEMENT

A contract awarded to Sodexo to provide offshore facilities management services for the Prelude FLNG project was Shell Australia's first t o feature positive gender diversity targets. As part of its Prelude project planning, Sodexo has committed to adding long term value to local and Indigenous communities and businesses across Broome and Darwin.

Sodexo will oversee the accommodation management, house-keeping and laundry services, as well as technical and administration/support and the implementation of a wellness program on-board. Sodexo will implement its Offshore Life service offer to meet Shell's objectives to create a 'Great Place to Work' and live offshore.

Source: Sodexo media release 'Sodexo partners with Shell Australia to deliver Facilities Management Services for Prelude FLNG', November 26, 2015. http://au.sodexo.com/sites/sdxcom-au/home/media/press-releases/newsListArea/australia-press-releases/sodexo-partners-with-shell-austr.html

Image: The Prelude Darwin Onshore Supply Base.

ASCO SUPPLY BASE

Global supply base operator ASCO Group is building a strong presence in the Northern Territory and is well positioned to support the burgeoning FLNG industry in the region. In August 2014, the NT Government opened the $110m Marine Supply Base in Darwin, providing a multi-user logistics hub to support oil and gas activity in the Timor Sea. ASCO is managing the base under a 20-year contract with the NT Government.

In 2015 ASCO was awarded the contract to manage Shell's Prelude logistics and supply base located within the East Arm industrial area, 2 kilometres from the Marine Supply Base. ASCO provides warehouse and yard services, local and domestic trucking services, and coordinating port services as part of the contract.

Sources: ASCO Group media release, 21 August 2014, 'ASCO Takes Over Management of Prelude Supply Base at Darwin Port', http://www.ascoworld.com/media-and-investors/press-room/news-articles/asco-takes-over-management-prelude-supply-base-darwin

CIVMEC WINS SUBCONTRACT WORK

Civmec, based at the Australian Marine Complex in Henderson, has won several contracts in support of the Prelude FLNG project. The company landed its first Prelude work in February 2014 with a contract for the fabrication, assembly, testing and delivery of 8 buckle initiators.

Civmec was then awarded a master service order contract by Technip for the supply, fabrication and testing of subsea components for Prelude. Shortly afterwards the company announced the award of a contract for the supply, fabrication, assembly, testing and delivery of 8 x 12" Pipeline End Terminations and 8 Pig Launchers and Receivers. In October 2015 Civmec was awarded its fourth Prelude contract, this time for the fabrication of 17 subsea jumper spools and associated lifting equipment.

Sources: 'Civmec secures subsea contracts for Prelude and Wheatstone LNG projects', 26 August 2014 in General News Posted by Civmec, Civmec awarded circa AUD$45 million in contracts across various sectors 12 November 2015 in General News Posted by Civmec, Project Prelude FLNG Buckle Initiators, http://civmec.com.au/project/prelude-floating-lng-project/

Image: CIVMEC produced four suction piles for Technip's installation activities for Prelude FLNG.

TECHNIP OCEANIA OFFSHORE INSTALLATION

Technip Oceania is undertaking 150,000 man-hours of specialist activities out of its Perth office as part of its delivery of the Shell Prelude FLNG – Offshore Installation Contract. The major contract also created local opportunities through the provision of 1,000 days of offshore vessel services.

The Prelude Offshore Installation Contract is targeted to be completed via 6 offshore campaigns scheduled. Opportunities for Australian industry exist or have already been placed on a wide range of services including fabrication, procurement, project management and engineering, flowline fabrication, transport and installation of structures, installation of riser and umbilical system and precommissioning.

Source: 'FLNG – Opportunities for WA: A Contractor's Perspective', presentation by Sam Allen, Managing Director, Technip Australia, AOG 2015 Conference, 12 March 2015.

SUPPLY CHAIN CASE STUDIES #2

Australia's research and education sector is building on its successes to forge long term partnerships with the LNG industry.

SHELL UWA CHAIR IN OFFSHORE ENGINEERING

In 2013, Shell and The University of Western Australia established the Chair in Offshore Engineering to grow UWA and Western Australia as a global offshore engineering hub. This builds on existing strengths such as the Centre for Offshore Foundation Systems, and adds a new focus on the first-mover advantage presented by Prelude FLNG.

Shell supports 4 academics at UWA, working on topics across offshore engineering, with focus areas that include LNG offloading and motion forecasting for FLNG projects. Their work has been applied on 10 Shell projects globally, including Prelude, as well as being widely adopted in industry design codes and cited in the Western Australian Government inquiries into the economic impact of FLNG. The success of the Shell Chair led to the establishment in 2016 of the $20m 5-year Australian Research Council Research Hub for Offshore Floating Facilities, bringing together 20 academics, 15 PhD students and 4 industry partners (Shell, Woodside, Lloyds Register and Bureau Veritas), cementing UWA and Western Australia as a recognised centre of excellence in offshore engineering and FLNG.

Source: www.cofs.uwa.edu.au

Image: The team from the Shell Chair in Offshore Engineering at The University of Western Australia.

PRELUDE TO THE FUTURE

Prelude FLNG, Charles Darwin University, Group Training NT and the NT Government have developed a social investment partnership to assist vulnerable young people to obtain fast-tracked apprenticeship qualification. The 'Prelude to the Future' program is running over 2 years and will employ 20 NT youth as auto-mechanic apprentices.

The program is offering training for a CERT III Qualification in Warehouse Operations or Transport and Logistics, with program participants undertaking 20 weeks of training at Charles Darwin University, 6 weeks of work experience in a range of transport and logistics roles, ongoing mentoring for 18 months, plus wages and work wear.

Sources: Charles Darwin University, enews, Issue 7, 4 August 2015, 'Group graduates from Shell Prelude to the Future', http://www.cdu.edu.au/enews/stories/Shell-Prelude

AUSTRALIAN CENTRE FOR ENERGY AND PROCESS TRAINING

Image: Challenger lecturer Dale Hewitt, with course participants Coralee Alexander and Sean Faherty.

Perth-based Challenger Institute of Technology's Australian Centre for Energy and Process Training (ACEPT) is partnering with Shell as part of a 4-year agreement to design and deliver technical training to technicians for the Prelude FLNG project.

At the ACEPT facility in Perth – the only one of its kind in the southern hemisphere – Challenger is delivering the training, assessment and assurance of process and maintenance technicians to ready them for work on the commissioning and start-up of Prelude. ACEPT is currently working with Shell to source emergency response, high risk licencing and other specialist technical training.

Sources: Government of Western Australia media release, 4 April 2014, 'World-first technicians primed for work on Prelude', http://challenger.wa.edu.au/news/media-releases/Pages/140404--World-first-technicians-primed-for-work-on-Prelude.aspx#.V0Jiy9fYl4w.

Shell, Prelude E-news, February 2016, 'An Evolving Partnership with Challenger Institute of Technology', http://s05.static-shell.com/content/dam/shell-new/local/country/aus/downloads/pdf/upstream/shell-prelude-e-news-feb-16-2-a4-6846.pdf

EVOLUTION OF AN ENERGY

British chemist and physicist Michael Faraday is credited with being the first person to develop natural gas liquefaction in the 1840s. But it took until 1917 for the first liquefaction plant to be built in the United States, with first commercial operations beginning in 1941.

It was another 9 years before the first LNG shipment was made on the Methane Pioneer – a converted former US World War II cargo ship. The UK became the first LNG importer in 1964, and Algeria the first exporter the same year.

Australia's LNG history can be traced back to 1971, when Woodside discovered the North Rankin and Angel prospects on the North West Shelf, followed by Goodwyn one year later. Construction of the first 2 processing trains began on the Burrup Peninsula in WA's Pilbara region in 1985, and 4 years later the first LNG cargo from the North West Shelf Project arrived in Tokyo, Japan.

Since that time, Australia's LNG capacity has expanded significantly, to include:

- North West Shelf Project – 5 trains, 16.3MT/a
- Darwin LNG – 1 train, 3.7MT/a
- Pluto – 1 train, 4.3MT/a
- Gorgon – 3 trains, 15.6MT/a
- Australia Pacific LNG – 2 trains, 9.0MT/a
- Curtis LNG – 2 trains, 8.5MT/a
- Gladstone LNG – 2 trains, 7.8MT/a
- Wheatstone – 2 trains, 8.9MT/a
- Ichthys – 2 trains, 8.4MT/a
- Prelude FLNG – 1 trains, 3.6MT/a

Australia is set to take over from Qatar as the world's leading LNG producer. By 2020 Australia is due to have 86MT of annual nameplate production capacity across 21 trains.

Small-scale floating LNG

Since the early days of the industry we have seen many innovations across the production and transportation of LNG – with another chapter being written with the start-up of the first FLNG projects currently underway.

The industry continues to spend significant time and capital on new ideas to reduce costs, improve

safety and reduce environmental impacts – from the well-head to the receival terminal. A good deal of effort is currently focused on reducing the size of many of the elements that make up the LNG production process, along with different small-scale floating LNG concepts.

Woodside has been one of the leading proponents, developing a suite of LNG Near Shore Gravity Based Structures (GBS) and floating solutions (example pictured above). The near shore GBS concept can operate in 15m to 30m water depth, with dimensions up to 370m long and 150m wide, and offering up to 400,000 cubic metres of LNG storage.[1]

DNV GL has also developed an unmanned floating LNG concept – dubbed 'Solitude' – that it believes overcomes many of the challenges currently faced by those looking to unlock the potential of remote offshore gas fields.[2]

Gas in a lower carbon economy

On the road to a lower carbon economy, natural gas is regarded as the primary complementary energy source to the development of renewable and alternative energies. Its versatility, price and performance characteristics make it the cleanest option for the delivery of base load, mid-merit and peaking power generation.

Studies by the International Gas Union found that enhanced use of natural gas across the board will lower carbon emissions and other air pollutants such as SOX and NOX, which are very real dangers to public health and major causes of respiratory diseases. Using natural gas to replace traditional refined fuels in transportation and solid fuels in domestic heating and cooking would enhance both the global environment and the life of billions of individuals around the world.[3]

References:

1 *Near shore LNG concepts: Low cost solution for LNG Developments*, Woodside, Fact Sheet, March 2014 http://www.woodside.com.au/Working-Sustainably/Science-and-Technology/Documents/Near_Shore_LNG_fact_sheet.pdf

2 https://www.dnvgl.com/technology-innovation/flng/index.html

3 *Natural gas, a partner for renewable energy*, International Gas Union. May 2015, p.2 http://brusselsenergyclub.org/get_file/id/natural-gas-a-partner-for-renewable-energy.pdf, p.12: 'Natural gas produces less than half the CO2 emissions of coal when burned and far fewer other particulates and emissions. When burned to heat homes or for industrial uses, it releases 25-30% less CO2 than oil and 40-50% less than coal per unit of energy produced.'

WANT TO LEARN MORE?

The following sources may be useful if you would like to read more on the issues and information contained in this synthesis:

- *BP Energy Outlook*, 2017 Edition
- *International Energy Outlook*, US Energy Information Administration, May 2016
- *LNG in Australia: Global and national benefits*, APPEA, 2016
- *Our FLNG Future: Engineering Opportunities and Challenges*, Engineers Australia, November 2014
- *Sustaining impact from Australian LNG operations*, McKinsey Australia, April 2016
- *The economic impact of floating LNG on Western Australia*, Economics and Industry Standing Committee, Legislative Assembly, Parliament of Western Australia, Vol.1, May 2014; Vol.2 May 2015

FILLING THE KNOWLEDGE GAP

FLNG is the application of existing technology in a new and innovative way. Uncovering the details is a challenge UWA and APPEA wanted to tackle to improve our understanding of what opportunities lie ahead for the industry.

The FLNG Study is primarily concerned with potential impacts on the national economy and the industry's product and service supply chain.

Deloitte Access Economics undertook an economic impact assessment of the FLNG sector in Western Australia with information supplied by FLNG proponents and publically available data. Investigations into the supply chain opportunities were undertaken by Ulfire.

The results of the FLNG Study are intended to be indicative of the potential benefits from future FLNG developments in Australia. The results and analysis are intended to inform debate about the potential opportunities and challenges facing the nation in maximising the long term benefits.

Copies of the UWA-APPEA FLNG Study are available to download from the website at:

www.emi.uwa.edu.au/reports

THE UNIVERSITY OF WESTERN AUSTRALIA

About The University of Western Australia

The University of Western Australia (UWA) was established in 1911 and is committed to providing world class education, research and community engagement for the prosperity and welfare of the communities it serves. UWA is a research-intensive university and aspires to be recognised as one of the world's top 50 global universities by 2050.

www.uwa.edu.au

appea

About APPEA

The Australian Petroleum Production & Exploration Association is the peak body representing Australia's oil and gas exploration and production industry. APPEA works with its member companies to promote the development of the nation's oil and gas resources in a manner that maximises the return to the Australian industry and community. APPEA aims to secure regulatory and commercial conditions that enable member companies to operate safely, sustainably, and profitably. APPEA also seeks to increase understanding of the upstream petroleum industry by publishing information about the sector's activities and economic importance.

www.appea.com.au