11 October 2013

ENGINEERS
AUSTRALIA
Western Australia Division

Economics and Industry Standing Committee
Legislative Assembly Committee Office
Level 1, 11 Harvest Terrace
West Perth WA 6005

BY EMAIL:laeisc@parliament.wa.gov.au

Dear Sir/Madam

Re: Inquiry into the Economic Implications of Floating Liquefied Natural Gas Operations

Engineers Australia is the peak representative body for the engineering profession in Australia, and is constituted by Royal Charter to advance the science and practice of engineering for the benefit of the community. We represent all disciplines and branches of engineering and have over 100,000 members across Australia. In Western Australia we have over 16,000 members, many of whom work in or benefit from the oil and gas industry. We offer the following comment with regard to some of the terms of reference of the committee

Background

Floating Liquefied Natural Gas (FLNG) production facilities have either been adopted or are being considered as the development option for a number of high profile offshore gas resources in Western Australian and Commonwealth waters. Shell are constructing the Prelude facility, which will be the worlds' first such vessel. Further facilities are being considered by Gaz de France Suez (GDF) for Bonaparte, Exxon for Scarborough and Woodside for Browse (Browse would comprise three vessels of similar size to the Shell facility). There are also other operators contemplating FLNG as an option for their acreage.

Historically, LNG plants have been built on-shore, with existing plants at Karratha (Woodside), Pluto (Woodside) Darwin LNG (ConocoPhillips) and ongoing development of a number of new facilities of direct relevance to Western Australia such as Gorgon and Wheatstone (Chevron), Darwin (INPEX). Other facilities under development include Curtin Island (APLNG (ConocoPhillips, Origin & Sinopec), GLNG (Santos, Petronas, Total and KOGAS) and QCLNG (QGC)). Construction of such onshore facilities provides large volumes of project based site employment, though in recent projects design and fabrication of the process plant modules has been undertaken in overseas engineering centres specialising in such technology.

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The gas reservoirs currently considered suitable for FLNG are typically large in volume and located long distances from shore in locations where there is no existing on-shore processing plant or infrastructure. For instance, Prelude and Browse are both located in the Browse basin at distances of 400km or more from shore. Browse was originally planned for the James Price Point precinct (JPP) but failed the internal cost evaluation by Woodside in early 2013. Industry has been increasingly concerned at the costs of constructing such onshore facilities and the JPP option also received considerable public protests from environmental and community lobbyists.

FLNG facilities are the world's largest steel vessels. Prelude will be 488m long and weigh 600,000 tonnes[1]. Vessels of this size can only be built in an extremely limited number of ship yards. In the Asia Pacific region, there is currently only one yard being considered, the Geoje shipyard operated by Samsung in Korea, where Prelude is presently under construction. Once on station, the facilities will be designed to remain in situ for the duration of production from the field they are servicing, including surviving the cyclones prevalent in the area. LNG will be transferred to tankers for shipment to markets typically in Japan, Korea, China and India. It is also worth noting that the Samsung yard and similar Korean yards owned by Hyundai and Daewoo represent the culmination of a generation of investment by the Korean government and private industry, building steel making facilities, fabrication yards and shipyards.

Engineering and design

Engineering and design for any new process plant follow a strict and structured sequence; concept select, front-end engineering and design (FEED) and detailed design. This is the same for FLNG as for conventional plants.

Concept select typically uses relatively small numbers of highly experienced personnel and can be performed as a single location exercise or as a global endeavour, FEED uses a larger workforce, having a broader skill base, and at this point, companies typically will establish engineering centres to undertake the work in one or more locations. For cost effectiveness and technical integrity, these are usually centres where similar design has been undertaken in the past. Detail engineering is performed by larger teams again, with much of the vessel detail design being undertaken by the fabricator (shipyard) and the detailed design of the topsides by the LNG design company.

Within each phase, there are areas that have to be addressed specific to the Australian design standards and safety codes, and there are other areas that must simply comply with internationally recognised design standards. This work is often performed by Australian engineers either resident in Australia or working overseas in one of the project design centres. Safety design for any facility operating offshore Australia must receive the approval of NOPSEMA[2] before the facility can start production. The regulatory regime managed by NOPSEMA and used in Australia is unique to Australia and must be complied with.

[1] http://www.shell.com.au/aboutshell/media-centre/news-and-media-releases/2013/preludeflng-keel-08052013.html.

[2] http://www.nopsema.gov.au

Historically, LNG trains such as those installed on a FLNG plant have been designed in overseas locations in the UK, USA and Japan. This was the case for the later trains at Karratha, for Pluto, Gorgon and Wheatstone, which has resulted in little current design experience in Australia for such technology.

Equally, the design of a vessel of the scale of an FLNG has never been undertaken in Australia and while the skills could be assembled for such an undertaking, they are already in place in other international design centres.

Subsea infrastructure is regularly designed by Australian companies or Australian offices of international companies, using either completely domestic based workforces or through split execution of the work. This approach would work as well for FLNG as for a Floating Production, Storage and Offloading (FPSO) unit or a fixed platform.

Additionally, at any given time, there are a number of Australian engineers and design personnel working in international design offices for projects for Australia, so while much of the design of facilities like FLNG's may be undertaken overseas, it is often done by teams with Australian personnel as part of them.

Fabrication and manufacturing

Fabrication of a facility such as a FLNG is undertaken in large modules. The hull and below decks equipment will be assembled in a series of large modules in a suitably sized dry dock then the topsides (comprising all of the process equipment, loading and unloading facilities, utilities, workshops accommodation etc.) will be installed in a series of very large modules weighing upwards of 5,000 tonnes each. Hull modules will be fabricated and assembled directly in the yard, as the shipyards are specifically designed for such activities.

The topsides modules can be fabricated anywhere in the world and shipped to the yard for installation, however, shipping costs and logistics issues mean that generally a fabrication company will want to do as much in-house or close to in-house as practical. There are exceptions to this however for either specialised assemblies or for low technology modules. Specialist assemblies might include the turret, which is a highly specialised component used to connect the FLNG vessel to the risers carrying gas from the sea bed to the vessel, (the Prelude turret is being fabricated in Dubai). Low technology modules may be manufactured in a low cost centre.

From a logistics standpoint, the topsides modules are large and complex undertakings that require specialised handling and require large port facilities when they are shipped internationally. It is possible to fabricate modules of this kind in Australia but the costs of both local labour and shipping costs and time can be detrimental to the cost effectiveness of such work. Similar modules for onshore plants are typically fabricated in overseas locations and shipped to Australia.

Inspection and testing of the finished modules must be done to recognised Australian standards and this work can only be undertaken by licensed Australian personnel. Similarly, in many cases, the components used must comply with appropriate Australian standards, necessitating their supply from or via Australian suppliers.

Construction and ancillary services

The construction of a FLNG installation is in a number of parts:

- The vessel
- The anchors and anchor chains
- Subsea equipment
- Risers and pipelines between the sea bed and the FLNG vessel
- Shore base

Each of these parts has a different construction profile and different opportunities for Australian participation.

As discussed above, the vessel will be manufactured in a foreign shipyard because there is nowhere in Australia to build such a large facility. Likewise, the great majority of topsides modules will be manufactured local to the hull or in specialised yards internationally, though many Australian suppliers will have opportunities to participate in the supply of components to these modules.

Anchors and anchor chains do not need to be manufactured local to the vessel, as they will be installed in the field before the vessel is delivered and as such, can be manufactured elsewhere. Anchor chain for a vessel as large as a FLNG facility can only be manufactured in one of a small number of specialist locations worldwide, none of which are in Australia. However, anchors are anticipated to be suction anchors. These are large fabricated steel boxes measuring over 25m square and standing over 15m tall that are placed on the sea bed and hold to the sea bed through suction. The fabrication of such equipment could readily be undertaken in an Australian fabrication yard and delivered to the field from a venue like the Australian Maritime Complex (AMC) at Henderson in WA. Anchors could be fabricated out of phase with the vessels and delivered in anticipation of the arrival of the vessel, meaning they are not critical path equipment for the delivery of the FLNG vessel.

Subsea equipment, like the anchors, would be installed in situ prior to the arrival of the vessel. Western Australia has several international companies that fabricate, test and maintain subsea equipment and as such, this equipment could readily be sourced domestically, though the componentry used in such assemblies is typically sourced from international factories.

Risers and subsea pipelines are used to connect the subsea equipment to the vessel. These are highly specialised components only manufactured in a small number of factories around the world, none of which are in Australia. However, there are companies here that sell this equipment and who manage the installation.

Operations, maintenance and modifications

Western Australia will be the first location in the world to have FLNG deployed into its offshore Oil & Gas industry. The first will be Prelude, which is under construction at the moment. This may be followed by several additional vessels as discussed above. It is the operational phase where the greatest potential lies for the Australian engineering fraternity to be engaged with the technology.

The facilities will be in situ for 15 to 20 years in each field and during that time will require operational personnel from many professions, including operators, engineers from many different disciplines, technicians and support personnel, virtually all of whom can be sourced from the existing skill pool in Western Australia. The facilities will require ongoing maintenance both ad hoc (performed by maintenance engineers and technicians based on the facility) and planned maintenance (undertaken by combinations of onshore and offshore personnel). Much of this work would logically be undertaken by Australian based engineers and technicians. There will also be ongoing modifications requirements both as the FLNG technology becomes better understood and as the field characteristics change over time. Australian engineers working with the original facility designs could readily perform this work.

Australia is a recognised world leader in the complex and technically challenging field of remote operations. This pioneering work has been undertaken in both the mining and the oil and gas fields where many process plants and services are either wholly controlled from remote locations or are partially controlled and monitored remotely. Examples of this are the BHP and Rio Tinto remote operations facilities located in Perth and the remote operations of some offshore assets by a number of Perth based operators. This particular skill set could readily be leveraged to provide partial remote operations and monitoring of FLNG facilities.

Through the combination of the potential number of FLNG facilities and remote operations in Western Australia in particular and Australia in general, Australia is well placed to potentially become a world leader in the knowledge base of operational support of FLNG facilities as they evolve and become more common-place, potentially placing Australia at the forefront of the understanding of such complex operations.

Should you have any questions about this submission, or Engineers Australia's position more broadly, please do not hesitate to contact me directly, either by telephone on 08 6214 6309, or by email on lhardwicke@engineersaustralia.org.au.

Thank you for consideration of this submission.

Yours sincerely

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