appea the voice of australia's oil and gas industry

Submission

August 2013

Western Australian Legislative Assembly Economics and Industry Committee: Inquiry into the Economic Implications of Floating Liquefied Natural Gas Operations

CONTENTS

OVERVIEW

- The Australian liquefied natural gas (LNG) sector is delivering on $200 billion of investment to meet the gas needs of countries that rely on imports for their energy needs. This is bringing benefits in the form of greater energy security in Australia and overseas, as well as building national wealth through responsible development of our energy resources.
- The next generation of new field developments are generally further offshore, in deeper water, contain less (valuable) liquids and have higher levels of impurities (resulting in higher processing costs), than the closer Carnarvon Basin fields that have met most of the markets needs over the past 20 years.
- We must improve our ability to secure the next wave of investment in our energy resources - worth up to $180 billion. New competitors are expected to deliver LNG to Australia's traditional customers, 20-30 per cent cheaper than from new Australia projects. Australian governments and industry must collectively meet this challenge.
- Innovative solutions to significant technical and cost challenges will be required. Floating LNG (FLNG) is one solution to these challenges. It builds on our experience with Floating Production, Storage and Offtake (FPSO) vessels which lie in Australia's major oil producing province off the coast of Exmouth, WA.
- The opportunities to capture local benefits from this evolution will require a proactive approach by both industry and governments. Construction of FLNG vessels will take place in specialist overseas shipyards. But there are significant local benefits and opportunities associated with the 25 plus years of operations and maintenance of these vessels.
- The industry, led by Woodside Energy, has committed to the formation of a national Oil and Gas Industry Innovation Partnership to be headquartered in Perth. The Partnership will focus on areas where collaborative innovation and R&D can improve the competitiveness of the Australian oil and gas industry and help local SME's connect to the high-level skills and technical innovation needed to capitalise on these opportunities. It is anticipated to attract funding from the Australian Government and leverage significant industry investment.
- There is no evidence of the need for domestic gas reservation on resources which may require an FLNG development model. The WA domestic gas market is functioning well, as evidenced in the recent independent Gas Statement of Opportunities prepared by the Independent Market Operator.
- State intervention in the marketing of gas from potential FLNG projects based on resources which are predominantly in Commonwealth waters, will make these projects more marginal. It will also place unnecessary hurdles to the development of WA's onshore gas resources, where State royalties apply and regional development opportunities exist.

ACTIONS NEEDED TO ADDRESS CURRENT ISSUES & OPPORTUNITIES

1. The State Government should work with the Australian Government and industry, to identify the skills and services that will be needed to support FLNG operations and structures based on an assessment of WA's comparative strengths and weaknesses. Resources should be put into priority areas to capture the significant long-term opportunities presented by FLNG projects.
2. Mechanisms that encourage collaboration among all those involved in the oil and gas sector, including SMEs, should be supported by the State Government. In particular, the industry led and Australian Government funded Oil and Gas Industry Innovation Partnership (OGIIP) should be supported alongside the existing WA: ERA partnership and the floating systems research partnerships already established with local universities and CSIRO. The Australian Centre for Energy and Process Training (ACEPT) provides a strong foundation in the skills development area.
3. Encouragement for development of onshore, as well as offshore, oil and gas must be pursued as a priority area within the State's energy security, State development and regulatory initiatives.
4. The Western Australian Government should undertake its planned 2014-15 review of the domestic gas reservation policy, taking account of the evidence from the Independent Market Operator that shows the State has a well-functioning market.

INTRODUCTION

The Australian Petroleum Production & Exploration Association (APPEA) is the peak national body representing Australia's oil and gas exploration and production industry. APPEA has more than 85 full member companies exploring for and producing Australia's oil and gas resources. These companies currently account for around 98 per cent of Australia's total oil and gas production and the vast majority of exploration. APPEA also represents over 240 associate member companies providing a wide range of goods and services to the industry.

APPEA welcomes the opportunity to make submissions to the Legislative Assembly Economics and Industry Standing Committee's *Inquiry into the Economic Implications of Floating Liquefied Natural Gas Operations*. APPEA's submission represents a broad industry view. It should be considered in conjunction with the individual submissions of our members.

Floating LNG provides significant opportunities for Australia, and Western Australia, to develop offshore deepwater fields that may not otherwise be commercialised due to cost (for example, establishment of significant onshore infrastructure) or technical barriers. The technology will place Australia at the forefront of innovation in the petroleum industry and see significant economic benefits flow into economies that take advantage of the opportunity.

Reducing cost pressures and improving productivity along the value chain will require action and cooperation from industry and government alike if projects are to proceed. LNG technology has had only one business solution for the better part of three decades – a large onshore plant with large tankage facilities being supplied by an onshore or offshore resource. FLNG allows the industry to develop alternative business models, enhancing flexibility in resource development options.

Industry for its part must continue to employ innovation and technology to deliver these projects and create value for all stakeholders. Interventions designed to force non-commercial outcomes are likely to impede critical investment decisions. Governments should work with industry to identify the potential opportunities offered by FLNG and structures that could be established to leverage the regional and national benefits of this significant innovation.

RESPONDING TO GLOBAL ENERGY AND COMPETITIVENESS CHALLENGES THROUGH INNOVATION

Over many decades of petroleum developments, the industry has employed innovative solutions to respond to cost pressures and technically challenging environments. Cost effective technologies have been developed by the industry to both extract gas and get it to where it needs to go. The development of LNG technologies made natural gas available to more distant markets that were not previously able to be reached by pipeline. This helped globalise trade in natural gas, opening up new markets around the world. This can also be seen in the evolution of technologies such as FPSO vessels and trans-continental pipelines.

More recently in the United States, the application of horizontal drilling and hydraulic fracturing techniques has enabled the extraction of natural gas from shale rock formations at a competitive cost. In 2000, shale gas provided only 1 per cent of U.S. natural gas production; by 2010 it was over 20 per cent and the US government's Energy Information Administration predicts that by 2035, 46 per cent of the United States' natural gas supply will come from shale gas.[1]

The driving force behind this shift is that it has become economically feasible to extract unconventional sources of gas that were previously considered inaccessible. Although the first true horizontal oil well was drilled in the 1920s, this technique only became a standard industry practice in the 1980s. Whereas a vertical well allows access to tens or hundreds of meters across a flat-lying formation, a horizontal well can be drilled to conform to the formation and can therefore extract gas from thousands of meters of shale.

However, horizontal drilling alone would not have enabled exploitation of the unconventional gas resources because the reservoir permeability is not sufficient to achieve economical gas production by natural flow. Hydraulic fracturing was developed in the 1940s to fracture and increase permeability of target formations and has since been improved to match the characteristics of specific types of reservoirs, including shales.

It was the combination of these two technologies that led ultimately to the shale gas "revolution" in the United States. While other factors were present (pipeline infrastructure, proximate large domestic market, large local services sector), a recent review of the emergence of shale gas development in the US found that of all the factors that converged in the early 2000s to make it profitable for firms to produce large quantities of shale gas, the most important was technology innovation.[2]

Contrasted with energy shortages in Europe, the success of the US experience has led some to conclude that "governments must support the realities of economics and technology."[3]

Chatham House recently summed up the current climate for energy projects when it stated that "the oil and gas industry is more competitive than ever"[4]. Within this environment of high competition, oil and gas companies have also been forced into more challenging environments to develop energy resources to meet the world's demand. Research by Wood Mackenzie indicates that more than half of the international global oil and gas companies are focusing on long-term capital investments in deepwater, shale/tight oil, shale gas and oil sands.[5]

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[1] Chatham House, Professor Paul Stevens, *The 'Shale Gas Revolution': Developments and Changes,* Dec 2012, http://www.chathamhouse.org/publications/papers/view/185311

[2] Resources for the Future, Zhongmin Wang and Alan Krupnick, *A Retrospective Review of Shale Gas Development in the United States: What Led to the Boom?,* April 2013, available at: http://www.rff.org/RFF/documents/RFF-DP-13-12.pdf

[3] Financial Times, Robin West, *Opinion: Allow market to transfer energy*, 15 May 2013, available at: http://www.ft.com/intl/cms/s/0/dd121870-b0ca-11e2-9f24-00144feabdc0.html#axzz2a7C3yrny

[4] Chatham House, John Mitchell, *What Next for the Oil and Gas Industry?*, October 2012, P. 64

[5] The Wall Street Journal, Guy Chazan, *Big Oil Heads Back Home*, 5 December 2011, available at: http://online.wsj.com/article/SB10001424052970204479504576638731600191382.html

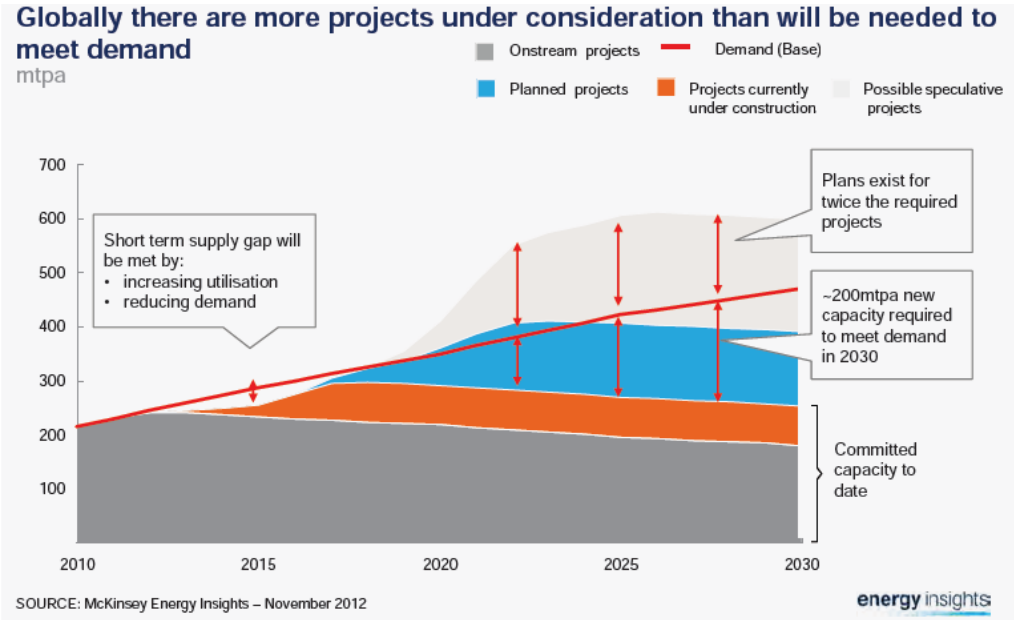
It has therefore become critical for companies to innovate and push the technological evolution of the industry. One such example of this is the development of FLNG in response to cost and technological barriers.

GLOBAL FORCES

The global oil market has been in existence for many years but the small number of suppliers trading gas worldwide has meant there has never been a completely global market for gas. Worldwide energy developments, such as the rise of potential gas suppliers in North America and Africa, point to a maturation of a more global and competitive gas market.

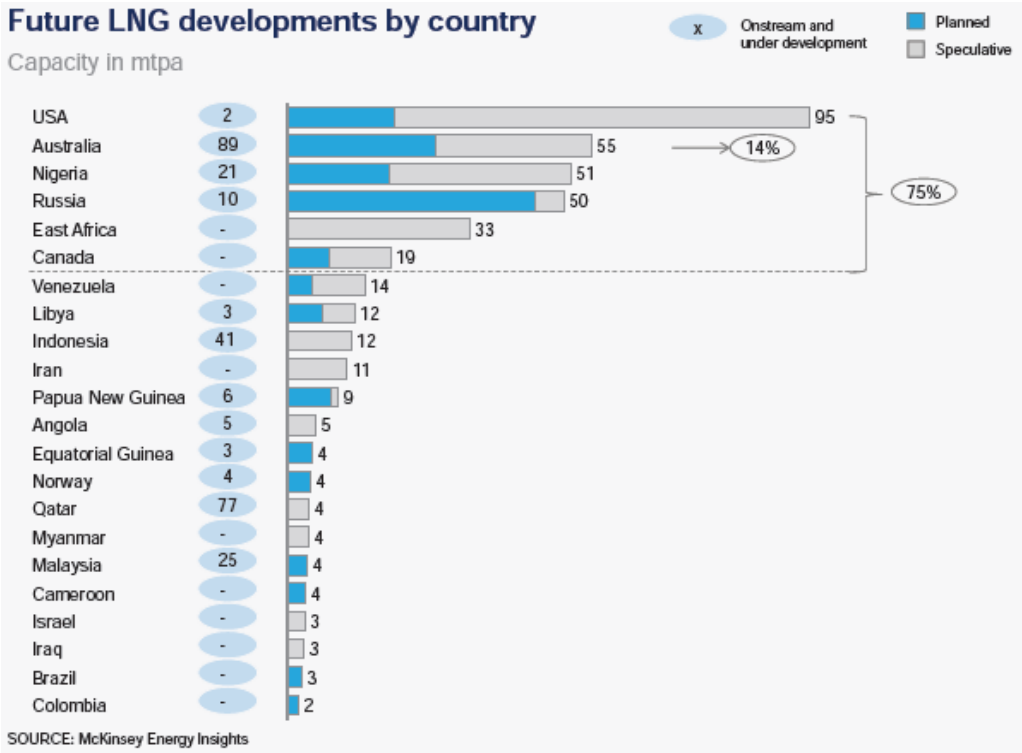
The global demand for LNG is expected to reach 470 million tonnes per annum (mtpa) by 2030. Existing projects and those currently under construction will provide 250 mtpa of this demand. To meet the remaining 220 mtpa of unmet demand, there are around 60 projects under consideration in over 20 countries. These projects represent, in aggregate, around 340 mtpa in capacity, 60 per cent more than the 220 mtpa required.

Figure 1: Forecast LNG capacity and demand



The combined output of all projects would exceed the expected growth in LNG demand, and therefore it is likely that not all projects will be realised.

Figure 2: Future LNG developments by country



Source: McKinsey & Co, Extending the LNG Boom

The intense international competition for gas supply and investment has forced many companies to re-examine projects and consider the potential return on investment that could be realised. At the same time, Australia has reached the top of the international cost curve in terms of LNG developments, including productivity rates that are approximately 30 – 35 per cent lower than comparable projects in the United States.[6]

AUSTRALIA'S COMPETITIVENESS

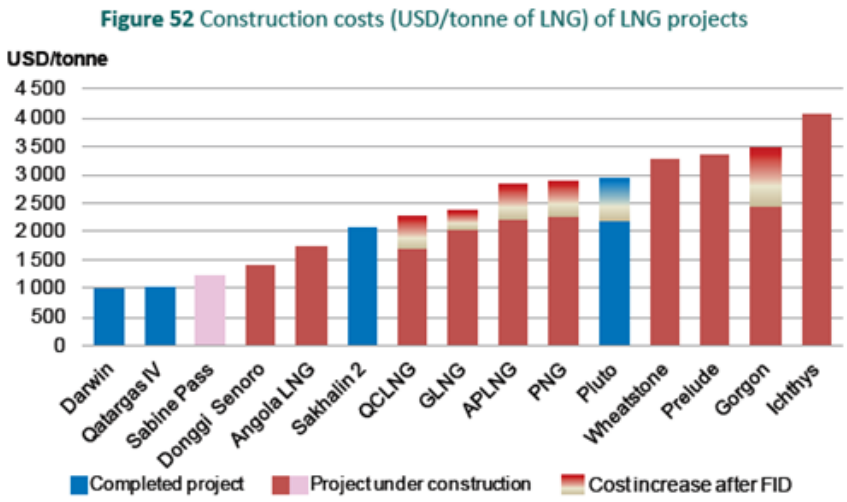
Cost competitiveness is very important to the Australian industry as "*higher costs jeopardise the chance of potential projects being built in Australia*."[7] In choosing which projects to develop, project proponents will consider cost, risks (including country risk), and ability to access the resources.

Cost pressures were recently highlighted by the International Energy Agency in its 2013 *Medium Term Gas Market Report*. Figure 3 highlights the construction costs of recently completed and currently under construction LNG projects. Cost inflation, rather than increasing production

[6] Business Council of Australia, *Pipeline or Pipe Dream? Securing Australia's Investment Future*, June 2012
[7] McKinsey & Company, *Extending the LNG boom: Improving Australian LNG productivity and competitiveness*, May 2013

capacity, is the major driver of increasing capital expenditure estimates, extrapolating the trends of the last decade when global costs of developing oil and gas infrastructure more than doubled.

Figure 3: Construction costs of LNG projects



Source: IEA, 2013 Medium Term Gas Market Report

Analysis by McKinsey & Co., found that the cost of building new LNG projects has increased in the past decade and is now about 20-30 per cent higher in Australia than that of the competition in North America and East Africa.[8] Australian LNG projects recently completed (Pluto) and those under construction (Queensland Curtis LNG, Gladstone LNG, Asia Pacific LNG, Wheatstone, Prelude, Gorgon and Ichthys) have been near the top of the cost curve.

McKinsey & Co has characterised cost pressures into two categories – compressible (which Australia has the ability to influence) and incompressible factors (such as reservoir characteristics which cannot be influenced). Within Australia, examples of these compressible factors include higher taxes, labour productivity costs, materials and freight, and more onerous equipment and infrastructure specifications.

The next generation of new field developments are generally further offshore, in deeper water, containing less (valuable) liquids and higher levels of impurities (resulting in higher processing costs) than the closer Carnarvon Basin fields that have met most of the market's needs over the past 20 years. Other factors include:

- since 2004, upstream petroleum development costs have more than doubled;
- inefficient approvals and regulatory processes;
- wages and productivity challenges;

[8] McKinsey & Company, *Extending the LNG boom: Improving Australian LNG productivity and competitiveness*, May 2013

- increasing conditions and objections in relation to environmental protection; and
- the growth of 'user pays' and cost recovery in regulating the industry.

These have all contributed to a substantial increase in the cost burden facing large gas projects. Australia needs to resolve the cost difference with competing countries where it can, but also needs to surpass these countries in certain cost areas to overcome its relative disadvantage on incompressible factors.[9] This is vital to keep Australia at the forefront of the global LNG industry and continue to provide sustainable employment and value to the Australia economy.

ACCESSING GAS RESOURCES OFF THE COAST OF WESTERN AUSTRALIA

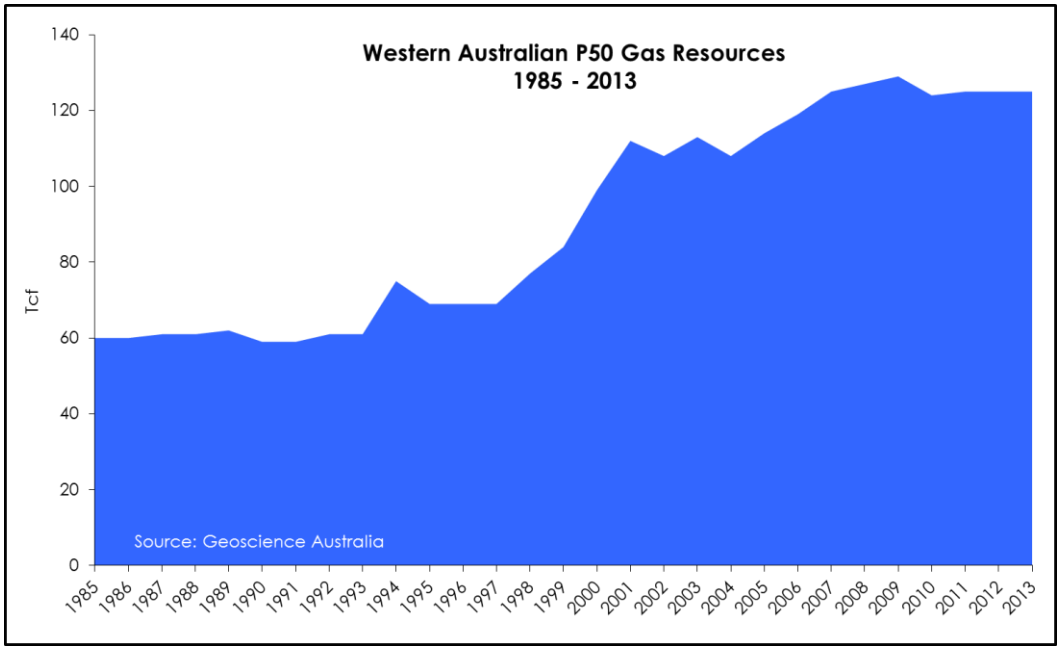
Western Australia's critical place in the history of Australian oil and gas is widely recognised. The State has been the most significant oil and gas province for Australia, hosting the country's first LNG export project – the North West Shelf Project – and the development of the Gorgon, Wheatstone and Pluto projects.

Western Australia has access to substantial gas resources found mostly in Commonwealth waters off its north-west coast. These known gas resources are estimated to total around 125 trillion cubic feet (tcf)[10] and are increasing as more exploration occurs and discoveries are made.

Despite increasing gas production for local and export markets, estimates of discovered and as yet unproduced gas resources have steadily increased since the commencement of gas production from the North West Shelf Venture (NWSV) in 1984. These known resources are now more than twice as large as those recorded in 1985 (Figure 4).

[9] McKinsey & Company, *Extending the LNG boom: Improving Australian LNG productivity and competitiveness*, May 2013
[10] Department of Mines and Petroleum (2013), *Petroleum in Western Australia*, May 2013

Figure 4: P50 Gas Resources (Western Australia and Commonwealth waters offshore from Western Australia): 1985-2013



Source: Geoscience Australia/WA DMP

Western Australia now has more than 130 years of known resources based on current production levels (reserves/production ratio). This compares favourably to the reserves/production ratio for a number of WA's other energy resources.

Globally, oil and gas resources are increasingly found in challenging environments:

> *"A paucity of new giant discoveries in mature onshore petroleum provinces and restricted access to new business opportunities in major oil and gas producing countries are pushing the industry to explore offshore locations and especially frontier deepwater and ultra deepwater basins. Based on a statistical evaluation of discoveries between 2005 and 2009, it looks like deepwater and ultra deepwater discoveries are becoming the dominant source of new reserve additions, accounting for 41 per cent of total new reserves."*[11]

Chatham House recently noted that projects today and into the future are increasingly technologically challenging, whether in very deep water, at extreme low temperatures or in regions with extreme environmental sensitivity.[12] As large reserves deplete, frontier exploration and the development of resources that require technically difficult or innovative technology

[11] IHS, *Energy Industry Trends*, Volume 11, Issue 1, available at: http://global.ihs.com/news/temp/enewsletter/energy/energy5-11-3.htm

[12] Chatham House, John Mitchell, *What Next for the Oil and Gas Industry?*, October 2012

(shale oil and gas, tight sands, ultra-deep water and Arctic offshore as well as enhanced recovery from depleting fields) will become the focus.[13]

A similar pattern is evident in Western Australia, where significant exploration activities since the development of the North West Shelf fields have moved exploration into areas further offshore and in deeper waters. These fields are very difficult and expensive to develop, evidenced by the Scarborough field which was discovered in 1979, 220 kilometres offshore and in 900 metres of water. Scarborough has become potentially more viable with the advent of FLNG.

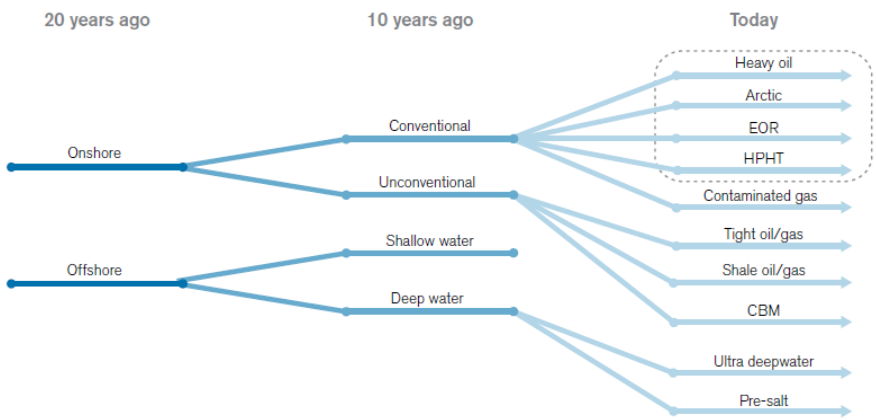
It is in this context that Australia's petroleum licensing regime seeks to facilitate exploration activities through the retention lease system. Retention leases may reward new exploration efforts, while at the same time encouraging innovation that leads to resource commercialisation.

INNOVATING TO OVERCOME COST PRESSURES

As noted above, innovation is a key part of the oil and gas industry's business. It is one of the ways that the industry is able to meet the challenges posed by resources that are difficult to extract.

As noted by Deloitte, *"…high development costs and technological challenges must be overcome. Due to the lack of experience and relative complexity of developing deepwater fields… there is an opportunity for new technologies to prove themselves and become established as the technology as choice."*[14]

Figure 5 – Evolution of Oil & Gas Technology Challenges



Source: Energy Intelligence North Sea Market Review 2012.

[13] Chatham House, John Mitchell, *What Next for the Oil and Gas Industry?*, October 2012
[14] Deliotte, *Developments in deepwater*, 2010, available at: http://www.deloitte.com/assets/Dcom-UnitedKingdom/Local%20Assets/Documents/Industries/EIU/Water/UK_EIU_DevelopmentsinDeepwater.pdf

As outlined in Figure 5, the challenges facing companies seeking to develop oil and gas resources have become increasingly complex. Where once resources were divided into onshore and offshore developments, today they are subcategorised into areas such as ultra deepwater drilling in locations like Alaska.

While land-based natural gas liquefaction has been the focus of developments in Western Australia for the last thirty years, the maturation of the State's gas resources has forced companies further offshore and into deeper waters, where innovative and complex technologies are required to develop resources.

THE EVOLUTION OF FLOATING TECHNOLOGIES

The oil and gas sector uses highly sophisticated technology to develop the world's natural resources safely while protecting the environment. The design of FLNG has evolved from the use of Floating Production, Storage and Offloading (FPSO) vessels, which have operated with excellent safety and environmental records. FLNG will not be the last technological innovation in oil and gas, as the industry will continue to adapt to new technical and environmental challenges into the future.

Originally, all oil platforms sat on the seabed, but as exploration moved to deeper waters and more distant locations in the 1970s, floating production systems came to be used. An FPSO vessel is designed to receive and process hydrocarbons and store oil until it can be offloaded onto a tanker or, less frequently, transported through a pipeline. The first oil FPSO was the Shell Castellon, built in Spain in 1977. Today, over 200 vessels are deployed worldwide as oil FPSO's.

The first FPSO began operating in Australian in 1986 at the Jabiru oil field in the Timor Sea, operated by BHP Billiton Petroleum. This allowed previously marginal or uncommercial fields to be developed in Australian waters. The safety and operational history of FPSO's in Australia is excellent.

FPSOs are preferred in frontier offshore regions as they are easy to install and do not require a local pipeline infrastructure to export oil. FPSO's can be a conversion of an oil tanker or can be a vessel built specially for the application.

These vessels are particularly effective in remote or deep water locations where seabed pipelines are not cost effective, as FPSO's eliminate the need to lay expensive long-distance pipelines from the processing facility to an onshore terminal. This can provide an economically attractive solution for smaller oil fields which can be exhausted in a few years and do not justify the expense of installing a pipeline. Once the field is depleted, the FPSO can be decoupled and moved to a new location.

Today, the development of FLNG technology provides operators with a means of potentially commercialising deepwater or greenfield gas resources that would otherwise be too small, expensive or technically difficult to extract. In the Australian context, in most cases, the development choice for investors for these resources will be to either develop using FLNG or not to develop the resources at all. As noted above, the global commercial challenges facing the next wave of LNG investment require investors to carefully consider the economic and technical requirements for commercial field development.

FLNG technology is an important development for the LNG industry as it reduces both the project costs and environmental footprint of an LNG development. The move away from long pipelines; compression platforms to push the gas to shore; near shore works such as dredging and jetty

construction all decrease project costs and potentially allow a project to achieve commercial viability.

There are currently no FLNG facilities deployed anywhere in the world. Shell's Prelude FLNG Project is likely to be the world's first. Joint ventures led by ExxonMobil and Woodside have indicated that they are also considering the technology's applications for a number of fields. FLNG may be the best economic and technical option for particular resources in order to address specific characteristics or costs.

The following extract from the McKinsey & Co report referenced earlier provides a useful comparison between onshore LNG development and FLNG[15].

McKinsey & Company – 'Technological Breakthrough – FLNG Example'

This box investigates the cost differences between an FLNG and a traditional on-shore LNG concept. This might not always be the right comparison; floating or no LNG plant at all could also be the case, either for economical or geological reasons. It does not look at other differences, such as the fact that FLNG can be moved or staged if field properties turn out to be different from what was expected.

FLNG facilities will typically be built outside the host country, for example in Korea or China. As a consequence, there is much less footprint in the host country in the construction phase of these platforms. For example, there are no onshore civil works and no camps to host construction labour. This may be partially offset by a more elaborate supply base onshore. The need for host-country labour is also much reduced in the construction phase compared to an onshore plant, while in operations FLNG will require more people. If Australia were to develop a deeper local expertise market, leveraging the fact that it is the first country that will have FLNG in operation, it might attract a larger share of the jobs. This has not been modelled as this is not currently the case.

Construction of an FLNG facility for use in Australia presents a number of potential cost differences across the project's phases. In summary, FLNG plants are likely to be cheaper to construct, but more expensive to operate. Below is a breakdown of how costs compare to an on-shore solution. Obviously, if a project is more distant to shore or has a challenging onshore operating environment the cost differences will increase.

FEED. The industry expects to achieve a higher level of repeatability in the design of FLNG facilities than achieved in onshore plants, as there is less need to take into account differences in geography and any on-shore restrictions. This would reduce the costs needed for FLNG FEED by around 20-25 per cent (or around $0.05/MBtu) compared to FEED for onshore plants driven by higher potential for repeatability and reduced scope (no export

[15] McKinsey & Company, *Extending the LNG boom: Improving Australian LNG productivity and competitiveness*, May 2013, p 23

pipeline or extensive onshore facilities).

- **Upstream**. Unlike onshore plants, FLNG plants do not require separate offshore platforms (e.g., production and central processing facility platforms). They will also have no export pipeline compression and flow assurance costs. The impact of this is calculated to be around US$0.7-0.8/MBtu.
- **Midstream**. An FLNG platform does not require the construction of an export gas pipeline from field to liquefaction plant, saving US$0.5-0.8bn for every 100km of conventional gas pipeline that would be required. Assuming a 400km pipeline, this would reduce landed cost by US$0.6-0.7/MBtu.
- **Downstream**
    - FLNG platforms are typically fabricated entirely in specially constructed ship building facilities that offer more cost competitive design and construction technology and experience (in the example of Prelude, in Samsung shipyards in Korea) before being hauled to their intended site of use. Modern onshore facilities can also be built overseas as several large modules. However, assembly and commission are still required onsite. FLNG removes the need for onshore civil works (e.g. site preparation, dredging, construction camp and related support infrastructure), onshore storage (potentially replaced with floating hulls), off-loading facilities and marine facilities (e.g. breakwater, berths). Unlike onshore facilities which are air-cooled, FLNG units are cooled using seawater which provides more consistent cooling and requires less capex. Altogether, the net difference in downstream capex between FLNG and an onshore concept is estimated at US$0.2–0.3/MBtu.
    - Increasing the proportion of materials fabricated in more cost competitive conditions from 50 per cent in the base onshore case to 100 per cent reduces capex by ~5 per cent (and landed cost by a corresponding amount of US$0.15/MBtu). In case of a highly modular design, host-country labour requirements during construction phase will be lower as more construction work will be done in the construction yards rather than at the plant site.
- **Operations**
    - FLNG experiences roughly 20–25 per cent higher downstream operating costs than onshore facilities. This is driven by the more challenging offshore operating environment for FLNG and lower synergies in case of multiple liquefaction units compared with onshore, because each FLNG facility has a stand-alone crew. The landed cost impact of higher opex is estimated at US$0.6–0.7/MBtu in landed costs for FLNG compared with onshore LNG.
    - Nonetheless, due to greater weather resilience for export loading operations, and less onerous demobilisation and remobilisation requirements, FLNG plants are expected to have 2–3 per cent more uptime than onshore plants.
- **Abandonment**. Due to their mobility, following depletion of a gas field, FLNG units can be either redeployed at another field or taken to a yard for conversion to scrap. Consequently, they have lower abandonment costs than fixed platforms.

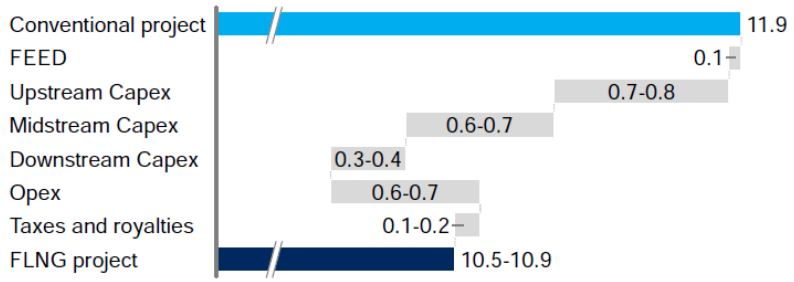
Based on the above, constructing an FLNG plant as opposed to a traditional onshore LNG facility could reduce landed cost by roughly $1–1.4/MBtu (Exhibit 12), including impact on government revenues and other costs; assuming a 2-train 8-mtpa development and cost of capital of 7.8 per cent over 40 years life of field). In addition to these cost factors, there are a number of other areas in which FLNG differs from onshore that are harder to quantify. On the potentially positive side, there is potential for less cost and effort needed around

environmental and safety procedures, due to the lack of onshore components and a pipeline. FLNG also allows for a more phased development approach, which would allow de-risking of the development. On the potentially negative side, the experience with operating FLNG is not as deep as with traditional platforms, and regulatory processes might actually take longer as there are no/few precedents.

Exhibit 12

Breakthrough technology such as FLNG has the potential to make marginal projects more economically viable

Landed cost in Japan in US$/mmbtu,



SOURCE: McKinsey LNG-OMG model

ENSURING BENEFITS TO WESTERN AUSTRALIA

The development of Australia's gas resources brings significant revenue flows to governments. A recent study by ACIL Tasman found that the Shell Prelude FLNG project will deliver around $12 billion in taxes and improve Australia's balance of payments by $18 billion over the 25 year project life[16]. These are direct economic benefits to the citizens of Australia that may not have been realised but for the use of FLNG technology.

MAXIMISING LOCAL CONTENT

The industry has a strong and demonstrated record of active engagement in exploring and implementing processes for enhancing the ability of Western Australian suppliers to participate in major resource projects (see **Attachment 1**). Industry recognises the many benefits provided by local suppliers[17] and is investing heavily both in financial terms and in the development of collaborative relationships to address priority areas of capability, capacity, skills and training gaps, which are seen as key to improving the participation of suppliers globally.

While FLNG vessels will be constructed overseas due to the scale of infrastructure required and the prohibitive costs of trying to build ultra large facilities in Western Australia, Western Australia would likely see a long period of sustained economic benefits from the operations of the project.

An independent analysis of the Prelude project found that the project would spend approximately $12 billion on Australian goods and services over its 25 year life. This is $12 billion in expenditure that would otherwise be unrealised if the gas was left in the ground and not developed through FLNG. This sustained period of local engagement should not be overlooked.

A study by Australian Venture Consultants on the economic benefits of oil and gas projects noted that "*while the benefits that accrue to the Nation during the construction phase are important, a project's construction phase typically lasts only a few years. The focus should be on the very significant benefits that accrue over the life of the projects, which is between 25 and 50 years at a minimum and likely longer as the projects expand*."[18]

Local content opportunities during operations include the employment of a skilled local workforce to operate and maintain the offshore facility; the provision of aviation, drilling and marine support services out of regional centres; and the provision of supply, accommodation, catering and maintenance services through the establishment of marine supply bases and the engagement of local workshops to provide maintenance services.

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[16] Shell Australia, *Evidence to the Economic and Industry Standing Committee*, June 2013

[17] Including in relation to faster turnaround of services, localised employment, improved timings and improved communication.

[18] Australian Venture Consultants, *The Wider Contribution to Australia of the Oil and Gas Industry: Selection of Case Studies from the Development of Offshore Gas Fields*

Recommendation: The State Government should work with the Australian Government and industry, to identify the skills and services that will be needed to support FLNG operations and structures based on an assessment of WA's comparative strengths and weaknesses.

Resources should be put into priority areas to capture the significant long-term opportunities presented by FLNG projects.

LEVERAGING FLNG INNOVATION IN WESTERN AUSTRALIA

The commitment by the oil and gas industry in Western Australia to continual improvement in technologies and techniques is demonstrated by its significant resource commitment of the industry to the Western Australian Energy Research Alliance (WA: ERA)[19] since its establishment.

More recently, Woodside has taken the lead in developing a successful proposal under the Australian Government's 'Plan for Australian Jobs' to create an Oil and Gas Industry Innovation Partnership (OGIIP).[20] The OGIIP is a national initiative that will be headquartered in Perth, with nodes in Brisbane, Darwin, Adelaide, Melbourne and Sydney.

The OGIIP will receive $16 million from the Australian Government to establish the partnership, with a further $4 million per annum for ongoing operations. This funding will be supported by industry contributions.

It will initially focus on seven areas where wide collaboration creates a dividend:

- Improve Construction Productivity – Lower costs and risks by streamlining the supply chain, improving work practices and utilising the latest technologies to eliminate waste.
- Gas Developments – Design, maintenance and operations capabilities around floating LNG technology to capture advantage for Australia in this new technology area. Develop data and expertise in extraction of natural gas from coal seams, shales and other unconventional sources that could potentially be double the offshore resource. Build expertise and assess competitiveness for gas-to-liquids.
- Computational Geosciences – Leverage the Pawsey Supercomputing centre and advanced computing methods to improve the acquisition and processing of geo-data.
- Subsea Production Technologies – Create a skill base and infrastructure for Subsea Technologies to be developed on local projects and exploited for growth across the globe.
- Remote Plant Operation – Build capability and technologies for remote plant operation. Create highly skilled and information centric jobs in an Australian central operations hub.

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[19] See: http://www.waera.com.au/

[20] APPEA, *Oil and gas industry partnership to build on unprecedented growth*, 16 August 2013, available at: http://www.appea.com.au/media_release/oil-and-gas-industry-partnership-to-build-on-unprecedented-growth/

- Cooperative Business and Safety Practices – Standardise contracts, pre-qualifications, safety and environmental systems. Lay the groundwork for shared infrastructure on remote projects. Collaborate on process safety, human and organisational factors and reliability engineering to prevent major accidents.
- Social Impact of Oil and Gas – Understand the social impact of the industry. Utilise advanced analytics and communications technologies to improve industry reach. Develop geosequestration as a mechanism to improve environmental sustainability.

Over 250 small to medium enterprises and research organisations have expressed their support to date, along with 35 core partners including the CSIRO, Shell, Santos, the University of Western Australia and Curtin University of Technology. The partnership will be governed by a six member board from industry, small to medium enterprises and universities and guided by an Industry Advisory Group comprised of core partners. APPEA is a supporting partner in the initiative.

National Floating Systems Research Centre

The Australian Government recently announced plans to establish a new National Floating Systems Research Centre in Perth, led by the CSIRO and the Australian Institute of Marine Science in partnership with industry.

The National Floating Systems Research Centre is expected to be a world leading research centre in offshore oil and gas production and floating systems aiming to attract new investment and new high-skill, high wage jobs to Australia.

The Australian Government plans to invest $30 million in the new centre, matched by co-investment from the project partners, taking total investment to more than $60 million over 3 years.

Australian Centre for Energy and Process Training

Challenger Institute of Technology's Australian Centre for Energy and Process Training (ACEPT), based at Henderson within the Australian Marine Complex Common-User Support Facility, is the oil and gas industry's recognised centre for excellence for entry level skills development and also ongoing up-skilling of the oil and gas industry' workforce in the area relating to production operators, maintainers and associated trades (e.g. electrical instrumentation).

ACEPT was officially opened in 2008 and represents an outstanding example of industry/government collaboration and investment (set up expenditure was in the order of $21 million). The closed loop training facility is the only fully operational training plant in the southern hemisphere.

The Centre, through its outreach and e-learning facilities, enables people from as far as the Northern Territory, Queensland and overseas to undertake real time immersive style skills development.

Global Centre for Floating Liquefied Natural Gas (FLNG) Learning and Research

In mid-2011, Curtin University and Shell Development Australia announced a partnership to establish the Global Centre for Floating Liquefied Natural Gas (FLNG) Learning and Research.

The Centre will be based at Curtin's Bentley Campus to provide professional leadership, management and technical education specifically relevant to the FLNG industry and will involve

partnerships with Vocational Education and Training (VET) providers for training in liquefied natural gas (LNG) factory operations.

The partnership will develop FLNG-focused research at PhD level as a means of enhancing the long term development of FLNG capability. Shell Development Australia will participate with Curtin University in the selection of the PhD candidates, provide input into the topic of research and have access to the outcomes.

ACEPT will also become an important member of the new Centre, through the provision of VET programs and pathways to higher education. This unique training joint venture will deliver the training needs for Shell's Prelude FLNG project, and potentially other projects using FLNG.

Recommendation: Mechanisms that encourage collaboration among all those involved in the oil and gas sector, including SMEs, should be supported by the State Government.

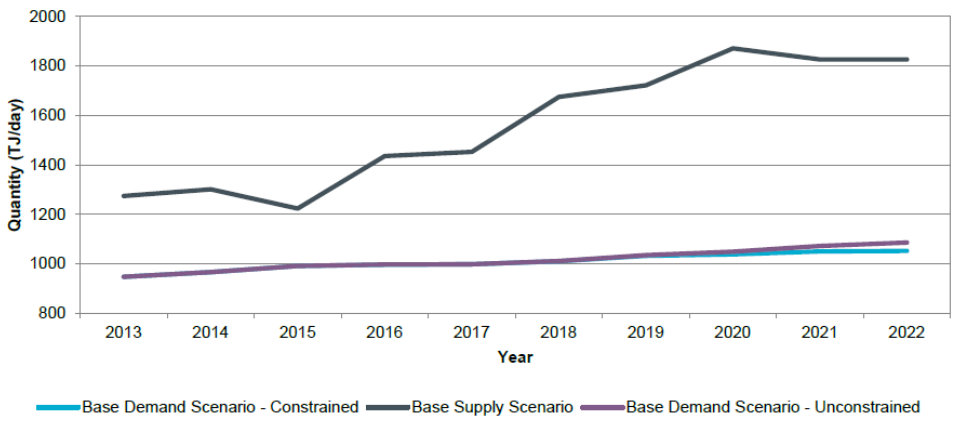
In particular, the industry led and Australian Government funded Oil and Gas Industry Innovation Partnership (OGIIP) should be supported alongside the existing WA: ERA partnership and the floating systems research partnerships already established with local universities and CSIRO. ACEPT provides a strong foundation in the skills development area.

DOMESTIC GAS ISSUES

An overview of the WA gas market is attached to this submission (**Attachment 2**).

There is no evidence of a market failure in the wholesale WA gas market. Indeed, the recently released *WA Gas Statement of Opportunities* (GSOO)[21] found that by 2022, forecast domestic gas supply is expected to be more than adequate to meet forecast demand for the WA domestic market. Forecast average annual growth for WA domestic gas supply is expected to be 3.7 per cent per annum, compared to a forecast average annual growth for domestic gas demand of 1.1 per cent per annum. In the GSOO, the Independent Market Operator (IMO) found that "*existing gas reserves are forecast to be sufficient to continue to meet 2022 domestic and LNG demand levels for a very considerable period beyond 2022.*"

[21] Independent Market Operator, *Gas Statement of Opportunities*, July 2013, available at: http://www.imowa.com.au/GSOO



Source: Independent Market Operator

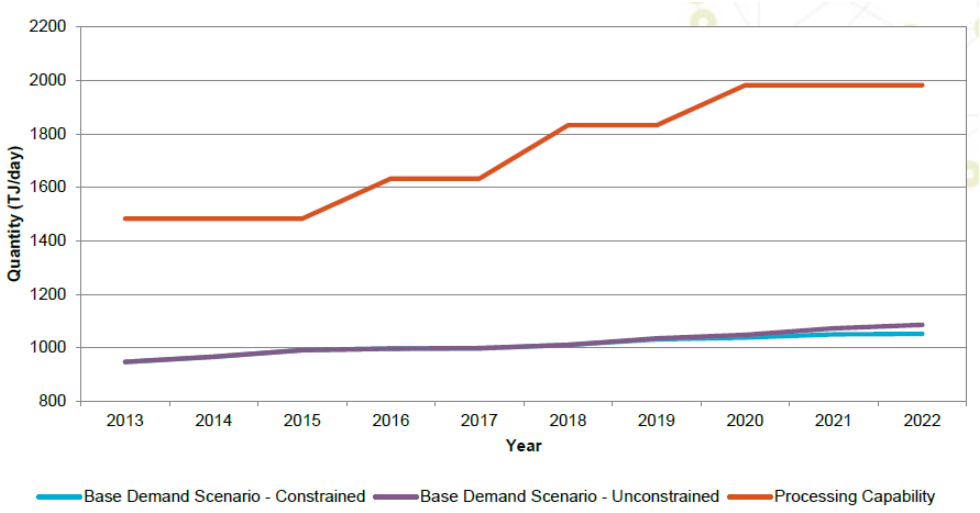
The resources currently being assessed for FLNG development would rely primarily on Commonwealth, not State approvals. While the industry remains committed to ensuring the WA market has access to adequate supplies of gas, efforts to impose a commitment to supply the domestic market are likely to constrain, rather than increase, supply to the market. The Australian Government in its November 2012 *Energy White Paper* has rejected a domestic reservation policy as unnecessary and counter-productive. For a more detailed discussion of the impacts of domestic gas reservation policy in a WA context, see **Attachment 3.**

FLNG facilities are likely to be located a long way from shore and not connected to a pipeline network which would enable supply of domestic gas. FLNG operations, already economically challenged by such factors as location and distance from shore, would be become even more marginal if attempts were made to force supply of natural gas to the local market.

In APPEA's submission, domestic gas reservation policies do not improve supply but act to inhibit the development of further sources of supply. Policy measures that encourage efficient investment, competition and transparency in the WA domestic gas market are a better approach to delivering competitive pricing than reservation. Desirable elements of such a policy include an independent periodic review of the commercial functioning of the WA domestic gas market (as now exists through the GSOO), identification of any pressure points that may exist and ongoing discussions between industry and government on possible responses.

The implementation of initiatives in WA such as the GSOO and Gas Bulletin Board (GBB), are a positive step in this regard. APPEA also looks forward to the opportunity to actively participate in the WA Government's review of the need for a domestic gas reservation policy in 2014-15 as announced under the recent Strategic Energy Initiative (SEI). The review is certainly warranted in light of the acknowledgement of the oversupply of gas processing capacity identified in the recent GSOO.

Figure 7: WA Domestic Gas Processing Capacity, 2013 – 2022



Source: Independent Market Operator

It is vitally important that the domestic market is allowed to function effectively and efficiently. A significant oversupply of natural gas, for example, may defer investment in the State's onshore shale gas industry, which is in its infancy, but has the potential to be a key pillar of the State's energy security and royalty base. In an environment of high exploration and development costs, the return on investment for onshore natural gas companies may be too low as a result of LNG projects already supplying significant quantities of gas into the WA domestic gas market.

Recommendation: Encouragement for development of onshore, as well as offshore, oil and gas must be pursued as a priority area within the State's energy security, State development and regulatory initiatives.

Recommendation: The Western Australian Government should undertake its planned 2014-15 review of the domestic gas reservation policy, taking account of the evidence from the Independent Market Operator that shows the State has a well-functioning market.

ATTACHMENT 1: LOCAL INDUSTRY PARTICIPATION

The industry has a strong and demonstrated record of active engagement in exploring and implementing processes for enhancing the ability of Western Australian suppliers to participate in major resource projects. Industry already recognises the many benefits provided by local suppliers[22] and is investing heavily both in financial terms and in the development of collaborative relationships to address priority areas of capability, capacity, skills and training gaps, which are seen as key to improving the participation of suppliers globally. Examples of industry engagement include:

- WA Industry Capability Network (ICNWA);
- National Resources Sector Employment Taskforce;
- Western Australian Government's Local Industry Participation Framework;
- Western Australian Government State Agreement Acts.

APPEA and its members regularly interact with the Department of Commerce's Local Content Unit to identify areas for further improvement and have also engaged with the Australian Government's Buy Australian at Home and Abroad program and the Resources Sector Supplier Advisory Forum and associated initiatives. Considerable effort is therefore being expended by oil and gas companies to promote local participation within the above mentioned processes.

Based on this experience, operators in the sector have identified several factors which influence how contracts are awarded:

- The globalisation of oil and gas supply chains and construction requirements and improvements in international suppliers, resulting in economies of scale that have made international suppliers more competitive than their local counterparts.
- Suppliers that operate internationally perform better in relation to scale, schedule and price, predominantly driven by their larger scale which additionally allows them to deliver against demanding schedules.

There are a range of other factors which are of importance in determining purchasing decisions, but these are not perceived as consistent differentiators between local and international suppliers.

Where local firms are capable and competitive, the ICN service has been widely embraced by proponents, providing maximum opportunity for suppliers. However, experience has indicated that there are several key issues preventing local suppliers from successfully winning work, including:

- Having appropriate management systems, together with processes to meet legislative requirements for health, safety and the environment;
- Developing the management systems and processes required to prequalify;

[22] Including in relation to faster turnaround of services, localised employment, improved timings and improved communication.

- Knowing how to tender and submit compliant tenders;
- Remaining internationally competitive with a high Australian dollar; and
- Complying with Australian and globally accepted technical standards for asset integrity and safety.

ATTACHMENT 2: WA GAS MARKET

In 2012, WA's gas production totalled 1.2 tcf[23] of which 0.5 tcf (42 per cent) was sold into the WA market.

The North West Shelf Venture (NWSV) currently accounts for around 55 per cent of WA gas sales[24]. While this project expects to have delivered its domestic gas obligation under State Agreement by the end of 2014 it has already committed additional volumes and has contracts that run past the end of the decade. It has no plans to reduce its domestic gas capacity.

The Apache operated Varanus Island hub is the next largest supplier at around 33 per cent of the WA market. Gas is also supplied by the recently commissioned Devil Creek facility (10 per cent)[25] and several fields in the onshore Perth Basin supply around two per cent of the market (Beharra Springs operated by Origin Energy, and Dongara operated by AWE).

WA domestic gas production capacity increased by more than 20 per cent (220 TJ/d) in early 2012 when the Devil Creek Development Project was commissioned by operator Apache Energy. Chevron Australia and its Joint Venture Partners also intend to initially supply 150 TJ/d of domestic gas from the Gorgon Project from 2015, with this capacity expanding to 300 TJ/d around 2020.

Other new sources of gas supply are also being planned subject to customer demand:

- BHP Billiton and Apache Energy have developed the Macedon gas field with production commencing in August 2013. The facility has a capacity of 200 TJ/d.
- Chevron Australia is also proposing a domestic gas plant in the Wheatstone project with a capacity of 200 TJ/d, commencing production in 2016.
- Woodside's Pluto project could also start supplying gas to the domestic market later this decade if economic to do so, following an evaluation to be conducted after the commencement of Pluto's LNG exports.[26]
- Rapid growth in the production of natural gas from coal seams in Eastern Australia and shale gas in the US is also triggering interest in WA's unconventional gas potential with several drilling programs now underway or being planned (for example, the Warro Gas Field development has seen Latent Petroleum Limited and Alcoa form a joint venture to appraise and develop the Warro Gas Field north of Perth[27]). A range of other onshore 'tight gas' fields are being actively appraised and onshore shale gas exploration is taking place in the Canning Basin.

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[23] APPEA, *Annual production statistics 2012*, available at: http://www.appea.com.au/industry-in-depth/industry-statistics/annual-production-statistics-2012/
[24] APPEA, *Annual production statistics 2012*, available at: http://www.appea.com.au/industry-in-depth/industry-statistics/annual-production-statistics-2012/
[25] See www.apachedcdp.com for further information.
[26] Economic Regulatory Authority, *Discussion Paper: Gas Issues in Western Australia*, June 2007
[27] See www.latentpet.com/about.asp for further information.

As noted above, gas supply from LNG developments is expected to double within ten years, however this will only occur if sufficient demand occurs and contracts can be obtained for terms and prices that can justify underwriting an LNG development. In this regard, it is worth noting that demand has historically been significantly influenced by mining and mineral resource projects, many of which are sensitive to global economic influences and historically do not see a high rate realisation.

The near doubling of domestic supply capacity by 2020, resulting from the gas supply developments outlined above, would require demand for gas to increase by more than seven per cent per year, compared to a ten-year historical average of 1.1 per cent a year[28].

It is also important to note the major role that LNG projects have played, and will continue to play, in supplying gas to the WA market. The large offshore gas fields provide large increments to domestic gas supply as part of an LNG project. These cannot, however, be developed economically for domestic gas supply alone. The economies of scale associated with LNG exports drive the economics of delivering gas into the market.

While the domestic market remains a very attractive segment for gas to be supplied into, its attractiveness is maximised when the market is allowed to operate efficiently and without interference. Without the LNG industry, supplies of domestic gas into WA are likely to be substantially less and consequently more expensive.

These factors point to the importance of the policy makers remaining focussed on the longer-term policy framework necessary to underpin the development of the WA energy market. It is vital that policy makers not lose sight of these longer term issues and become overly focussed on short term matters and assertions over the structure of the WA gas market, many of which do not withstand close scrutiny.

[28] Independent Market Operator, *Gas Statement of Opportunities*, July 2013, available at: http://www.imowa.com.au/GSOO

ATTACHMENT 3: WA DOMESTIC GAS RESERVATION

The current domestic gas reservation policy, rather than increasing domestic gas supply, is having the perverse effect of discouraging new market entrants and supply diversity. The requirement on LNG projects to set aside the equivalent of 15 per cent of gas to be exported as LNG for possible domestic gas supply to unspecified customers at some unspecified time in the future is effectively a unique form of resources tax on LNG projects not applied to any other part of the resources industry. The major beneficiaries though, are not WA households but the relatively small number of existing and potentially new large scale industrial projects who would secure 'cheap' prices as a consequence of a mandated quantity of supply of gas into the WA domestic gas market. Ironically, many of these large projects export their output at world market prices and are strong advocates of free trade.

In order for new multi-billion dollar gas projects to proceed, suppliers and customers need to reach an understanding on terms (including prices, volumes and duration) that will enable both parties to develop commercial projects. New gas supply projects and large new gas-fuelled resources projects typically take a number of years to gain approvals and develop. As projects move forward, gas supply agreements firm up.

It is critical that policy makers understand this aspect of the market when considering the long-term policy framework for WA. In this respect, the market outcomes in WA are often compared with the Eastern Australia market or markets overseas and ignore that WA gas prices have, for many years, been well below gas prices in these other markets. Prices vary according to the economics of individual projects and market forces. That prices delivered by the WA market are different to other parts of the world reflects the very different structure of the WA gas market. To compare prices and structures is to ignore the fundamental differences at play in this comparatively immature market. Prices in WA have risen primarily because costs are escalating and the remaining gas resources are more expensive to develop.

Reservation policies can also make it harder for LNG projects to secure the large amounts of capital required for their development and distort investment decision making (as, for example, the expenditure for the domestic gas plant may not be optimised with the LNG plant construction). Reservation requirements also create the perception among other domestic gas suppliers and customers that large increments of gas will be forced into the market at prices that are subsidised by LNG or liquids sales. The mere perception of such a possibility acts to discourage domestic gas exploration and development activity by other industry participants. This is particularly important in relation to the emerging shale and tight gas sector in the North Perth and Canning Basins where WA holds an estimated 280 tcf of natural gas.

The current gas reservation policy also creates a perception that the Government may be prepared to intervene in the gas market in other ways in order to secure 'cheap' energy or other objectives. Gas reservation reduces investor certainty and increases investors' assessments of risk and therefore of the returns needed to justify the investment. In a commercial negotiation for example, the prospect of government intervention discourages both buyers and sellers from

finalising contracts – sellers because they will be wary of terms being changed after they have committed to a major investment and buyers in the hope that government intervention may deliver better terms and large savings over a long term contract.

It is also noteworthy that the West Australian coal industry has also spoken out against gas reservation in favour of a market-based approach where energy inputs go to where they achieve the highest value to ensure the most efficient allocation of resources[29].

[29] Address to the Australian Institute of Energy Seminar on the Strategic Energy Initiative, Mr William Moody, General Manager, Marketing and Development (WA), Wesfarmers Resources, Perth, 24 February 2010.

ATTACHMENT 4: ECONOMIC CONTRIBUTION OF AUSTRALIA'S OIL & GAS INDUSTRY

Major shifts in world economic growth from west to east have been driven by the rapid industrialisation of China and other structurally large Asian economies. This economic advance of our region is overwhelmingly positive for Australia. It has changed the dynamics of key international resource, product and capital markets.

For Australia, this has translated into strong demand for our energy and mineral resources and is driving massive investment by the oil and gas industry to find, develop and produce new energy sources. It plays to our comparative advantages: as a secure and reliable energy exporter; and our proximity to markets.

Reliable, secure and competitively priced energy is crucial to industry, our communities and households. It underpins Australia's economy and industrial structure. Within this framework, oil and natural gas plays a key role. At present, petroleum (oil and natural gas) accounts for nearly 60 per cent of Australia's primary energy needs – this is expected to increase over the next two decades.

Australia's upstream oil and natural gas industry has entered a period of unprecedented growth and transformation. The industry is today investing almost $200 billion in Australia, which would deliver eight of the world's fourteen natural gas liquefaction plants under construction or firmly committed worldwide. This will propel Australia towards being the world's second largest liquefied natural gas (LNG) exporter and potentially challenging Qatar for the top position.

According to Deloitte Access Economics modelling, this major investment will increase Australian GDP by up to 2.2 per cent a year and see substantial indirect benefits flow from the industry, including to the national and state economies via a growing services and contractor sector.

By 2025, the construction and operation of these projects will:

- cumulatively add more than $260 billion to Australian GDP in net present value (NPV) terms; and
- see the industry's total tax contribution at around $12.1 billion a year in revenue.

Much of this growth is occurring in Western Australia where annual LNG production is expected to reach more than 50 million tonnes by 2016, up from the current level of 20 million tonnes. In total, Western Australia accounts for 47 per cent of investment in oil and gas projects, including the Gorgon, Wheatstone and Pluto projects.

In addition, Western Australia has derived significant benefit from spending with local suppliers both during construction and operations phases of projects.

Importantly, a second wave of investment in the Australian oil and gas industry of almost $180 billion is under consideration. This includes projects offshore Western Australia such as Browse LNG, Scarborough, Gorgon expansion, Wheatstone expansion, Bonaparte FLNG, and potentially others. The second wave of investment has the potential to:

- cumulatively increase Australian GDP by $192 billion (in NPV terms) above the level of what could be expected from the first wave of investment, over the period 2012 to 2035 ($804 billion compared with $612 billion);
- lead to industry taxation payment totalling up to $18.9 billion per annum by 2035; and

- achieve significantly higher levels of Australian content through the operational phase ((the North West Shelf project achieving overall spend of 85.5 per cent on local content in 2012. Estimated levels of operational local content spend can be as high as $33 billion over the life of a project.[30]

Beyond the economic contribution to the nation and to Western Australia, these projects will also help reduce the growth in Australian and global greenhouse gas emissions, improve Australia's energy security and increase the competitiveness of our energy markets. They will also provide a long-term boost to jobs and income for service industries and tax revenues for governments.

[30] Australian Venture Consultants, *The Wider Contribution to Australia of the Oil and Gas Industry: Selection of Case Studies from the Development of Offshore Gas Fields*, September 2012