ECONOMICS AND INDUSTRY STANDING COMMITTEE

INQUIRY INTO THE ECONOMIC IMPLICATIONS OF FLOATING LIQUEFIED NATURAL GAS OPERATIONS

TRANSCRIPT OF EVIDENCE
TAKEN AT PERTH
MONDAY, 21 OCTOBER 2013

SESSION FIVE

Members

Mr I.C. Blayney(Chair)
Mr F.M. Logan (Deputy Chair)
Mr P.C. Tinley
Mr J. Norberger
Mr R.S. Love

Hearing commenced at 2.57 pm

Mr LUKE MUSGRAVE
Vice President, LNG, ExxonMobil (Australia) examined:

The CHAIR: On behalf of the Economics and Industry Standing Committee, I would like to thank you for your appearance before us today. The purpose of this hearing is to assist the committee in gathering evidence for its inquiry into the economic implications of FLNG. You have been provided with a copy of the committee's specific terms of reference. At this stage I would like to introduce myself and other members of the committee present. I am Ian Blayney, the member for Geraldton and chair of the committee; Hon Fran Logan is the deputy chair; and our other members are Jan Norberger and Peter Tinley.

The Economics and Industry Standing Committee is a committee of the Legislative Assembly of the Parliament of Western Australia. This hearing is a formal procedure of the Parliament and therefore commands the same respect given to proceedings in the house itself. Even though the committee is not asking the witness to provide evidence on oath or affirmation, it is important that you understand that any deliberate misleading of the committee may be regarded as a contempt of the Parliament. This is a public hearing and Hansard is making a transcript of the proceedings for the public record. If you refer to any document during your evidence, it would assist Hansard if you would provide the full title for the record.

Before we proceed to the inquiry-specific questions we have for you today, I need to ask you the following: have you completed the "Details of Witness" form?

Mr Musgrave: Yes.

The CHAIR: Do you understand the notes at the bottom of the form about giving evidence to a parliamentary committee?

Mr Musgrave: Yes.

The CHAIR: Did you receive and read the information for witnesses sheet provided with the "Details of Witness" form today?

Mr Musgrave: Yes.

The CHAIR: Do you have any questions in relation to being a witness at today's hearing?

Mr Musgrave: No.

The CHAIR: I will defer to one of my colleagues because I have not chosen a question.

Mr J. NORBERGER: I will kick off. I notice that as part of your submission there is information that in regard to the Scarborough field, you are currently in pre-FEED —

Mr P.C. TINLEY: No, concept.

Mr J. NORBERGER: I was under the impression that it is currently pre–front end engineering and design. Is that were you are up to at the moment?

Mr Musgrave: Would the committee mind if I began with —

The CHAIR: Sorry, the chair's mistake; I should have given you a chance to make an opening statement.

Mr Musgrave: I am sure that some of your early questions may be answered.

Mr J. NORBERGER: We all apologise on behalf of the chair.

The CHAIR: It has been a long day!

Mr Musgrave: That is okay. Thanks for the opportunity to appear before the committee today.

ExxonMobil Australia is the country's oldest petroleum company; we have been operating here since 1895 and we have invested over $19 billion here in Australia. Our business covers a wide range of petroleum-related activities, oil and gas exploration and production, through to petroleum refining and the supply of fuel and lubricants. We employ over 1 800 people in Australia and indirectly thousands more through our contractors and the suppliers that support our business. We operate principally through a number of affiliated companies; Esso Australia Resources, Mobil Exploration and Producing Australia, Mobil Australia Resources Company, Mobil Oil Australia and Refining. We are part of ExxonMobil Corporation, which is the largest publicly-traded international oil and gas company in the world—I am sure that you know that.

We have extensive experience in LNG and our current liquefaction capacity is approximately 65 million tonnes per annum through our ventures in Qatar and Indonesia. We also have new facilities coming on stream soon in Papua New Guinea and others planned in various other parts of the world. We also have significant expertise operating in difficult environments, and have overcome challenges to succeed in conditions ranging from Arctic up in the deep Russian areas, to the deepwater oil and gas fields off the coast of Nigeria. Basically, we operate in over 100 countries around the world at this point in time.

Here in Australia, we operate from 22 production facilities located in the Bass Strait. We have been producing there for more than 40 years. We have a network of production facilities—the petroleum comes onshore to our facilities at Longford in East Gippsland where we do the processing, and then we export and market our products from a terminal to the south-east of Melbourne in Western Port Bay, called Long Island Point. We also produce and market natural gas. Currently, we are supplying significant quantities of natural gas to the east coast domestic market, all of which comes from Gippsland. In our downstream, through primarily Mobil branded products, we supply a whole range of fuels and lubricating oils to the Australian market. We also own the Altona refinery in Melbourne and we are one of Victoria's major suppliers of fuel.

Here in Western Australia, we have a number of interests. We are a 25 per cent foundation participant in the Gorgon development. As you know, Gorgon is the largest single resource development project in Australia's history and represents a very significant investment for ExxonMobil in this state. ExxonMobil Australia is also the operator of the Scarborough gas field located in the Carnarvon Basin, offshore Western Australia, in joint venture with BHP Billiton. While Scarborough is in the early stages of development—we are still doing concept studies—we have at this time identified floating liquefied natural gas, or FLNG, as what we consider to be the best concept for progressing that remote development opportunity.

I would like to make a couple of comments on energy demand because I think they are relevant in terms of the areas the committee is examining. From ExxonMobil's perspective, of course, energy is fundamental to economic growth and national prosperity. We expect global energy demand to be about 35 per cent higher in 2040 than it is today, as the world population grows from around 7 billion people today to nearly 9 billion in 2040. Energy demand in developing nations, especially in the Asia Pacific region, is expected to increase by 65 per cent by 2040. This is an interesting statistic; it is the equivalent of adding all of Australia's energy demand to the region every 18 months. It gives you some sense of the scale of that growth.

Each year we publish an outlook for energy and in our "2013 Outlook for Energy" we commented that electricity demand will remain the biggest driver of global energy needs. While oil will continue as the most widely used fuel worldwide, natural gas demand will rise by 65 per cent through to 2040 and will overtake coal as the second most widely used fuel. Meeting this demand for energy and for cleaner burning natural gas will be an enormous challenge and require ongoing innovation and technological transformation. I think we will talk about the role FLNG plays in that.

ExxonMobil is an industry leader in the development and application of technologies that can unlock new energy sources in a safe and environmentally responsible manner. Technology not only delivers significant value in previously uneconomic resources, but it can also reduce our environmental footprint and increases capital efficiency. For example, we have developed and applied new technologies to construct the world's largest LNG trains—currently operating in Qatar—and ships. The size of the ships transporting LNG in the past 15 years has increased significantly, and that technology is technology we were involved in developing as well.

Australia is experiencing an unprecedented period of growth in the LNG sector. This has been driven by the global demand for natural gas. There are currently seven new LNG projects under construction in Australia that, when added to the existing three producing projects, will take production capacity to approximately 85 million tonnes a year. So as our country's more conventional gas resources are being developed, technology will be required to drive the next wave of projects and ensure we can compete for markets in our region. FLNG technology will open up gas fields that were previously uneconomic or technically difficult to develop, and will deliver significant benefits, we believe, to Australia and Western Australia. Just as technology has allowed access to vast unconventional oil and natural gas resources in other parts of the world, including the United States, so too can new technology unlock new gas resource and position Australia as a leader in global LNG trade.

[3.10 pm]

I would like to make a couple of specific comments about the Scarborough project that is most relevant, I am sure, to you here on the committee. The Scarborough gas field is very remote. It is located approximately 220 kilometres offshore in the Carnarvon Basin, northwest of Exmouth. It is one of the Carnarvon Basin's most remote gas resources. It is located in relatively deep water, around 950 metres, and it is in a challenging metocean—its marine condition and weather environment. It was first discovered in 1979, so over 30 years ago, and we have been working very hard to commercialise it since then. It is considered a mid–size gas field with a resource of approximately eight to 10 trillion cubic feet. Interestingly, and I think in comparison to many of the other LNG developments that have occurred, this particular field contains mostly methane. It contains no measurable quantities of oil or condensate products. It is essentially a dry gas. It is very low in carbon dioxide as well. Because of the specific reservoir conditions, the reservoir itself is actually at quite a low pressure. I can talk a bit later about what that means. It means we have to assist recovery.

Scarborough is being developed as a joint venture between ExxonMobil and BHP Billiton. It is apparently under WA-1R; retention lease 1R. We each have 50 per cent. Our two companies have a long history of working together, having jointly developed the Bass Strait, and then working together there as joint venture partners for more than 40 years. Following detailed consideration of a range of development options for the Scarborough project, including onshore development at the Ashburton north strategic industrial area, where we currently have a land entitlement, ExxonMobil has selected floating liquefied natural gas as the lead development concept for Scarborough. After exhaustive studies—we have been studying development opportunities for eight to 10 years; we have looked at many, many options—we have selected floating liquefied natural gas as the lead development concept for Scarborough. As a remote and isolated gas resource, developing the Scarborough field remains challenged due to its distance offshore, its water depth, its ocean conditions and its resource characteristics. Some relatively recent technology enhancements that are incorporated into FLNG could provide an opportunity to overcome these challenges and enable development of the Scarborough resource. In the case of a remote gas field like Scarborough, FLNG technology could allow development of this field which otherwise may remain stranded. I think that is testimony to the fact that we discovered this in 1979 and have been working constantly to look for the optimum development opportunity. With the advent of new technologies, we have

found a viable means of developing Scarborough, otherwise that gas had been stranded and, in the absence of technology, may well have remained stranded for some time.

Although FLNG is considered the lead option for developing Scarborough today, further engineering and design work is still to be undertaken before we are ready to make a commitment to develop that field. We are doing concept studies, which we expect to continue through 2014. At the conclusion of those, we need to make a decision whether to do engineering studies; front-end engineering design—FEED. At the conclusion of that we would have a decision on whether to invest in the project and proceed with development. That is called a FID, or a final investment decision.

In conclusion, ExxonMobil welcomes the inquiry as an opportunity to highlight the importance of technology in meeting global energy demand and the positive impact FLNG will have on the national interest and on the state's economy. I think I might leave it there. I have said all I wanted to say in my prepared remarks. I will be happy to take your questions.

The CHAIR: You said you have to assist in recovery. Does the FLNG process make that easier to assist in recovery? How are you assisting in recovery?

Mr Musgrave: Because this reservoir has relatively low pressure, placing the production facilities close to the field is an advantage to efficient recovery of the field. In the concept of FLNG, because the recovery and production are packaged into a vessel of some sort that sits very proximal to the field, the gas will flow from the reservoir up onto that. If we were to consider that, and we have in the past with other development options such as bringing this gas onshore, the requirement before you even get to the liquefaction side, is that we would have to put a floating platform above the field to provide initial recovery and compression to give that gas energy to actually flow 220 kilometres to the shoreline. It becomes very capitally efficient to eliminate the compression step and eliminate the transportation step by putting those facilities proximal to the reservoir itself.

Mr J. NORBERGER: I appreciate that. That answered some questions that I no longer need to ask. You mentioned that you considered a number of options for Scarborough including bringing it to shore. Did you also look at the opportunity for brownfield development? Is there an argument that existing pipeline infrastructure in WA could be better shared?

Mr Musgrave: The answer is yes and no; I will explain it to you. When you typically talk about brownfield, you are talking about synergising most prominently with existing facilities. Your part of the development is a small increment to something that already exists. Greenfield is typically where you have to build most of the facilities yourself. Some of the opportunities we have looked at onshore involved working synergistically with other operators on the coast of Western Australia—one already established, and at Ashburton north another beginning to develop a facility that had some potential, when completed, to have some existing capacity added to it. It still has some years to go before it is completed. For us, that would have been a mixture of greenfield and brownfield. The greenfield component being what I referred to earlier: the development of the platform to go offshore, the compression, the early processing, the laying of quite long pipelines. One of those pipelines was over 200 kilometres; the other pipeline to the more northern opportunity was over 400 kilometres. That would have had to have been laid, crossing quite a lot of existing infrastructure. The fact is Scarborough is very remote. If you look at the map of the Carnarvon Basin, Barrow Island and the Gorgon field come a long way south and a little bit further offshore. Scarborough sits at the outer edge of the Carnarvon Basin pretty much all on its own. It is very remote. It does not have the benefit of being proximal to any existing infrastructure that would be capable of being easily expanded at this point in time. It is predominantly greenfield development for us.

Mr F.M. LOGAN: Can I ask about the exploitation of the Scarborough field by FLNG and the scale of the FLNG required? I think it was reported in the media that Exxon is looking at an FLNG facility double the size of Prelude. Could you explain to the committee what type of facility would

be used out there for FLNG and what size it would be? Would you use the Shell technology or would it be Exxon's own development?

[3.20 pm]

Mr Musgrave: There are some truths and some incorrect information in what you have said. The doubling part of it would refer to the capacity for LNG annual production. That can sometimes be confused with a doubling in the size of the actual structure. Let me tell you what we are contemplating as our concept, recognising that we are still doing a lot of work on that concept. It would be a floating concept—if I was to draw you a picture, it would look like a large supertanker—just short of 500 metres in length and about 75 metres wide. It has a bow and a stern. It is permanently moored. It is designed to withstand the most severe storm that we could possibly anticipate. It would stay on location permanently for the life of its production, which could be somewhere between 20 and 30 years. The front of the ship always points into the weather. Because Scarborough is very dry—I mentioned it has no condensates—we do not have to provide facilities on the vessel for the separation and storage of gas condensates. Technology limits set the size of the actual ship's structure. The size that I just described to you is at the limit of the largest that could be built anywhere today in the modern technical world. There are probably only three shipyards in the world—they are located in South Korea—that would be capable of constructing that type of vessel today. That technology does exist today. Those construction facilities did not exist 10 years ago. We can use the real estate on that size to provide for between six million and seven million tonnes per annum of LNG liquefaction capacity. By contrast, the capacity of the Prelude facility—I am quoting from information that I read publicly; you have probably taken more accurate information—is around 3.5 million tonnes per annum. They have to make available some of the real estate that is on that vessel, both storage real estate and processing real estate, to handle the liquids that come from their richer gas stream.

Mr J. NORBERGER: That is a credit to Exxon. You do not do things by halves. Half a kilometre—that is decent. In relation to the FLNG for Scarborough, has any consideration been given to a possible location for a supply base?

Mr Musgrave: At a conceptual level. Earlier this year we made a referral to the federal environmental regulator SEWPaC. In that, we described that we would look at both existing supply base locations and we would also consider potential sites for new supply base locations. We have not done extensive studies on this other than to conclude that the provision of a supply base is an essential and integral part of being able to maintain and operate a floating structure like Scarborough. We think there are existing very high–quality marine supply bases along the coast of Western Australia today, up in the north, in the Karratha area, also here in Perth and perhaps also down at the AMC in Henderson, which is a brilliant facility. We are using it extensively for our Gorgon project development and have experience there. We would look there first. Should that not provide the capability or the capacity, we would have to look for options that may involve developing or jointly developing or some other way of creating new capacity. It would seem to us that if cost-effective capacity was available already, to utilise that would be a sensible thing to do. I do not think that the provision of marine terminal capacity would be a barrier, ultimately, to the development of this infrastructure. It would either be here or it would need to be developed to meet Scarborough and perhaps potential other developments that would require marine-based servicing and all of the logistics and supply capability that comes from those sorts of facilities.

Mr P.C. TINLEY: Given that your US parent, ExxonMobil, is the largest player in gas development in the US and I think, if not granted, has an application for an export licence, as a strategic issue, what imperative is there for Exxon to allow such a relatively high risk and return closer to a market that it might be seeking?

Mr Musgrave: We invest all around the world. Australia has long been a favoured investment location for ExxonMobil. Our history of investment, as I mentioned, goes back over 100 years. We

think that the technology has been developed to a point now. Shell and others have been researching FLNG technology. ExxonMobil has been researching FLNG technology for many years. Some of the basic technology units are similar and some of them are slightly different variants of each other, but common themes. We feel that this technology can be deployed. It can be deployed safely. It can be deployed with minimum risk. We frankly would not embark on the journey of developing the technology unless we believed that to be the case. Our company has a history of technological innovation. It has a history of deploying new technologies. If we had more time, I could tell you about some of the new technologies that we have developed. For example, a lot of this unconventional gas and oil recovery technology—long horizontal drilling and so forth—is technology that we helped develop within the industry going back over many years. We have held Scarborough for 30 years. It is a valuable resource to the company. We are very keen to develop it. We have not been able to develop it until this point in time because, frankly, we have not found a viable means of developing it but we think FLNG technology opens the opportunity to develop this field safely and efficiently because of its unique location and unique characteristics. We would be very keen to do that.

Mr P.C. TINLEY: I am talking about a more global strategic view about energy use and energy pricing, particularly gas pricing. If the US becomes a net exporter of any great global scale—it sounds like it could well be there—it is naturally going to impact on your capacity, given the higher cost of production that FLNG seems to present. That is an open-ended question. Do you have customers for this gas resource?

Mr Musgrave: I think we would. We have already successfully marketed our share of equity output from Gorgon. In fact, we sold that back in 2009. I am responsible for LNG marketing here in Australia. I have a good understanding of the market. The demand for LNG is very, very strong. It is a growing demand. Countries, particularly like China, India and some of the developing economies, such as Vietnam and others, are going to need sources of energy into the future. Australia, particularly the north west of Australia, is very favourably positioned to meet those demands. It is a global market and we have to compete. We are competing now against more varied sources of LNG. For example, four export projects have already been approved for LNG from North American gas. This is why it is very important that we continue to build capitally efficient developments here.

[3.30 pm]

It may be that the source of gas at the moment, the Henry Hub price for gas the United States, which is currently around between $4 and $5, is quite low, but they have the cost of having to liquefy that in the US and then having to transport it for long distances to Asia. If we can construct cost-efficient, capitally efficient development projects, we have the benefits of shorter transportation distances and would and should be able to compete with other LNG sources, for example, coming from the US. I also think we are developing conventional resources still on the north west coast of Australia, which is very much a defined quantity and very much understood for Asian buyers. Many Asian buyers have preferences to enter into longer term energy contracts to underpin energy self-sufficiency and national energy security. These big fields we have off the coast of Western Australia provide a great opportunity for Australia to capture those markets because the synergies are very strong. There are high-quality gas resources. We have a stable government, and it is very important that we have stable fiscal policies. We have reputable companies here developing our resources and building world-class projects. I think all the dynamics are right for Australia.

Mr P.C. TINLEY: Do we have the right tax regime in terms of tax offsets against the PRRT?

Mr Musgrave: I think there is always room for improvement, but by and large you can see from the projects that are currently developing and the successes we have had as a nation. I think, generally, our settings are close to being optimum. There is always room for some tinkering around

the edges and those debates are ongoing, as you know. I think Australia has a good reputation. In the last few years I think our reputation is that people have seen the cost of development here in Australia increase and I think that we need to be very conscious of maintaining our competitiveness globally through looking for capitally efficient development options, so there is a capitally efficient option to develop something that is going to result in a more competitive project—a more competitive resource space. We need to test all of those and make decisions accordingly.

Mr F.M. LOGAN: Can I just ask couple of questions? One is about the stabilisation of FLNG in Scarborough. It is in deep water, so 900 metres. Is it going to be anchored or is it floating?

Mr Musgrave: The vessel is attached to a turret. The turret is a huge structure. It is roughly 30 metres in diameter and that structure is anchored to the sea floor through a catenary arrangement. There are multiple anchors in all directions with multiple layers of redundancy built into them.

Mr F.M. LOGAN: So the turret is anchored, not the vessel.

Mr Musgrave: That is right. So the vessel sits —

Mr F.M. LOGAN: So it is going to weathervane.

Mr Musgrave: Yes, so the vessel can always weathervane around the turret so that the turret stays permanently moored and the vessel can go up and down with the waves and the tides and whatever. It can rotate into the oncoming wind and waves.

Mr F.M. LOGAN: Can I ask a different type of question about the decision to go with FLNG? Obviously, Exxon and BHP for a fair while have been looking at bringing gas onshore to what is called Ashburton North now, but what was Onslow precinct. I know you are going to say cost, but we are trying to dig down as the committee to find out what were the aspects of the cost that would have persuaded you to make a decision to go to FLNG rather than bring it onshore.

Mr Musgrave: The primary aspect was a cost associated with this field's remote location and its relatively low pressure. As I said earlier, when you start to conceive of a project that has an onshore base, you have to get committed as well to putting significant facilities offshore, in that base case, that need to be there for the life of that field—that need to be manned and operated. If you are to come ashore to Ashburton, it would be over 200 kilometres and if you are to head up to more the Karratha area, you are over 400 kilometres in pipelines. Those costs have made the development unattractive to us for onshore. When we look at the floating technology, those costs come out of the equation because the plant is essentially at the field, and we have other investments that we need to make, of course, shipping and so forth, but it is a lot more capitally efficient.

Mr F.M. LOGAN: So you would, given the nature of the field, this low pressure and the need to pressure rise that gas to get it onshore. That is one aspect of the costs obviously, but I gather from what you are saying, and we have heard that from various industry players, that pipeline costs have escalated dramatically not only here in Australia, but also around the world.

Mr Musgrave: They have—the cost of steel, the cost of installation. It is that whole package of development cost that has escalated. I would make the comment that I think there is definitely a place for onshore development, but you always have to look at it in the context of the specific field that you are looking to develop. If I can just contrast, we are a 25 per cent partner in the Gorgon project and it is being developed on Barrow Island. We are building 15.6 million tonnes of capacity there. That is a very appropriate development concept for the greater Gorgon resource because of the scale of the project. Scarborough, on the other hand, is about a fifth of that scale. It cannot carry the burden anywhere near like that investment. This is part of the reason why we have been searching for a development concept for so long. You have to look at the fact that it does not have the liquid add that some other gas fields get the benefit of from an economic point of view to supplement the overall project return. There are many, many factors that you have to take into account, but specifically for the Scarborough project, yes, we did we look at Ashburton North, both with an existing operator and as a stand-alone on our own piece of land that we have there

currently, and still do have. That entitlement remains valid until the end of this year. We also looked further north along the coast at opportunities there as well, but despite months and months of engineering and commercial technical evaluation, we could not find a way to make those projects viable.

The CHAIR: The Prelude vessel is about 600 000 tonnes. Is yours one million tonnes?

Mr Musgrave: I do not have that particular number, but I am more than happy to take that question on notice and respond to you. I would think it would be similar. The reason that I do not have the precise dead weight of that vessel is that part of our concept work at the moment is looking for ways to reduce the weight, because weight contributes directly to cost, and in the choice of material, the types of technology and in the layouts that you take, you can impact the overall weight of your facility reasonably significantly. So, we are looking at these issues carefully at the moment as part of our concept studies. I would say the main driver for weight is the length and dimensions of the vessel. Our vessel dimensions are roughly the same as the Prelude one. The only other things that would vary the weight would be the type of facility that went on the topside or the way the tanks were built or some other part of technology like that. But I do not have the precise number with me today. I am sorry about that but I can get back to you if you would like me to.

The CHAIR: I am sure the figure will come out sooner or later anyway.

[3.40 pm]

Mr F.M. LOGAN: Just coming back to the reasons for calling the inquiry and the four aspects of the inquiry and particularly the first two, which go to not just opportunities, but the impact of FLNG on local engineering, manufacturing and fabrication. At the early stages that Exxon–BHP are in in terms of FLNG, we have heard—I do not know whether you were in here earlier, but we have heard from a number of other operators about how they want to approach their FLNG facilities. It appears, particularly from Shell onward in terms of the operators and the proponents, that the argument from oil and gas companies is that the benefit to Australia and Western Australia is all in the operational phase, the jobs, the maintenance opportunities, the supply opportunities et cetera. It is all in the operational phase. Obviously, you are well aware of the differences in opportunities between onshore and offshore—22 000 jobs versus a few hundred jobs in the operational phase. What opportunities do you believe Western Australia and Australia could have out of the design, engineering, fabrication end of your FLNG, which is the same time question I put to all the other companies?

Mr Musgrave: You know, I think the spectrum, as I look into the future for Western Australia and Australia, is great. I think we are just at the beginning with this technology. It is new and innovative technology and there are only a few who have the expertise to design and construct this technology. Initially, it may be a challenge for Australian companies that do not have experience in this area to establish their place at a level comparable with those that are currently experts, but challenges are opportunities and I think as this industry develops, there is very much the opportunity. I mean, our company would embrace the opportunity to use Australian resources for these projects. In fact, our local content policy would be that in tendering, making work available, we will include Australian companies in the opportunity list of companies available to tender for work and work with organisations like the ICN and others to ensure that Australian contractors and industry are aware and have the opportunities. I think as time goes on that capability will develop here.

If you look at the history of the development of traditional oil and gas processing, at the very beginning—I mean I was involved in Gippsland back in the late 1970s and when the Bass Strait facilities were being designed in the late 1960s, there was not the capability in Australia to support that type of engineering. Those engineering designs were done by firms like Hudson in the United States, but today that is here. I think the Australian industry has the ability to attract and develop skills that are synergistic and can support the development of this industry. I would say in the near term there is a gap that needs to be filled here in Western Australia, in particular around having

quality services for maintenance and operations. If you were to do an analysis of what offshore facilities existed 10 years ago off the coast of Western Australia, if you were to actually look at the number of kilometres of pipeline, the number of subsea wells and compare it with today, the increase is many orders of magnitude of facilities have gone in. What we cannot allow to happen here in Western Australia is for our maintenance and operation costs to be amongst the most expensive in the world as our development costs have become recently. We have to invest in the services and infrastructure such that when we get into the operating phase of these projects, we are very competitive and we can provide the needs to all the projects that have been established along the Western Australian coast for efficient maintenance and operations.

Mr P.C. TINLEY: You are talking about marine supply support bases—that sort of thing?

Mr Musgrave: I am talking about marine bases, underwater inspection, underwater maintenance. There is a whole plethora of technologies that are required to maintain and operate and inspect and all the billions of dollars of facilities that are being installed under the water and up in these remote locations. To be able to source those resources from Australia—from places like Perth that are very well-positioned to supply all of the needs and technologies that north west Australia will need in the future—is a very powerfully thing.

Mr P.C. TINLEY: Can I pick up on that if you do not mind? One of the questions we have been asking is, "What could the state do better?", which I suspect is part of where you are going. What do we need to do as a business called Western Australia to keep that and maximise that opportunity? Do we need to provide common-user infrastructure in the north west, for example?

Mr Musgrave: I do not have a view yet of specific policies, but I see evidence of some companies beginning to establish facilities of the scale here in Western Australia that would be right-sized for those future types of needs; for example, GE just building down at Jandakot a massive regional base that has that capability. I can see that type of investment in other areas of maintenance and operations, marine bases, servicing supply vessels, maybe even building supply vessels. I think you have got to be visionary and I think we need to be able to think ahead to what level we need to be at in 10 years from now in terms of the infrastructure we will need to have in this state to run cost-effective services and support for maintaining and operating all these sorts of facilities, compare it to where we are now and put in place a plan to get there.

Mr F.M. LOGAN: It is interesting you put it that way, Luke, because—you are well aware of this in terms of the development of the Gippsland fields over the years—companies like Exxon and BHP, effectively, gave a leg up to local companies in Gippsland who provide not only maintenance services but also construction services of topsides and all sorts of pieces of equipment that were put in place in Bass Strait. There was similar work done here. There have been drill rigs built here in Western Australia, there have been topsides and FPSOs done in Western Australia, a whole platform has been exported to New Zealand and various other—and, of course, the entire stages 1, 2, 3 and 4 of the North West Shelf was done and stick built from Western Australia as well. But all of that work was done with support and encouragement from upstream clients and that is clearly not there in the FLNG, from the answers that we have been receiving from companies that have come before the committee. How do you then encourage upstream companies to provide that leg up for local industries, to liaise with the Samsungs of the world as to what could be supplied. For example, as you know, in the oil and gas industry in many other countries around the world, African, European, Asian countries—Malaysia, for example—governments have leant very heavily on oil and gas companies to provide their local industries a leg up. That has not happened here in Western Australia yet. But what can be done, because this is a completely new technology—and I do agree with you that there are very many opportunities that could be accessed—but how?

[3.50 pm]

Mr Musgrave: I think in the development phase we compete in a global construction industry now. I think it is for two reasons. I think the heavy engineering centres in South Korea and the

shipbuilding capabilities at Japan, even China now building LNG tankers and a lot of heavy engineering, that is part of the environment that we have to compete with. Maintenance and operations, I think, is a slightly different area of expertise. It is often very calibrated to the environment that you are working in, the local conditions; often the response time is important. If something breaks down, you want somebody close who can respond quickly. You want the capability locally so that the shutdown time is short, and I think we are just at the beginning of that growth curve. In 10 years from now, when we have 50 to 60 million tonnes of capacity on the west coast of Australia compared to five years ago when we were 10 to 15 million tonnes, that the scale drives a totally different industry capability for responding to all of the ongoing challenges of maintenance and operations. So, I think this is our opportunity here to be a part of that. There is no reason why Western Australia cannot be a regional centre for those types of services, to be honest. With all of the facilities right on our back doorstep, and then if we get efficient, competing in the regional market for those types of contracts as well, so I can see that opportunity.

The CHAIR: With your supply bases, is Exmouth a possibility, is it a base?

Mr Musgrave: Yes, it is. We noted Exmouth as a possibility. In our environmental referral we have not studied it in any detail, but we think its location is proximal to the Carnarvon Basin and it provides shelter. It is a physical location that is definitely a candidate for that type of development service capability. I cannot talk about it as a specific opportunity, because we have not got to the stage yet of really looking in detail around the marine support side. We are still back focused on getting our basic development concept right. But, as I said, having an efficient, well-located, reliable, marine-based support is absolutely essential to the long-term viability of significant operations that are based offshore. I think, while the capital costs of developing floating LNG compared to onshore development in the case of Scarborough may be lower. I think the operating costs compared to the same development onshore could be higher, because it is in a marine environment. I think for that reason we will be very focused on finding ways to operate and maintain these facilities, obviously safely, that is number one, but clearly with facilities that are efficient and cost effective. And I think more capacity will be needed in time. The existing capacity will all get consumed at some point and we will need to develop more marine-based capability along the coast. Just when that time frame is, I am not sure, but if these developments continue to progress at the rate they are, I am sure that that is coming in the near future.

The CHAIR: I have only one more question on safety. Everyone talks about the one in ten thousand-year storm and how you are going to survive it. I just wondered if the eye of a cyclone passed directly over the ship, okay, and from what I have read about it when the eye of a cyclone passes over you, the winds all just stop and you get about 20 minutes of no wind and then as the cyclone moves, you go almost straight back up to full velocity winds. It is much quicker than when the cyclone initially moves over you. So, would the vessel be able to rotate quick enough to react to those winds, because they are going to come on a lot quicker than they did when the cyclone was first felt.

Mr Musgrave: The answer is yes. The vessel will either take its direction, its weathervaning direction, from the prevailing energy source, which is the wind, or the vessel can be pointed with its own thrusters and whatever, to whatever direction is anticipated. If you think about it—you have picked a very extreme example there—there is always weather coming through and there are always wind changes coming through associated with frontal systems and changes in weather pattern. So, it is important when you are operating one of these that you understand the weather and how to manage the vessel in relation to the weather. I think a dynamic positioning, all the data gathering to enable us to do that safely, exists now—all of those technologies.

The CHAIR: Because your weather there is going to be quite different from what you have got off the Kimberley coast.

Mr Musgrave: It is. So the metocean conditions in the outer Carnarvon Basin are more severe. I mean, they are not in the severity of what you would call Bass Strait or the North Sea, but they are more severe than the more tropical areas. One of the differences that that manifests itself into for Scarborough development is, for example, our shuttle tankers which load with product will load end to end. So the tanker will come along behind the vessel, which is weathervane, and it will fill through flexible pipe from the stern of the production vessel across to the bow of the tanker. In a more benign weather environment area, such as up in the tropical areas, you can bring the tanker physically alongside and you can have a side-by-side loading, so that the location sets some of those basic design parameters as well, which are also safety and integrity design parameters too. In the Carnarvon basin it is much safer to do the loading the way I just described it for Scarborough. And so I think they are factors that come into play from a safety and location specific point of view.

The CHAIR: With that I would like to thank you for your evidence before the committee today. A transcript of this hearing will be forwarded to you for correction of minor errors. Any such corrections must be made and the transcript returned within 10 days from the date of the letter attached to the transcript. If the transcript is not returned within this period, it will be deemed to be correct. New material cannot be added via these corrections and the sense of your evidence cannot be altered. Should you wish to provide additional information or elaborate on particular points, please include a supplementary submission for the committee's consideration when you return your corrected transcript of evidence. If some things occur to the committee afterwards, is it all right if we write to you to ask for answers to those questions?

Mr Musgrave: Yes, certainly.

The CHAIR: Thanks for that. Thank you very much for your time today.

Hearing concluded at 3.58 pm