Shell Development (Australia) Pty Ltd
ABN 14 009 663 576

2 Victoria Avenue
Perth WA 6000
Australia
Tel +61 8 9338 6000
Email paul.ryan@shell.com
Internet www.shell.com.au

Correspondence
PO BOX A47 CDC
Perth WA 6837

The Chairman
Economics and Industry Standing Committee
Parliament House
Perth, Western Australia
6000

Your ref: A416691

18 November 2013

Dear Mr Chairman,

Please find enclosed Shell's response to the list of questions raised by the Economics and Industry Standing Committee's Inquiry into the Impact of Floating LNG on Western Australia.

We have grouped some of the answers together where they logically fit under a common theme. We hope this assists the Committee in understanding Shell's responses.

Yours sincerely,

Paul Ryan
Senior Communications Adviser
Shell Development (Australia) Pty Ltd

1. What are the five greatest risks Shell faces in relation to using FLNG technology?

Shell's FLNG projects are assessed in line with standard industry practice, using a process to understand the opportunities and risks associated with all aspects of any project: Technical, Economic, Commercial, Operational and Political.

The risks identified for Prelude FLNG are common to many Australian LNG developments. These include:

- Subsurface: relating to the reservoir behavior, the volume of hydrocarbons in-place and volumes that can be economically recovered;
- Cost and schedule: As with all LNG projects worldwide, cost and schedule overruns are key risk factors. Independent Project Analysis benchmarking suggests that many large projects experience greater than 25% cost and schedule overruns, with Australian LNG projects typical or worse than this benchmark.;
- Political risks: Under this category, consideration is given to socio-political risks and opportunities. Long term fiscal and regulatory certainty is a critical element in this consideration, but so are the broader social or environmental impacts or opportunities each project brings.
- Technical risks include factors such as safety and environmental performance.
- Resourcing for operations: the recent rapid expansion in the Australian LNG and resources sector has significantly increased the demand for skilled operators. In addition, FLNG requires operators to have a combination of skills to operate both upstream (reservoir, wells, subsea) and downstream (steam boiler, steam turbine, liquefaction, loading) facilities. Shell is investing extensively and early in the training of skilled FLNG operators.

2. What consideration, if any, was given to developing the Prelude and Concerto fields as satellite fields within the Ichthys project?

Prior to taking FID for the Prelude FLNG project Shell assessed multiple development concepts, including onshore options. Shell's analysis of developing Prelude via long pipelines to an onshore plant was that it was uneconomic (even as incremental gas to a larger gas field) either due to the burden of cost or due to delays (decades) in development timing, as a result of infrastructure constraints.

The permit containing the Prelude and Concerto fields was released separately to that containing the Ichthys field under the Federal Government's offshore petroleum development laws and policies, and is subject to Commonwealth licences and conditions that are different to those for the Ichthys field. The FLNG option delivered the earliest economic development of the Prelude/Concerto gas resource.

The timing of the Prelude design and engineering work preceded equivalent work on Ichthys and the Ichthys FID only occurred at a later time. At the time of Prelude decision-making, there was no certainty that the development of Ichthys would proceed.

3. Page 5 of Shell's submission includes a graph entitled 'LNG development cost', which compares the cost in US$ per MTPA across several LNG projects. The top seven most expensive

projects in the graph are all Australian projects. Could you please explain where the Prelude FLNG fits onto that graph, and why that is the case?

FLNG greatly reduces and simplifies the scope of an LNG development, by removing the need for separate offshore processing facilities, large compression, long pipelines to shore, near-shore works (shipping channels and port/jetty facilities) or the civil works associated with an onshore plant. The smaller footprint (less than $1/10^{th}$ of the materials involved in an onshore LNG development) results in significant cost and schedule benefits (as well as a reduced environmental footprint) compared with an onshore LNG development. Shell can provide further details on these matters in our session on 20 November.

4. Shell's submission states that the proposed onshore LNG project for Browse would 'not have met generally accepted return rates for the very large sums of capital required …. and would [probably have] destroyed value for shareholders'. What, for Shell and its shareholders, is a 'generally accepted' rate of return on investment?

For investments of this scale (tens of billions of dollars), this cannot simply be 'boiled-down' to a single metric. Shell, like all major investors, assesses specific investments based on a wide range of factors that influence the rate of return of the investment and its sensitivity or robustness to changes in the project and the external market, especially downside risk. This includes an analysis of the technical and non-technical profile of the investment (e.g. cost and schedule risk, fiscal stability, product prices, foreign exchange rates).

What represents an acceptable return is therefore highly dependent on the company's individual investment profile and strategic intent. In all cases we have to be confident that the specific investments will create shareholder value, not erode it. For reference, NOPTA's Offshore Petroleum Guideline for Grant and Administration of a Retention Lease states that "The Joint Authority will usually consider projects which have an IRR of 12% or more as commercially viable."

5. What work has Shell done to assess the cost-benefits of Prelude FLNG in relation to return and risk; that is, how does Shell price risk? What is your thinking in weighing up and then deciding that higher risks might be preferable to a lower rate of return?

The Prelude Final Investment Decision was taken following Shell's usual process of investment analysis, as referred to in other questions from the Committee, taking a wide range of factors and sensitivities into account. Prelude FLNG was selected, on its merits, as the only viable economic development option in the near-term. Prelude FLNG has superior risk profile and economics compared to the alternatives.

6. The Browse Basin holds something in the order of 16 trillion cubic feet of gas, and 417 million barrels of condensate. The James Price Point project proposal included a liquefaction plant consisting of three trains, with a total capacity to produce 12 million tonnes of LNG per annum. The pipeline from the field to James Price Point would have been 350km long. What would be the total number of construction workers required to build an onshore gas liquefaction plant of that size, along with the supporting infrastructure? How many people would ordinarily be required to operate a plant of that capacity?

The Browse basin holds approximately 30 tcf of discovered gas resources. The Browse project incorporates three discovered gas fields (Brecknock, Calliance and Torosa) holding an estimated 15.5tcf recoverable gas and 417 mmboe gas condensate (Woodside estimates). Details of the previously proposed LNG development at James Price Point are best directed to Woodside, as Operator of the project. As stated during Shell's 23rd October hearing with the Committee, in Shell's view the James Price Point project was shown to be uneconomic.
The number of operators required for an LNG plant is dependent on the specific plant and project in question and will vary according to, for example, development scope being considered, type of equipment, age of plant, location and critically operations and maintenance philosophies. As an estimate, a 3-train onshore LNG project may be expected to employ 600-900 direct staff on an ongoing basis and a single train onshore LNG project approximately 300 staff. A comparable single-train FLNG (such as Prelude) will employ 350 direct and 650 indirect staff, and a 3 FLNG project 1000-1500 direct and 3500-4700 indirect staff.

7. If you were building an onshore liquefaction plant with a 12MTA capacity, located 350km from the field, today, what proportion of a capital expenditure for such a project would likely be spent on offshore componentry, such as FPSOs and the like?

The split in costs between offshore and onshore (where relevant) scope is highly variable and is entirely dependent on the specifics of the project and development case in question. Variables to consider include: the gas and liquid compositions, the size of the gas resource, the reservoir characteristics, the number and type of wells, the extent of subsea architecture, the nature and type of production platforms/facilities, the pipeline size, distance and seabed crossing, the material specifications throughout, the need for inerts and CO2 management, the extent of new marine/port facilities required (including dredging) and the need for new onshore gas pipelines to tie into existing infrastructure. These are all technical parameters, and no mention is included here of other commercial, financial or tax matters that significantly impact on development costs. For Browse-specific detailed development costs, the Committee is referred to the Operator, Woodside.

8. During the public hearing on 23 October, you indicated that the James Price Point project was not commercially viable. We know that environmental approvals have a cost, that there is a cost in labour, and that there is a cost in manufacturing. How far off in dollar terms was James Price Point from being commercially viable?

The question refers to a few but not all of the significant scope and risk factors that go into the cost of an LNG development, such as the Browse project. These are complex mega-projects involving tens of billions of dollars investment, and generally take many years of detailed assessment by investors and regulators before final project sanctions to proceed are given.

As noted above, details of the previously proposed LNG development at James Price Point are best sought from Woodside as operator. Shell's assessment of the proposed onshore development concept for Browse is that it was not economically viable. Shell can provide further details on these matters in our session on 20 November.

9 . Are you able to attribute approximate dollar figures to red tape, green tape, local labour costs and international labour costs?

As noted in our submission to the Inquiry, Australian landed LNG is estimated to be 20-30% more expensive than competing suppliers, particularly North American and East African suppliers.. It is estimated that almost 50% of this cost disadvantage is attributable to intrinsic factors in Australia, such as gas reservoir characteristics, water-depth and metocean conditions, which are all outside the control of investors and governments. [1]

It is true that Australia is a high cost producer, but as noted in the above report wages and regulatory complexity are just part of this picture: some costs are "non-compressible" or intrinsic to the Australian LNG sector, notably remote locations and distance from existing infrastructure.

Any assessment of the economic impact of inefficient or duplicative regulatory burdens upon specific projects or on a whole of industry basis is complex and requires significant research and analysis. However Australia has recently seen a number of comprehensive studies on these issues which we expect will assist the Committee, including:

- APPEA "Cutting the Green Tape" (2013);
- BCA "Securing Investment in Australia's Future, Report of the Project Costs Task Force" (2013); and
- Productivity Commission, COAGs Regulatory and Competition Reform Agenda (2012)

10. How big a factor in FID is sovereign risk, and how does Shell price this risk?

As for all major investors in Australia, so called sovereign or country risk is an important consideration in very large, long term investment decisions. Shell takes into account country risk when establishing its global investment portfolio and the specific countries and projects to be included in that portfolio. Stability and predictability in fiscal and regulatory environments are important for companies such as Shell to make multi-billion dollar investment decisions that will be sustained for many decades.
Shell sees Australia as a good place to do business, although in recent years sudden changes in taxation arrangements have clouded this perception, creating uncertainty for a number of major investors. As an established OECD country, Australia represents low political risk. From our perspective, the most pressing business concern for Australia at this time is how to address the lack of cost competitiveness and the implications it has upon major resource investment decisions.

11. The Committee has heard that one of the challenges faced by LNG operators in Australia is the remote locations of the gas fields. How does FLNG address this challenge?

The commercialisation of remote gas fields offshore via onshore LNG projects Australia have to overcome a number of significant challenges, including:

- the necessity for substantial offshore facilities (structures, offshore processing equipment and long distance pipelines) and their associated life-cycle cost;

[1] *McKinsey and Co "Extending the LNG Boom : improving Australia's Productivity and Competitiveness" (2013)*

- the need for additional quantities of rock or concrete for offshore pipeline stabilisation, given the combination of shallow water bathymetry and cyclonic forces;
- material increases in size of near-shore infrastructure (such as jetties and offloading facilities) as a result of large tidal height changes;
- the distance to existing infrastructure such as ports, aviation and ancillary support facilities; and
- the distance from a large population base and the supporting infrastructure that brings, including a substantial, available workforce; accommodation; and other community infrastructure.

All these factors add to the total quantities of construction material needed to produce, transport and process the gas, from the wellhead through to LNG product export, and the cost of building the required facilities. FLNG greatly simplifies and reduces the construction scope, since it does not require separate offshore processing platforms, long pipelines to shore, near-shore works (dredging of shipping channels or jetty construction) or the civil works associated with the development of an onshore LNG site, thus avoiding all of the issues above. The smaller footprint and materials requirement (1/10th of onshore LNG developments) of FLNG developments results in significant cost and schedule benefits compared to onshore developments and enables gas fields to be economically developed sooner.

12. We understand that Shell has contracted Samsung Heavy Industries to build a number of FLNG facilities or vessels. Can you confirm the number of vessels to be built and whether Shell intends that they be built over 15 years? What assumptions underpin the decision to contract for multiple vessels over a relatively short time period?

Shell has entered into a framework agreement with the Technip-Samsung Consortium (TSC) that allows for the Front End Engineering and Design work and the Engineering Procurement Construction and Installation scope for the delivery of an FLNG facility. The agreement has the flexibility to include multiple FLNG facilities but does not stipulate the number of FLNG units, nor a specific timeframe. The agreement provides Shell (and its upstream JV partners) with the certainty that, where FLNG is selected as the development option, there will be access to the necessary capabilities and capacity to deliver the FLNG facility.

Through this agreement additional benefits are expected from learning and repetition over time, which provides further confidence in relation to the delivery of quality, cost and schedule. Alongside this framework, Shell and TSC have a policy to provide full, fair and reasonable opportunity for companies to participate in both the construction, and operations and maintenance phase of the FLNG project on the basis of capability, cost and safety. In Australia this includes Shell's ongoing work with AIPN, ICN-WA, ICN-NT, and ProjectConnect.

13. Where does Shell intend to base its offshore support mechanisms? In Singapore, or Darwin or elsewhere? What criteria does Shell assess in making this decision?

In the case of Prelude, Broome is Shell's base to support drilling, subsea installation, marine and aviation services, whilst Darwin will be the base for operations and maintenance support services.

These decisions were based on criteria such as capability, capacity, quality, cost, safety, reliability and productivity. In Shell's experience, developing local support and relationships for the operations and maintenance phase delivers effective and efficient outcomes and Shell operates a local content policy accordingly.

The support mechanism for Browse is the subject of a separate decision-making process by the JV led by Woodside as Operator.

14. The Committee appreciates that the Prelude FLNG vessel is intended to remain on-point throughout its operating lifetime. If for any reason there was a need to disconnect the vessel and bring it closer to shore for maintenance, would it be taken to Singapore, or is there a location along the WA coast that might be used?

The Prelude FLNG will remain on location for an estimated 25 years, depending on reservoir performance of the various gas fields to continue to supply gas to the facility. There is no requirement for the FLNG facility to leave the Prelude location at any time during that period because all maintenance will take place on-location for the duration. For this reason, Prelude FLNG will require a higher level of regular maintenance compared to an onshore development, which in turn then leads to increased opportunities for local contractors during the operations and maintenance phase.

At the end of the project, the FLNG facility will be towed to dry-dock for refurbishment and refit, in preparation for its subsequent deployment to another gas development (the scope of the work being dependent on the specifics of the subsequent development). This work can only take place in a dry-dock with the necessary capacity and capabilities, which currently only exists in a very limited number of locations.

15. What factors led to steel being used for the Prelude FLNG facility rather than a concrete floating facility?

In the early concept phase of Shell's FLNG design, both concrete and steel substructures were considered. Detailed concept feasibility studies assessed the steel and concrete options and concluded a number of disadvantages with concrete, again linked to Shell's design philosophy of only using proven and tested technologies:

- concrete would require a purpose-built graving dock to be constructed, adding substantial cost and longer schedule to the project;
- the established and proven construction capabilities of the ship building industry provided greater cost competitiveness and a safer construction environment; and
- the integration of cryogenic storage tanks into a submersed concrete substructure was unproven and involved potentially major hazards associated with water freezing and propagating concrete cracks. By contrast, the building of cryogenic storage in a steel substructure is already proven and can draw on long standing experience with LNG carrier construction.

16. The Committee understands that Pressure Dynamics, a hydraulic systems engineering business headquartered here in Perth, has recently been awarded a contract to design and manufacture the subsea control system Production Hydraulic Power Unit for Prelude. We are interested in how Pressure Dynamics was able to be part of the supply chain for this project. Is it the case that the work done by Pressure Dynamics is unique? Does this example offer guidance to other local firms as to how they might contribute to the development of FLNG technology?

Pressure Dynamics is a well known and respected supplier to the oil and gas industry and has been for more than 30 years. At the time Pressure Dynamics was completing work for Shell Prelude it was also constructing Hydraulic Power Units in its yard for several other oil and gas operators in Australia. Pressure Dynamics was awarded the contract for Prelude following a competitive tender. Pressure Dynamics was nominated by the ICN to FMC, prior to prequalification and tender, and its bid was evaluated and selected by FMC through a competitive tender process.

17. How does off-take from an FLNG compare with an FPSO? What are some of the challenges in offloading LNG at sea? Why will condensate be offloaded by the established method of using a floating hose?

The decisions to offload condensate by floating hose and LNG via side-by-side loading arms for Prelude FLNG are based on the same design premise: they are conventional and proven systems. This ensures confidence in equipment performance and reliability, and benefits from Shell's existing operational and procedural experience with their use. The main challenge when offloading in open seas is associated with the fact that both the LNG carrier and the FLNG are moving. Understanding these motions and the 'windows' where a product carrier can be moored and loaded has been studied for many years, using actual metocean data. The size and mass of the FLNG is a critical advantage when loading in open seas because its motion is considerably less than that of an FPSO or a LNG carrier. Work carried out by Shell (basin testing, berthing simulations and full-scale equipment testing of the loading arms) has validated the offloading performance.

18. Shell is a global company, and has experience with various governments worldwide. In relative terms, how would you describe the Australian Federal Government's appetite for seeing Australia's petroleum resources developed generally and through using FLNG technology in particular?

The Australian Federal Government regulates offshore petroleum operations conducted beyond state and territory coastal waters (under the Commonwealth Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGSA) and related Acts and Regulations. In our view, this framework allows the Federal Government to apply appropriate scrutiny and regulation in the assessment of how its natural resources are developed with a view to their efficient exploitation, consistent with the principles of environmental responsibility and sustainable development. Generally speaking, the Federal Government does not mandate specific development outcomes. We support the Government's policy of allowing commercial decisions to determine the nature of energy resource developments, within a transparent and stable regulatory framework, and allowing commercial interests to seek least-cost solutions to government objectives (e.g. environment, safety or good resource management objectives).

19. The Committee understands that some of the Browse joint venture partners preferred the option of using the North West Shelf LNG plant for developing the Browse Basin. Shell is a 1/6th owner of the North West Shelf LNG project - what was Shell's view on the merits of developing the Browse Basin using the North West Shelf facility?

Following the decision of the joint venture not to proceed with the James Price Point option, on the basis that it was not economically viable, Woodside assessed a number of alternatives to take the project forward. This included a Browse to Burrup option. After considering that assessment, all joint venture partners selected Shell FLNG as the preferred development concept for the project.

In Shell's view, the extent and complexity of technical and commercial issues associated with a "Browse to Burrup" development option are significant barriers to commerciality. Such a development would involve multiple offshore facilities at the field, a long-distance 1000 km pipeline to the Burrup across either a difficult seabed environment (including major offshore compression facilities) or onshore (with associated land access complexities), together with a major expansion and refurbishment of the NWS LNG plant and marine facilities. A key issue would be ensuring the integrity of LNG trains and infrastructure that is already up to 25 years old, to extend their life for several more decades. Another fundamental barrier to commerciality would be the slow ramp up in the availability of capacity in the NWS plant (given the venture's own plans for securing additional supplies), setting aside the complexity of the commercial arrangements required between the two joint ventures.

20. What caused the federal government to stipulate, in renewing the relevant retention leases, that James Price Point was to be the only onshore option for developing the Browse Basin?

The setting of Retention lease conditions is a matter for the Federal and State Government, under the current system through the mechanism of the Joint Authority under the OPGSS Act.

From a project perspective, as Woodside is Operator of the Browse project, it is best to seek their advice on the original 2009 retention lease conditions. The wording of the specific condition state that within 120 days of the notice (being 24 December 2009), "….the lessee shall select the development concept likely to be commercially viable at the earliest time. This shall be the concept whereby gas is processed at the Kimberley LNG precinct unless the lessee can demonstrate to the satisfaction of the JA that an alternative development concept is likely to be commercially viable at an earlier time". The RL conditions were accepted by all the joint venture participants at the time, since it was not then known which development concept(s) would be commercially viable.
Having completed the required extensive assessment of the James Price Point development option, Woodside as Operator has demonstrated that JPP was not viable.

21. How will Shell manage environment and safety risks for Prelude FLNG?
22. If there is an issue or incident when there is a full crew on board the Prelude vessel, how will the crew be efficiently and safely taken off the vessel?
23. One of the recommendations made in the aftermath of the Deep Water Horizon disaster was the need for escape modules to be installed on all sides of an offshore vessel. Will this be the

case with Prelude? Is there a safety risk associated with the release of life boats from so high above the water?
24. What is Shell's view on requirements for de-manning in cyclonic conditions for Prelude?
26. What is Shell understanding of the process for environmental and safety approvals, including consent to operate, for FLNG;
27. Where is Prelude currently in the approvals process?
28. Have the Design Safety Case and Development Environment Plan for Prelude been approved?

The responses to the above questions are included in the information below and are provided further to Shell's information on safety and environment on the 26th June and the information in Shell's submission.

All of Shell's operations are conducted in accordance with Shell's Health, Safety, Security and Environment and Social Performance Control Framework, a comprehensive corporate management framework. This Framework contains the HSSE and SP requirements that apply to every Shell company, contractor and joint venture under Shell's operational control. It contains a set of mandatory requirements that define high level HSSE and SP principles and expectations, which are documented in a set of supporting manuals. The framework covers areas including contractor HSSE and SP management, safety, environment, health, security and social performance management systems.

Safety in Design

Shell has been developing and improving all aspects of its Floating LNG design since the 1990's. Shell's objectives are that it be safe, robust, cost efficient, and with a high availability to enable continuous and stable LNG supply. Safety is the primary focus, with multiple, formal safety assessments at various stages of the design confirming that the FLNG facility would be at least equally as safe as modern FPSOs and offshore production facilities currently in operation.

To that end, Shell's FLNG design intentionally incorporates a number of proven and tested technologies that have been in use in existing LNG plants for many years. Shell has extensive experience in the operation and maintenance of this equipment.

Shell's FLNG design includes a number of key safety features:

- hull design that minimises motion and rolling, enhances stability and reduces stress on equipment and piping;
- double-wall hull design (bottom, sides and top);
- product storage design features to minimise/eliminate 'sloshing';
- layout (and separation) of hydrocarbon processes from accommodation modules;
- enlarged safety gaps between process modules;
- fire-proof and cryogenic-proof protective coatings; and
- specific design and procedures for side-by-side product loading.

The Prelude FLNG facility has undergone extensive research, modelling and empirical testing to confirm the robustness of the design. Substantial development, analytical study and wave basin

model testing (using actual metocean conditions for Prelude's location) have been carried out to prove the suitability of the substructure to ensure safe habitability during cyclonic events equivalent to a one in 10,000 year condition, and to continue operations post-cyclone without sustaining structural damage. This means waves in excess of 28m and wind gusting at more than 300km/hr. At all times including during a cyclone the facility remains on-location with personnel on board. Its size and sheer mass (600,000 tonnes fully ballasted) is in itself an important feature for maintaining stability in extreme weather.

Full-scale rig testing of the loading arms and coupling features has been carried out, replicating the facility motions to be experienced on-location.

Remaining on-station for continual production and maintenance improves its overall availability (as it eliminates the lost time needed to disconnect and reconnect) and also avoids the safety risk associated with de-manning. Shell's FLNG system is designed to have a total system availability similar to that of conventional onshore LNG projects.

Regulatory Approval processes

The Prelude field is located in Commonwealth waters and is subject to Commonwealth legislation. The principal Acts and regulations governing petroleum operations in Commonwealth waters are as follows:

- Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act);
  - OPGGS (Environment) Regulations 2009;
  - OPGGS (Resource Management and Administration) Regulations 2011; and
  - OPGGS (Safety) Regulations 2009.
- The Environment Protection and Biodiversity Conservation Act 1999;
  - The Environment Protection and Biodiversity Conservation Regulations 2000;
- The Navigation Act 2012 (applies to movements of regulated Australian vessels).

Shell employs a rigorous Asset Integrity-Process Safety Management (AIPSM) process across all stages of an asset's life-cycle. This AIPSM process ensures that assets are designed and built such that risks are As Low As Reasonably Practicable (ALARP), and safety critical equipment is operated and maintained accordingly. The AIPSM process is key and dovetails seamlessly with the Safety Case, and ensures compliance with relevant Australian and International laws, and Shell Corporate standards.

Safety

As early as 2009 Shell engaged with NOPSA (now NOPSEMA) providing a sequence of deliverables detailing the rigorous approach to safety in design of the FLNG facility. In accordance with NOPSEMA's 'Early Engagement Safety Case Assessment Policy', this process culminated in a Design Safety Case, which included the design integrity and As Low as Reasonably Practicable (ALARP) demonstration of the Prelude FLNG Facility. The Design Safety Case included a suite of imperative Formal Safety Assessments (FSAs), which modelled and analysed the potential major accident

1

events that could affect Prelude. These FSAs provided recommendations that the Project has incorporated into the ALARP design.

The Prelude FLNG Safety Case is to be submitted in stages during 2014 and 2015, with each submission fulfilling the requirements of the OPGGS (Safety) Regulations. The first submission covers the subsea infrastructure installation scope, the second submission covers the Floating LNG hook-up and installation and the final submission covers the introduction of hydrocarbons through production. The Prelude Environmental Impact Assessment was prepared and submitted to the then DEWHA (Department of Environment, Water, Heritage and the Arts) in July 2009, covering development drilling, installation of subsea facilities and FLNG hook-up, commissioning, operations, maintenance and decommissioning. The project received environmental approval on the 12th November, 2010 from the Federal Environment Minister and SEWPAC (Department of Sustainability, Environment, Water, Population and Communities).

In compliance with the requirements of OPGGS (Environment) Regulations, Environmental Plans for Prelude Drilling activities have been submitted and approved by NOPSEMA. Shell's Oil Spill Contingency Plan (OSCP) for the drilling phase is included in the approved Drilling Environment Plan (January 2013) and all spill response arrangements are in place with third parties.

The remaining regulatory activities involve submissions of Environment Plans (EP) to NOPSEMA and for the wells completion (including spill and monitoring modelling) subsea installation and FLNG installation and operation.

Evacuation, Escape and Rescue

The design of the Prelude FLNG facility has focused on the containment of hazards and incorporates extensive mitigation and recovery measures, should they be required.

The Prelude FLNG facility has an Evacuation, Escape and Rescue (EER) Strategy, as summarised below:

- personnel on Prelude can escape safely from an area where there is a hazardous event, via multiple escape routes forward and aft;
- temporary refuges are provided in multiple locations (main Temporary Refuge aft and Secondary Refuge forward) on Prelude with adequate sizing for maximum anticipated personnel and protection for as long as required to control an incident and/or effect a controlled evacuation (if necessary);
- a controlled safe evacuation from the facility with different means of evacuation at strategic low risk locations. There are primary, secondary and tertiary means of evacuation via helicopter, freefall lifeboats (located aft) and integrated chute-based liferafts respectively;
- once evacuation has been carried out, the rescue and recovery of personnel can be facilitates by external means (for example, using facility-based infield support vessels, acting as standby vessels).

One of the FSAs conducted during the Design phase was an Evacuation, Escape and Rescue Analysis, which found that the Prelude EER provisions satisfy the requirements.

25. What is Shell's view on requirements for periodic (18 months) shut down and maintenance, where several hundred extra personnel may be required on Prelude?

The Prelude operations and maintenance philosophy specifically identified the need to challenge shutdown scope in order to reduce the number of people on board for shutdowns, and their duration. The design of Shell's FLNG has realized this philosophy predominantly through;

- the selection of equipment which requires less maintenance; and
- already-installed spare equipment which has been included where appropriate meaning normal operations can be continued whilst the primary equipment is maintained, negating the need for the scope to be included in facility shutdowns.

The deployment of the additional spare equipment also supports improving the production availability of the facility. During normal operations, around 130 personnel are onboard , whilst 340 personnel can be accommodated onboard during shutdown periods.

29. FLNG technology will limit the ability for projects in waters off Western Australia to supply gas into the domestic market. One possible solution to this problem would be for companies like Shell to meet their domestic gas supply obligations by aggregating their projects and increasing the supply of gas into the domestic market from, for example, the North West Shelf plant. How would Shell respond to such a suggestion?

As noted in our submission, in Shell's view security of domestic gas supply for Western Australia is unlikely to be an issue in the long term. It is the case that linkages to international energy markets have seen domestic gas prices rise from low levels in the early part of the last decade. Although Shell does contribute domestic gas to the current market through the North West Shelf JV and has done since 1984, Shell believes that the current WA State Government domestic gas reservation policy is not required and is likely to be counter-productive for long term domestic gas supply. In our view a market without this intervention will allow clearer price signals and assist in the development of more difficult to monetize gas resources for the domestic market.

As noted in our submission to the inquiry, the concept of offsets is a challenging one for a range of commercial and technical reasons. The complexity of differing joint venture ownership structures, customer relationships, infrastructure owners and supply chain arrangements make aligning the commercial terms needed to facilitate an offset arrangement very difficult to resolve.

Shell believes that it has met all domestic gas supply obligations through its participation in the NWSJV, Gorgon and Wheatstone Joint Ventures. Prelude does not have a domestic gas supply obligation, as unlike the land based LNG projects referred to above, there was no agreement between the project proponents and the State. Shell notes that although domestic gas requirements have been a feature of land based LNG developments in Western Australia, the policy involved the formal agreement of the sharing of risk and value between project proponents and the State of Western Australia and is not just the imposition of an "obligation".

As noted in our submission, Shell remains open to engagement with the State on these issues on a case by case basis.

30. Will FLNG technology mean that the state will need to construct regassification facilities in order for domestic gas consumers to purchase gas in the future?

As noted in the answer to question 29, Shell believes that future investment in domestic gas production supply facilities is best left to market principles, as direct Government interventions in the market will be counterproductive for investors and consumers in the long term. Any domestic gas project (including a re-gas facility) would have to meet to commercial rates of return for investors, or else direct Government subsidies would have to be applied, disadvantaging consumers and taxpayers in the long term. Shell agrees with the IMO forecast that WA should have access to adequate domestic gas supplies in the short, medium and long terms.