	Shell CRUX
Package Title	**Crux – Jacket and Piles EPCI**
Scope of Work	Shell Australia Pty Ltd. *("Shell")* is seeking Expressions of Interest *("EoI")* from experienced and capable contractors to provide lump sum engineering, procurement, construction and installation services (EPCI) for the Crux project's jacket and piles. **<u>Crux Project Overview</u>** The Crux gas field is located in Australian Commonwealth waters, within permit AC/RL9 in the East Browse basin. The title is operated by Shell *(82% equity)* on behalf of the other joint venture participants SGH Energy *(15%)* and Osaka Gas *(3%)*. The field is located ~620km NNE of Broome, ~300km from mainland Australia and ~160km NE of the Shell operated Prelude Floating Liquified Natural Gas *("FLNG")* facility. Crux's remotely operated Not Normally Manned *("NNM")* platform concept dehydrates gas and condensate streams and exports a multiphase stream to the Prelude FLNG. The platform has a 550MMscfd capacity with five platform wells. Key components of the Crux facility include: 1) Five dry tree wells tied back to the platform; 2) Fixed jacket structure with drilled and grouted piles; 3) NNM Platform topsides weight of approximately 10,000 tonnes dry weight 4) Single 26" multiphase export pipeline to Prelude; 5) Flexible riser and umbilical at Prelude; 6) Brownfield modifications at Prelude; 7) Fibre optic cable tied to the "Fitzroy" fibre optic backbone; Front end engineering design of the Crux project commenced in January 2019. **<u>Scope Overview</u>** The platform substructure is a fixed steel lattice type jacket with drilled and grouted piled foundations, installed over pre-drilled wells. The Crux substructure comprises of the following main components: a) Jacket structure. b) Pile sleeves. c) Cathodic protection and coatings. d) Skirt piles, each comprising of driven primary and drilled and grouted insert

piles.

e) Mudmats.
f) Installation appurtenances.
g) Pile drilling appurtenances.
h) Subsea interfaces including:
    i. Riser subsea connector porch.
    ii. Riser supports.
    iii. Umbilical j-tube(s) and j-tube supports.
    iv. Fiber optic cable j-tube and j-tube supports.

The successful contractor will be responsible for:

a) Project management, design and installation engineering, and operational management required to perform the scope or work in a safe, robust and efficient manner.
b) Detailed design, procurement, fabrication, loadout, transportation, installation and handover of the platform substructure.
c) Preparation of all as-built data and documentation including close-out reporting.

Indicative Timeline

Shell seeks to award this package in January 2020, several months prior to FID, to ensure completion of jacket installation, inclusive of all piling, before the start of the 2023 cyclone season.

Project Tenets

The Crux Project is underpinned by five key tenets: ensuring Personal Safety and Process Safety, and meeting the Project Outcomes of NNM quality, competitive cost and schedule certainty.

Safety is a core value of Shell and implicit in this is protecting the environment. We believe that we can execute the Crux project without the need to hurt people and to protect the environment. The safety of everyone involved in the Crux project from engineering, fabrication, construction and offshore installation, hook-up and commissioning through to operations must be addressed and everyone goes home safely.

The offshore production and processing of hydrocarbons has inherent risk and there

are numerous examples of offshore incidents that have led to people being killed and severely injured or resulting in significant environmental impacts. Using an inherently safe design approach; the design of the offshore facilities needs to reduce this risk to as low a reasonably practical, while reducing risk exposure, using creative ideas during construction, installation, commissioning and operations activities.

Schedule certainty and competitiveness are of critical importance for the platform substructure scope of work. Delivery of he platform substructure is on the project's critical path and schedule delays have the added potential risk of causing the project to miss its 2023 installation window *(prior to the onset of the tropical cyclone season)*, deferring installation activities well into 2024.

The above notwithstanding it is Shell's expectation to fabricate the jacket and piles at a competitive cost by leveraging capable yards in Southeast Asia or China.

Substructure Summary

The Northwest Shelf region is well known as challenging for fixed offshore structures. A significant number of projects executed in the region, including Shell JV projects to-date, have experienced a range of technical difficulties during the installation of platform foundations. The Crux drill center is in approximately 170m water depth, 40m deeper than the deepest installed fixed offshore platform in the NWS to-date. Crux has the added complexity of substructure installation over pre-installed wells subsea which demands attention and deliberation.

The Crux substructure is a four-legged, load-bearing jacket structure. Each leg features a cluster of vertical skirt pile sleeves through which driven primary piles with drilled and grouted insert piles are installed.

Indicative *(pre-FEED)* substructure particulars are as follow:

Jacket and Ancillaries	Jacket Weight *(Te, installed condition)*	21,885
	Drilling Caisson Weight *(Te)*	1,167
	Drilling Deck Weight *(Te)*	300
	Height *(m)*	190
	Base *(m x m)*	70x70
Primary Pile	Number	12 *(3 per corner)*
	Outside Diameter *(m)*	3.5
	Wall Thickness *(mm)*	90
	Depth / Penetration *(m)*	120
	Overall Length *(m)*	150
	Indicative Pile Weight *(Te, in air)*	1306
Insert Pile	Number	12 *(3 per corner)*
	Outside Diameter *(m)*	2.9
	Wall Thickness *(mm)*	90
	Depth / Penetration *(m)*	35 *(120 – 155)*
	Overall Pile Length *(m)*	65

	Indicative Pile Weight *(Te, in air)*	466
	Hole Diameter *(m)*	3.1

The seabed conditions and stratigraphy at Crux are considered challenging from the perspective of the design and installation of foundations for the proposed platform.

Soils beneath 117m consists of interlayered dense cemented sands and calcarenites with insufficient cementation over the bore length to drill and install insert piles without some additional means of hole stabilization. Positive head drilling, the application of hydrostatic pressure to the open hole to keep it from collapsing over time, has been selected as the means of hole stabilization.

Piles are likely to need to be driven through upper calcarenite units and then require free fall arresters to limit the pile velocity in the event of free fall through lower relatively low strength units.

Expressions of Interest - Instructions

Please note this is an EoI to develop a better understanding of capability and interest in the market.

The project is subject to future corporate approvals, and the scopes of the EoI are subject to change pending project demand and timelines.

Contractor(s) are to express interest via the Industry Capability Network *("ICN")* Gateway where competency can be demonstrated. EoIs will be accepted for full scope only.

Contractors will only be considered for prequalification to tender if deemed suitably qualified by Shell.

All initial enquiries can be made through ICN including assistance with EoI submissions on the ICN Gateway.

This package is one of 3 packages that will be presented in the Crux Project Briefing Session to be held on 22 Feb 2019.

Final responses to this EoI should address the three (3) areas of focus expanded below, preferably collated into a single concise document, including your business details. The information below is in a word document which can be downloaded when you submit your Full package registration on ICN Gateway.

Area of Focus 1 - Capability and Track Record

Prospective contractors are sought with a proven capability and successful track record in delivering similar projects, preferably in offshore northwest Australia.

In your response to this EoI please clearly summarize your capability and successful track record in:

1. **Installation of comparable drilled and grouted piles.**
2. **Detailed design of large steel jackets.**
3. **Transportation and installation of large steel jackets.**

	The installation of Crux's piled foundations will necessitate complex operations and is recognized as a key project risk. Responses to this EoI should specifically address capability and track record in this area.
Area of Focus 2 - Execution Strategy	**It is recognized that prospective contractors may partner or engage key subcontractors to successfully deliver the full scope of work.** **Proposed contracting strategies should ensure that key installation risks associated with the piling scope are sufficiently addressed.** **In your response to this EoI please summarize what execution or contracting strategy would be employed to deliver the scope or work, specifically:** **1. Which scope of work would be undertaken by which party. What contractual arrangement(s) would link parties together. What track record or experience do the parties have working together.** **2. Indicative fabrication yard(s).** **3. Indicative location of project office(s).**
Area of Focus 3 - Synergies with Topsides	**Securing a single EPCI to deliver both Crux's substructure and topsides is recognized as a potential opportunity for synergy during the execute phase of the project.** **In your response to this EoI please clarify is this potential opportunity is one that you would pursue and, if so, how it would be realized.**
Business Details	**Please also provide the following business details:** **Company Name:** **Contact Name:** **Contact Details:** **Company Location:**
Contacts	For NT companies: David Royle, Resources Coordinator Industry Capability Network Northern Territory T: (08) 8922 9424 E: david.royle@icnnt.org.au For all other companies: Linus O'Brien, Principal Supply Chain Consultant Industry Capability Network of Western Australia T: (08) 9365 7556 E: Linus.OBrien@icnwa.org.au
EoI Closing Date	11 March 2019