

## Charting a new course

Offshore liquefaction facilities can make Australia's LNG sector competitive

**P**RELUDE, Shell's floating liquefied natural gas (FLNG) project primed to start up off Australia, is a pioneer. Not only does the technical masterpiece blow away all the other competition, it represents the future of the Australian LNG business.

FLNG has been touted as the solution to the soaring development costs now blighting the next wave of LNG investment in Australia. For LNG ventures still working towards a final investment decision, five of seven have decided on, or are considering, FLNG as a processing solution, particularly to save on cost.

These projects could add between 28 million and 49 million tonnes a year (t/y) of liquefaction capacity to the market around the turn of the decade, depending on phasing and further concept changes. Realistically though, only 8 million t/y of this capacity could be online by 2020.

In May 2011, after a very long preparatory road, rumoured to have cost \$500 million, Prelude operator Shell gave the go-ahead for the world's first FLNG scheme of any type. Considering the pioneering circumstances, it's an impressively large example.

When it's towed to the field from its South Korean construction yard in about three years time, the ship-shaped steel platform will be the largest floating facility ever built. The hull is being built in a dock that normally provides for construction of four large LNG carriers.

It will measure nearly 500 metres in length – slightly longer than four football fields laid end to end – and when its holding tanks are fully loaded with LNG, the vessel will have a displacement of 600,000 tonnes, double the largest sailing supertankers.

The Prelude field sits some 200 kms off Australia's northwest coast, deep in tropical cyclone territory. Yet Shell has decided to design the floater to stay firm in the face of the severest event possible – a top of-the-scale category-five cyclone.

The 12,000 tonnes turret at the heart of the mooring system will be the largest ever built by specialist provider SBM.

As well as transfer of high-pressure gas flows through its swivels, it is engineered to handle the mooring forces expected to arise as the huge vessel weathervanes around the turret in the strongest of cyclones.

On its deck, the floater will be able to process 3.6 million t/y of LNG.

But because the Prelude field is rich in liquids, the floating platform will also produce 1.3 million t/y of condensate and 400,000 t/y of liquefied petroleum gas, helping the project's economics.

Shell executives have always declined to go public on the overall cost of the groundbreaking venture. But they say it benchmarks well, at between \$3 billion and \$3.5 billion per million t/y of production capacity.

Doing the sums on that basis for a 3.6 million t/y unit results in a capital cost ranging from \$11 billion to \$12.5 billion for Prelude.

The cost of the floating unit itself is estimated at around \$8 billion, with the rest of the project sum going towards drilling costs and subsea development.

Yet there is no doubt Prelude is competitive with

land-based plants built in the north and west of Australia that suck deep-water gas up from offshore platforms.

Inpex's Ichthys project has a capital cost of \$4.04 billion per million t/y of LNG capacity, Chevron's Gorgon comes in at \$3.46 billion and the US major's Wheatstone plant is pegged at \$3.25 billion.

But what the numbers don't reflect is that the Prelude field would never have been developed without FLNG. It was too small and too remote to make a conventional land-based liquefaction scheme viable.

Indeed, the real advantage of FLNG is that it allows smaller, stranded fields to be developed relatively cheaply.

This explains why Woodside Petroleum, Shell and ConocoPhillips have long eyed the technology for the Greater Sunrise fields, which straddle the joint petroleum development area between Timor Leste and Australia.

GDF Suez and Santos are considering FLNG for their Bonaparte field, Thailand's PTT Exploration & Production has mooted it for its Cash-Maple fields, and ExxonMobil and BHP Billiton are doing the same for their Scarborough reserves.

The decision by Woodside to pursue FLNG for its huge Browse field is a little different. But the story highlights the change in sentiment over the past few years and suggests a possible model for the future of Australian LNG.

### A change of plans

Last year, Woodside scrapped the originally proposed onshore processing complex for Browse LNG at James Price Point, which had been chosen and strongly supported by the Western Australian state government. Crippling development costs, estimated at \$80 billion for a 12 million t/y onshore plant or \$6.6 billion per million t/y of liquefaction, resulted in some of the highest break-even rates in the industry and made it uneconomic.

After spending some \$2 billion on studies for a land-based plant, the Perth-based operator and its joint-venture partners (Shell, BP, Mitsubishi-Mitsui and PetroChina) decided, much to the dismay of the local government, to study the possibility of building three FLNG units, in phases.

Shell, which has a stake in Woodside, as well as the Greater Sunrise and Browse schemes, plans on Prelude being just the first of many such projects to follow.

FLNG can go well beyond simply accessing stranded gas resources. With that in mind, the Anglo-Dutch supermajor is now turning its attention to the next phase in the programme, which it has dubbed FLNG Lean.

FLNG Lean – a concept developed for gas fields which lack volumes of condensate or liquefied petroleum in the well stream – will open up larger deep-water gas fields.

Whereas the Prelude concept is aimed at a liquids-rich stranded gas field, Shell believes FLNG Lean will have a much wider application.

The company thinks multiple FLNG facilities operating on a large field may prove even more competitive versus a traditional onshore LNG plant.

With the FLNG Lean concept that will boast a nominal

LNG production capacity of about 6 million t/y, compared with Prelude's 3.6 million t/y, the emphasis shifts to lean gas.

With no need to provide for substantial production of liquids that come with rich gas feedstock, more space becomes available for the two liquefaction trains needed to hit the higher production rate of LNG on the same size of hull.

As a substantial part of Shell's front-end engineering and design (Feed) work is reusable for future developments its next wave of facilities should become cheaper and faster, it says.

Meanwhile, supermajor ExxonMobil's Scarborough FLNG plans appear to have been set back as the US company tries to rein in development costs and convince joint-venture partner BHP Billiton that FLNG is the best option.

Feed had been planned to start last year, with a final investment decision eyed this year or early 2015. But engineering work is yet to begin and a more likely start date is next year.

ExxonMobil is reportedly concentrating on lowering the project's proposed development costs, which analysts have estimated at between \$16 billion and \$19 billion for a floater capable of handling between 6 million and 7 million t/y of LNG.

Joint-venture partner BHP Billiton remains sceptical about the project's economics, preferring a tie-in to one of Western Australia's existing LNG plants. Scarborough is close to the North West Shelf complex, and linking them would offer significant cost savings.

GDF Suez's smaller Bonaparte project with Santos has environmental approval to process up to 2.4 million t/y of LNG. Following several delays, it was aiming for a final investment decision next year.

But it has since put the FLNG scheme on hold, preferring to investigate supplying gas for brownfield expansions for onshore LNG plants in Darwin, which should be more economic.

Similarly, Thailand's PTTEP has postponed a decision on its planned 2 million t/y floater – based mainly on its Cash-Maple fields in the Browse basin – after finding

further gas resources and while seeking an equity and technology partner.

There are plenty of other fields off northern Australia that could be earmarked for FLNG in future too, including Poseidon and Crux in the Browse basin, as well as the Caldita-Barossa, Heron, Blackwood and Evans Shoal fields in the Timor Sea.

## Diplomatic solution

Meanwhile, the Woodside-led Sunrise venture, long ago mooted for FLNG technology, will have to wait for a diplomatic solution to the border dispute between Australia and Timor-Leste before more commercial and technical work can be carried out. Even if there is a speedy resolution to the spat, they will still have a further fight on their hands with the Timorese.

The Timorese authorities rejected FLNG, instead preferring to pursue piping gas to shore for processing. This option, they hope, will bring numerous economic benefits to the country, and also forms part of its vision to drive an onshore petroleum industry.

It highlights the politically choppy waters the technology will need to navigate.

Even in Western Australia, the state's premier Colin Barnett has dug his heels in against the Browse FLNG concept, arguing the state will lose valuable revenue, jobs and domestic gas supply.

But industry lobby group the Australian Petroleum Production & Exploration Association says that just one FLNG unit has the potential to deliver up to 1,000 highly skilled jobs and around A\$12 billion (\$11.2 billion) in tax revenue during its 25-year operating life.

The same project could also generate around A\$45 billion in economic activity and up to A\$200 million every year in maintenance and supply deals for local contractors, it claims.

If successful FLNG technology will revolutionise the industry, making the development of offshore gasfields that would not otherwise be commercially viable possible. It could also make Australian LNG competitive again.

It seems Australian LNG is primed – literally – to chart a new course. **DE ●**

**Table 1: Australia FLNG projects**

Project	Capacity	Shareholders	Status
Prelude	3.6 million t/y	Shell	Under construction. Expected to start up around 2017.
Browse LNG	12 million t/y	Woodside, Shell, BP, Mitsubishi-Mitsui, PetroChina	Phased FLNG. Final investment decision expected 2015.
Scarborough LNG	6 million to 7 million t/y	ExxonMobil, BHP Billiton	Final investment decision expected 2015.
Cash-Maple	2 million t/y	PTT Exploration & Production (PTTEP)	Considering strategic partner and technology. Final investment decision expected 2015.
Sunrise LNG	3.5 million t/y	Woodside, Shell, ConocoPhillips, Osaka Gas	Needs diplomatic solution to border dispute and profit sharing in the joint petroleum development area with Timor Leste. Timor Leste wants onshore plant.
Bonaparte LNG	2.4 million t/y	Santos, GDF Suez	Put on hold. Joint venture preferring to explore supplying onshore brownfield expansions

Source: Petroleum Economist