
A Baseline Assessment of Australia's Offshore Oil and Gas Decommissioning Liability







Executive Summary

The Australian offshore oil and gas industry is facing a significant decommissioning portfolio over the next few decades, with the potential for earlier abandonment activities given changing market conditions.

Advisian has been commissioned to determine the total estimated liability for equipment in Australia's offshore areas and to identify the quantum of potential cost savings across the supply chain. The assessment is funded by NERA and seven operators (BHP, Chevron, Cooper Energy, ExxonMobil, Santos, Vermilion Oil and Gas Australia and Woodside). The assessment extends to all oil and gas assets offshore Australia, including those under non-funding operator responsibility.

The outcome is the first operator-supported assessment of Australia's offshore decommissioning liability outlook and represents a critical first step towards transformation of the approach to decommissioning.

At a high level, the study has identified:

- A combined estimated liability of USD \$40.5 billion (including wells and facilities). Well plugging and abandonment (P&A) and pipeline removal comprise the majority of estimated spend.
- A potential for a significant decommissioning workload between 2020 and 2030, based on independent estimates of decommissioning commencement dates.
- Substantial opportunities for cost reduction through well-established initiatives, such as knowledge sharing and multi-asset campaign approaches.
- A need to continuously improve the underlying dataset and to maximise efficiency through a centralised planning system.

Further detail on these findings is included in the body of the relevant reports.



Australian offshore oil and gas asset stock

The Australia offshore oil and gas industry considered under the remit of the assessment involves a very significant asset stock, as summarised:

1,008

wells split across platform wells (59%), subsea development wells (30%) and subsea exploration and appraisal wells (11%)

57

fixed facilities (inclusive of 237,000 tonnes of topsides and 518,000 tonnes of substructures)

11

floating facilities (7 FPSOs, 2 FSOs, 1 FLNG and 1 semi-submersible)

82

export and inter-field pipelines (with an overall installed offshore length of 4,960km)

205

infield flowlines (1,700 km overall excluding jumpers and spools)

130

static umbilicals (approximately 1,500km overall excluding flying leads)

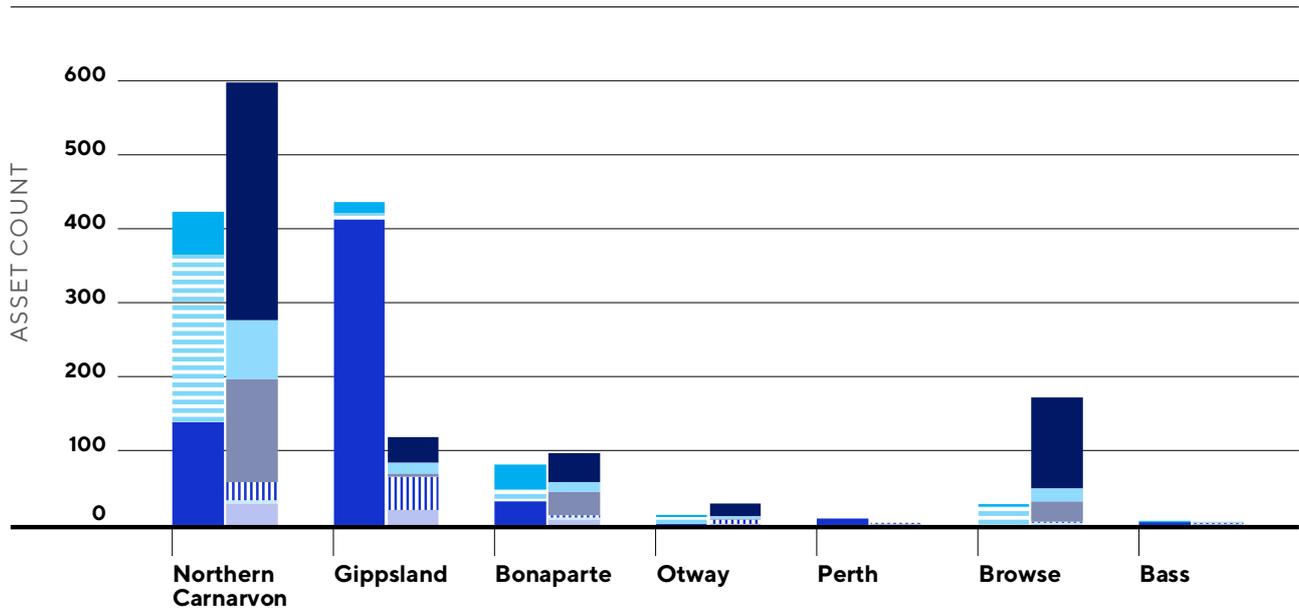
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subsea structures (e.g. manifolds, PLEMS, etc) to be lifted, excluding trees;

126

flexible risers and dynamic umbilicals associated with floating facilities, which will be laid on the seabed following removal of the associated facility.

Figure 1
Australian offshore oil and gas asset stock by basin and typology



The per basin activity split is summarised in Figure 1. The North Carnarvon basin is the area with the greatest level of decommissioning potential accounting for 42% of the well stock, 55% of the overall fixed facility mass to be removed and 45% of the floating facility count. North Carnarvon also accounts for approximately 47% of the overall pipeline stock and approximately 60% of the subsea structures to be removed.

The Gippsland basin accounts for 20 fixed facilities (37% in mass terms) and 45% of the well stock (predominantly platform wells). There is a high density of inter-field and export pipelines (44), however the overall installed length accounts for only 18% of the overall Australia length.

Browse and Bonaparte are dominated by large developments (3 floating facilities in each basin accounting for 60% of the Australia wide vessel mass to be transported). These basins also include 4 long distance export trunklines to shore (30% of the Australia wide pipeline installed length).

Overall, approximately 81% of the combined topsides and substructure mass to be removed is in shallow water (<120m water depth).

Approximately 56% of the well stock is also in shallow water.

- Platform Wells
- Subsea Exploration & Appraisal Wells
- Floating Facilities
- ||| Infield Flowlines
- Subsea Structures
- Subsea Development Wells
- Fixed Facilities (Platforms)
- Export & Inter-field Pipelines
- Static Umbilicals

Australian offshore oil and gas decommissioning liability

Cost norms and rates for decommissioning execution strategies per asset typology have been applied across the databases to derive an aggregate liability estimate. The liability (capital cost estimate) targets AACE Class 5 (-50% / +100%) accuracy. The database quality, which defines the base quantities used for this exercise, influences the estimate class. As a result, elements of the estimate may be considered of greater accuracy, up to AACE Class 4 (-30% / +50%), specifically where the asset data was directly verified by operators.

The database excludes planned developments and phased infrastructure not installed at that date.

Liability is premised on the full removal of all infrastructure in alignment with the regulatory base case as defined in Subsection 572(3) of the Offshore Petroleum and Greenhouse Gas Storage Act 2006, recognising that other outcomes with equivalent or lower HS&E outcomes may be acceptable.

The forecast decommissioning over the next 50 years for the nationwide offshore oil and gas industry is USD 40.5 billion. The liability distribution by asset type and basin is shown in Figure 2. The estimated timeline of decommissioning spend is shown in Figure 3 (cumulatively).

Figure 2
Australian offshore oil and gas decommissioning liability by asset typology

The estimate figures are real terms 2020 and presented in USD currency for international comparison. The liability reported captures installed infrastructure offshore as of April 2020.

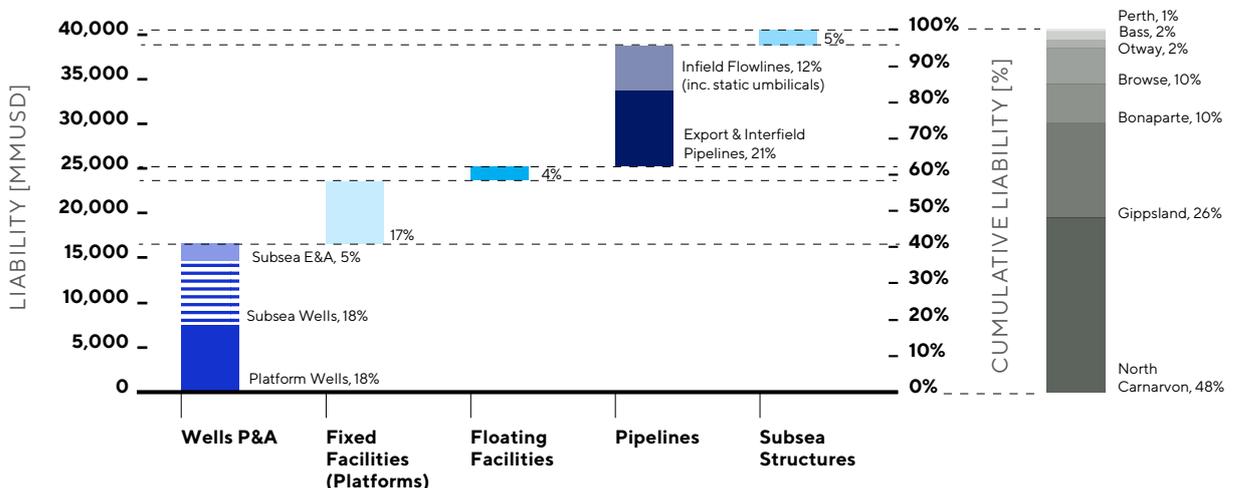
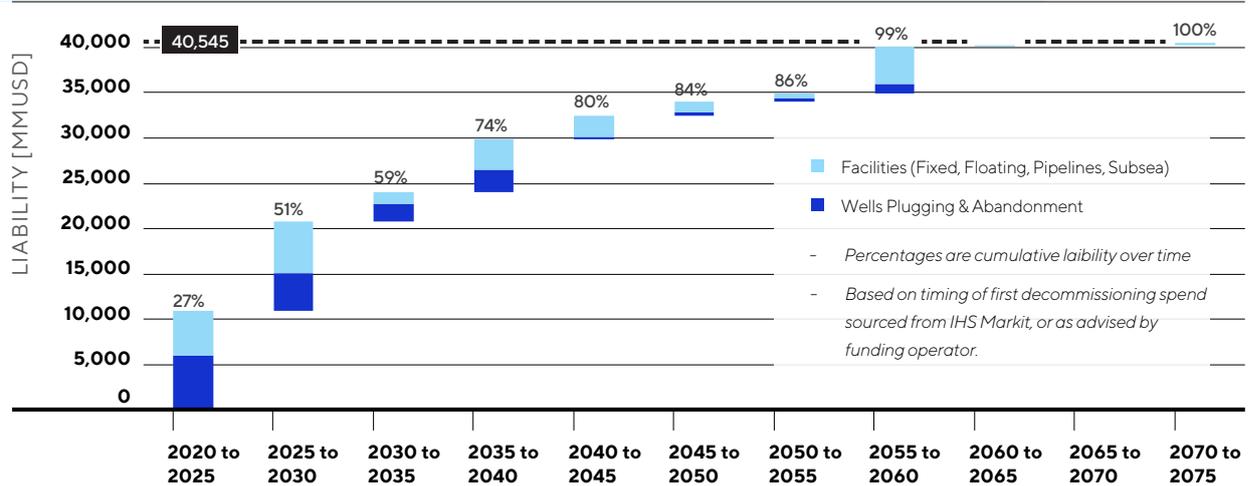


Figure 3
Australian offshore oil and gas
decommissioning liability timeline



The key outcomes of the liability assessment are:

- Wells P&A is a high proportion of decommissioning spend at 41% (USD 16.6 billion) of the overall liability. There is an even split between subsea development well and platform well spend.
- The baseline liability premise of full removal results in a high cost of decommissioning for pipelines / flowlines / umbilicals (33% of the overall liability, USD 13.5 billion). This cost is primarily driven by the removal cost of long-distance export pipelines to shore and inter-field pipelines (21%, USD 8.6 billion).
- Approximately 51% of the decommissioning liability occurs in the next 10 years (2020 to 2030 inclusive). A further 23% of the liability is predicted during 2031 to 2040 (74% overall by 2040).

- Assets in North Carnarvon and Gippsland comprise the majority of the spend (74% in total).

If demonstrated to be ALARP, acceptable and compliant with regulatory requirements, a key cost reduction opportunity is to leave pipelines in-situ, as discussed below in Section 1.4. In this scenario the well P&A component would increase in prominence in the overall liability distribution (from 41% to approximately 50%).

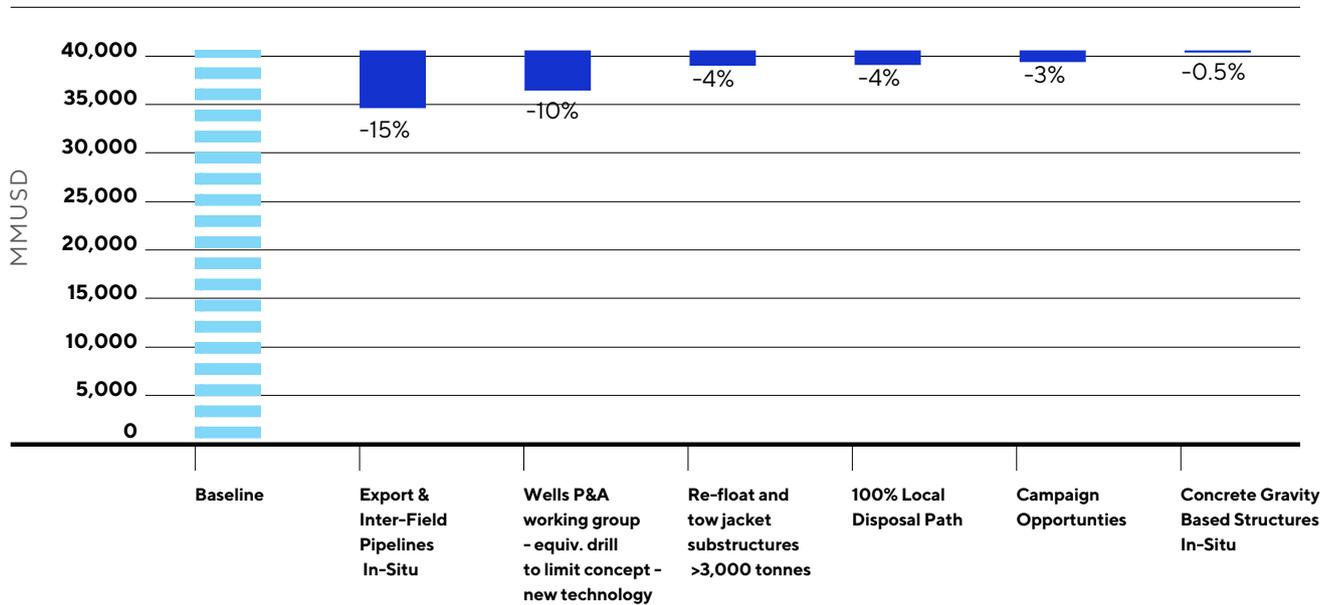


Cost reduction opportunities

Several measures have been identified to reduce cost based on the insights generated from the asset databases as outlined below. Where possible, a quantum of reduction that can be targeted for key measures has been estimated by adjusting the work breakdown structure (basis, norms and rates) of the costed decommissioning database, as shown in Figure 4.

- The removal and transport component of export and inter-field pipeline decommissioning is significant. Limiting activities to preparation, disconnection, cleaning and site remediation (e.g. re-trenching or burying pipe-ends) to leave all export and inter-field pipelines in place gives a 15% (USD 5.9 billion) saving on the overall liability.
- The operations phase (excluding mobilization/ demobilization, rig move and tripping) represents 64-73% of the USD 16.6 billion Australian well P&A liability. The following three factors combined would provide an estimated 10% (USD 4.1 billion) saving on the overall liability:
 - A dedicated P&A workgroup to share lessons learned, pre-screen wells, optimize the execution schedule and ensure continuity of the work schedule (even mini-campaigns);
 - Given the sheer volume of wells and a focused effort, it is conceivable that application of a 'Technical Limit' approach (best possible performance, limited only by technology and nature) could provide at least 1.2 days saving in operations optimization per well;
 - It is also conceivable that suitable application of new technology could also provide at least a 1.0 day saving in operations per well.
- There are companies around the world developing a "re-floating and towing" method for large jacket substructures. The methodology is not yet in wide use, however it holds some promise and negates the need for a heavy lift vessel. There is a potential cost saving opportunity of 4%.

Figure 4:
Quantified opportunities for cost reduction



- (USD 1.5 billion) assuming all jackets >3,000 tonnes (21 examples Australia wide) can be removed using re-float and tow.
- Asset removal and transport accounts for approximately USD 5 billion of the liability. Large structures from the West / North West basins are premised on shipment to South East Asia for disposal due to local yard constraints. The identification and development of designated ports and marine facilities on the West coast to handle large structures and marine spreads has the potential to reduce the overall decommissioning liability by 4% (USD 1.5 billion).
- Approximately 13% of the overall decommissioning liability (USD 5.1 billion) is comprised of vessel and marine spread mobilisation and de-mobilisation. A campaign approach across multiple assets is required to spread the high

cost of equipment mobilization across a portfolio of compatible decommissioning projects. Example campaign opportunities for groups of assets assessed in Attachment 1 show indicative savings of USD 0.2 to 0.5 billion (1% saving on the overall liability for a single campaign example). It is reasonable to target a 3% cost reduction based on multiple campaign opportunities nationwide.

- Re-float of concrete gravity-based structures poses significant technical challenges, carries high safety and environmental risks and may incur disproportionately high costs compared with the benefits to society. The opportunity to leave such sub-structures (5 in Australian waters) in place represents a cost saving of 0.5% (USD 0.2 billion) on the overall liability.

The reduction measures are considered independently rather than cumulatively, as further assessment is required in each area to define achievable cost. The study outcomes support an overall indicative cost reduction target of 15 to 20% (USD 6.1 to 8.1 billion) on the liability, premised on the implementation of multiple opportunities.

The assessment is focused on cost, notwithstanding additional potential net benefits realized through optimized scope. There are clearly HS&E and social-economic factors to be considered in planning the overall asset lifecycle.



Recommendation

The Australian nationwide offshore oil and gas liability is premised on full removal of assets and decommissioning execution of individual developments and assets. A common theme emerging from the analysis is the potential for significant cost reduction and socio-economic benefits to be realized through collaboration between industry and government (e.g. variation from regulatory base case), within industry (e.g. campaign partnership agreements) and within the supply chain (e.g. disposal infrastructure).

It is also stressed that the decommissioning industry in Australia is young, and benchmarking of liability estimates to actual costs has not yet been done. Industry experience built up in the next few years will help re-target the database against 'as-built' figures. However, maintaining continuity of savings on the liability requires effective industry-wide knowledge sharing. Failure to ensure continuous improvement will risk sub-optimal cost reduction outcomes.

Advisian notes that, through the course of this study, NERA has identified that a tool, such as a Decommissioning Planning System, would be one way of automating potential efficiency and collaboration opportunities identified by this study. This system could be used to promote:

- An integrated view of decommissioning scope and timelines;
- Collaboration and stakeholder engagement;
- An understanding on disposal paths and options;
- Navigation of the regulatory framework;
- Transparency in asset information;
- The potential benefits from completing a Comparative Assessment;
- Recognition that the removal of facilities results in a reduction in activities with limited economic flow on and the potential to dis-incentivise future sale and / or long-life operations.
- Early late in life activity planning, incorporating lessons learned and leveraging activities elsewhere in the region;
- The potential to grow a new sub-industry in Australia that supports jobs and investment.

Collaboration across key stakeholders, including government and industry, supported by a centralized decommissioning planning system will ensure that targeted cost reductions on the identified USD 40.5 billion liability are further assessed and pursued.



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