



CENTRE OF
DECOMMISSIONING
AUSTRALIA

Decommissioning Innovation and Technology Roadmap

Executive Summary

January 2023



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Introduction —

Australia's oil and gas industry has been operating for decades and an increasing degree of infrastructure is approaching the end of its productive life. CODA was established as a joint initiative between NERA (National Energy Resources Australia) and BHP Petroleum, Chevron Australia, Esso Australia, Santos, Vermillion and Woodside to deliver a transformational approach to late-life asset planning and decommissioning execution. To provide long term support to the growth of Australia's decommissioning sector CODA registered as an independent not for profit in late 2021.

In 2021, CODA sanctioned three projects to establish a foundation understanding of opportunities for collaboration, innovation, and efficiency in decommissioning that support the CODA objectives. These projects are:

1.

Understanding the opportunity for local disposal and recycling pathways;

2.

A global review of decommissioning planning and execution of learnings; and

3.

Development of a decommissioning innovation and technology roadmap.

This report has been prepared by Linch-pin and summarises the outcomes of the Technology and Innovation Roadmap Project, including the development of a roadmap with a supporting report.



Objectives & --- scope

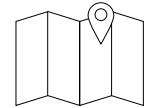
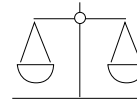
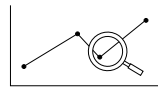
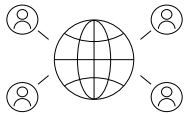
The Australian offshore Oil and Gas industry is facing a significant decommissioning portfolio over the coming decades, with the potential for the application of technology and innovation to significantly improve decommissioning project outcomes. This work seeks to:

- Identify the areas that will most benefit from applying innovative approaches or technologies, taking into account completed decommissioning projects and findings from other jurisdictions. Jurisdictions include those with comparable regulatory regimes such as the United Kingdom and Norway, as well as the Gulf of Mexico.
- Identify local capabilities and the opportunities to develop innovations, technologies or other solutions within Australia and consider the opportunity for Australia to export these products and services to the region.

The roadmap focuses on the offshore Oil and Gas assets in Australia and draws upon technology currently used or emerging in other centres of decommissioning activity such as the North Sea and the Gulf of Mexico. The report also identifies roadblocks and opportunities to innovate specifically for the Australian market. The Roadmap serves as an alignment tool for Operators and service providers and plays an important role in the transformation of the industry approach to decommissioning.

Methodology ---

This study has been completed in the following stages



1

2

3

4

5

Framing & Literature Review

- Determine value drivers
- Tabulate work breakdown structure (WBS)
- Review of globally available technologies

Market Analysis

- Shape of Australian market capability & capacity assessment, including SWOT analysis
- Development of screening criteria

Market Engagement

- Interviews with:
- Operators
 - Service Sector Companies
 - Regulators

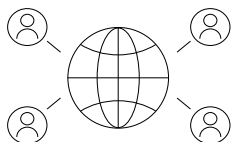
Screening & Technical Feasibility Assessment

- Categorisation and opportunity value assessment against screening criteria and in relation to asset base and asset retirement timelines.

Roadmap & Report Development

- Documentation or report
- Development of roadmap

Framing & literature review



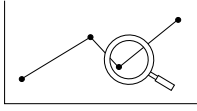
A framing workshop was hosted to determine the value driver, which was defined as “the generation of robust improved outcomes opportunities”. The assessment criteria were identified as:

- Improved safety
- Net environmental benefit
- Societal benefit
- Probability of success:
 - Technical risk - available technology / elements, prior use, locally / regionally available,
 - Regulatory framework engagement
 - Stakeholder support
- Strategic/ tactical merit e.g., Australian export opportunity
- Economics

The decommissioning technology work breakdown structure (WBS) was determined (Table 1). A literature review of related articles, papers and reports was undertaken to develop an understanding of the state of the art and emerging technologies worldwide.

WBS element	Sub element	
Owner Costs	<ul style="list-style-type: none"> • Planning • Post CoP costs 	<ul style="list-style-type: none"> • Project management • Surveys and approvals
Well Plug & Abandonment	<ul style="list-style-type: none"> • Studies & planning • Well suspension • Vessels & Rigs 	<ul style="list-style-type: none"> • Rig / vessel mods • Well decommissioning • Waste Management
Facility / Subsea / Pipeline preparation	<ul style="list-style-type: none"> • Isolation & cleaning • Pre removal works 	<ul style="list-style-type: none"> • Pigging • Waste management
Facility Removal	<ul style="list-style-type: none"> • Fixed platform topsides • Sub structures 	<ul style="list-style-type: none"> • Floating facilities • Transport & Logistics
Subsea / Pipelines / Flexibles Removal	<ul style="list-style-type: none"> • Subsea equipment • Pipelines 	<ul style="list-style-type: none"> • Flowlines & Umbilicals • Logistics
Decontamination / Recycling / Disposal	<ul style="list-style-type: none"> • Cleaning, decontamination, and waste handling • Recycling, repurposing, disposal and transport 	<ul style="list-style-type: none"> • Dismantling • Waste Management
Remediation	<ul style="list-style-type: none"> • Remediation 	<ul style="list-style-type: none"> • Waste management
Monitoring	<ul style="list-style-type: none"> • Monitoring equipment and installation • Nav aids 	<ul style="list-style-type: none"> • Specialist services • Logistics

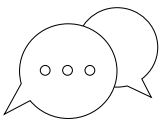
Table 1 | Work Breakdown Structure



Market analysis

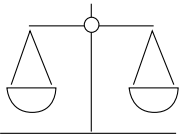
A market analysis was undertaken which considered geographies, timelines, forecast spend and asset types. This analysis built on CODA's earlier work "A Baseline Assessment of Australia's Offshore Oil and Gas Decommissioning Liability".

A SWOT (strengths, weaknesses, opportunities and threats) analysis technique was adopted to assess the state of play of the regional decommissioning landscape and to provide a basis to identify technology and innovation on a value and risk basis in the context of the Australian decommissioning industry, decommissioning asset base, Operator decommissioning requirements, and regional decommissioning service capability and capacity.



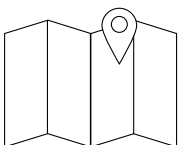
Market engagement

A series of interviews were held with representatives from Operators, the service and the technology sector and the oil and gas regulators. These interviews solicited views from these stakeholders to inform the development of the roadmap. These discussions provided insights into pathways and barriers to the development and adoption of technologies.



Screening & technical feasibility assessment

Technologies and innovations identified through the literature review, market engagement and the SWOT analysis of regional capability were consolidated into a themed opportunities register. All items in the register were then assessed and ranked against the pre-determined assessment criteria detailed above. These were then further evaluated to identify solutions across timelines (immediate, 5-10 years and future, 10-25+ years) that offered the potential return on investment were they to be adopted into the Australian industry.



Roadmap & report development

The outcomes from the above process were then consolidated into a technology innovation roadmap report. An interactive online technology and innovation roadmap is also being developed.

Outcomes

Analysis of the Australian offshore Oil and Gas decommissioning market has highlighted a number of interrelated insights pertinent to the assessment of innovation:

- Australia's petroleum basins are geographically distant from each other with marine vessel sailing times between Australian ports servicing the offshore industry comparable with those from South East Asia ports (typically the Ports of Singapore, Batam and Jahor Bahru). Marine construction vessels are generally located in these South East Asia ports to service the region, offering vessel owners higher utilisation and lower operating costs. This supply chain was used during the Australian offshore Oil and Gas construction phase and for similar reasoning is being used for the decommissioning phase;
- There is a high level of variation in the types of offshore Oil and Gas assets from shallow water monopods through to large floating structures. This is unlike, for example, the Gulf of Thailand where the bulk of the structures are reasonably similar and lend themselves to a common decommissioning plan and campaigning using fit-for-purpose marine spreads and equipment;
- The Australian decommissioning liability is spread around Australia, phased over a 30-year period without a sustained level of activity and managed by a number of Operators leading to less opportunity for shared campaigns, or for Australian based marine assets to gain continuity of work that would justify locating specialist vessels permanently in Australia.

The adoption of Oil and Gas decommissioning related technology and innovation in Australia is influenced by a range of factors. These factors are both cultural (for instance, the Oil and Gas industry in Australia tends to be technology takers rather than makers) and structural with the Australian Oil and Gas industry as a whole not benefiting from significant research and development.

A wide range of possible technological innovation was considered, taking into account the market analysis, innovation enablers and blockers, decommissioning practices applicable to Australian conditions and industry feedback, to arrive at a Roadmap and associated recommendations.





Well plugging and abandonment (P&A) accounts for around 50% of the forecast spend and related innovation is an international continuous improvement process with wide application including in Australia. There are a series of tools and techniques by a range of service providers that are proven in other jurisdictions and supported by engineering standards accepted in Australia that can be deployed in the short term, subject to verification and acceptance by Operators and Regulators. This technology, when applied with best practices such as economies of scale, dedicated well decommissioning teams, optimised risk-based planning and a technical limit approach, offer an opportunity for a step change in outcomes.

Facilities topsides removal will benefit from emerging technical products such as laser cutting and drones that have broad application across most decommissioning projects. However, 'large scale' local Australian innovation in this area is limited.

Notwithstanding the innovation in the removal of facilities, subsea equipment and pipelines identified in the report there will be additional innovation that is deployed or developed as required by contractors in response to specific project challenges identified during the tendering process. This type of innovation does not lend itself to pre-investment and therefore is not identified on the Roadmap. The encouragement of this type of innovation will require adjustment to established industry capital stewardship processes and established supply management practices identified in the report. Development of new or novel technologies to address specific local challenges may also require earlier and deeper engagement between parties than is typically the case, as well as financial support for the development of these concepts.

There are sufficient gains to be had from pursuing a pan industry technology innovation Roadmap with a focus on value rather than quantity of opportunities. Additionally, individual decommissioning campaigns will continue to offer the opportunity for innovation specific to those assets.

Given the early stage of decommissioning in Australia and the international nature of the Oil and Gas Industry, no uniquely Australian innovation export ready opportunities have been identified during the study. However, during the course of decommissioning, innovative ways of tackling problems specific to a particular campaign, will be developed by the service companies involved. How this innovation applies to other decommissioning projects in other regions, and whether this innovation is propagated as best practice or is developed and patented by an Australian company and therefore suitable as a product export opportunity needs to be monitored (CODA would be in a good position to do this). Export of services and engineering and project management expertise regionally is possible and likely to be at similar or lower levels to that realised during the project development phases.

Recommendations

The report's recommendations are summarised below:

Recommendation 1

A coordinated, whole of industry, approach is adopted to enable the overall uptake of technology and innovation identified in the report and corresponding Roadmap. This 'operationalisation' of the Roadmap would support, as applicable, Operator supply chain management processes, joint industry projects, effective supplier engagement, grant application and joint funding of appropriate areas of innovation on the Roadmap. CODA would be well placed to coordinate these activities, including reporting and feedback on the development and implementation of innovation and new technology.

Recommendation 2

It is recommended that industry working groups are formed under CODA to guide specific areas of innovation and research. Based on our analysis in the report, initial groups would cover:

- Well P&A;
- Trunklines; optimise pipeline removal techniques covering shallow to deepwater and shore crossings.
- Structures and facilities removal
- Subsea facilities removal

Additional groups could be contemplated subject to an assessment of common objectives.

Recommendation 3

The fostering of decommissioning innovation and R&D in Australia requires a review of enablers and blockers. Following that review it is recommended that a policy and plan be developed noting that the proposed industry focus groups (recommendation 2 above) will assist in the fostering and adoption of technology and help change industry behaviour.

Recommendation 4

This report has established a preliminary ranking of the technology and innovation opportunities. It is recommended that these rankings are regularly reviewed by the industry such that an agreed, up to date, prioritised list is made available for communication to stakeholders.

Recommendation 5

The opportunity for the regional export of Australian decommissioning related products and services should be monitored and supported. Whilst limited export ready opportunities have been identified at present, opportunities could increase as the number of successfully completed decommissioning projects grows over the next five years and the scale and nature of Australian innovation becomes more apparent.

Further reading

Executive summaries of the accompanying reports in this series as well as other CODA materials can be accessed via the CODA website at www.decommissioning.org.au.

The full version of this report as well as the other reports in the series is available to CODA partner members. To find out more email contact@decommissioning.org.au or visit the CODA website at www.decommissioning.org.au