Future Energy Exports (FEnEx) CRC **MILESTONE SUMMARY TABLE**			
Research Program 1: LNG Efficient Value Chains			
1.0	Generally aligned with the goal of making LNG Value Chains more efficient but not specifically aligned with any of the other RP1 Milestones	1 Jul 2020	30 Jun 2030
1.1.1	Full audit of helium recovery potential from Australian and global LNG production and overview of current technology limitations	1 Dec 2020	30 Jun 2021
1.1.2	Commissioning of helium recovery unit operation	1 Jul 2024	30 Jun 2026
1.2.1	Methane leak audit of LNG plants and gas distribution networks coupled with review of available detection technology & recommendations for minimisation	1 Jul 2021	30 Jun 2023
1.2.2	Pilot scale demonstration with extrapolation to full scale LNG plants of both improved maintenance strategies and acid gas removal techniques so as to reduce LNG carbon footprint	1 Jul 2024	30 Jun 2027
1.3.1	Software based model of boil-off gas production with predictions of when it becomes unstable	1 Jul 2022	30 Jun 2022
1.3.2	Demonstration of sensor able to provide early detection of freeze-out events	1 Jul 2023	30 Jun 2025
1.4.1	Optimised operation and sensing requirements for scrub columns featuring product purity control	1 Jul 2022	30 Jun 2024
1.4.2	Construction and commissioning of a low temperature gas dehydration unit operation	1 Jul 2026	30 Jun 2028
1.5.1	Report as to best practice regards LNG storage and transportation so as to minimise boil-off	1 Jul 2024	30 Jun 2026
1.5.2	Report on success of foaming prevention strategies based on better sensing and improved process understanding/foam modelling	1 Jul 2027	30 Jun 2029
1.6.1	15 PhDs completed in RP1	1 Jul 2020	30 Jun 2030

Future Energy Exports (FEnEx) CRC MILESTONE SUMMARY TABLE			
Research Program 2: Hydrogen Exports and Value Chains			
2	Generally aligned with the goal of developing Hydrogen Exports & Value Chains (including Utilisation) but not specifically aligned with any of the other RP2 Milestones	1 Jul 2020	30 Jun 2030
2.1.1	Detailed design of a liquid hydrogen production and storage plant at the scale required for export	1 Jul 2021	30 Jun 2023
2.1.2	Identify optimum integration and recovery of hydrogen from a selected liquid organic carriers	1 Jul 2025	30 Jun 2027
2.2.1	Develop and test a liquid hydrogen boil-off gas model as a user-friendly software tool	1 Jul 2021	30 Jun 2022
2.2.2	Report detailing technical requirements for scale up of electrolysis methods relevant to production at export-scale	1 Jul 2023	30 Jun 2024
2.2.3	Optimal containment material identified for large-scale hydrogen storage accompanied by required operation data for its inclusion in system design	1 Jul 2028	30 Jun 2030
2.3.1	Final design of integrated renewable energy co-electrolysis (power-to-gas, gas-to-power) with energy storage and heat integration to produce and transport hydrogen	1 Jul 2026	30 Jun 2028
2.4.1	Report detailed options for (i) closed loop carbon economies and (ii) coupled methane reforming and carbon capture and storage for the delivery of hydrogen	1 Jul 2020	30 Jun 2021
2.4.2	Identification, development and demonstration of hydrogen utilisation technologies that will drive export markets	1 Jul 2022	30 Jun 2025
2.5.1	Experimental design and construction of test rig for technical evaluation of solid-state hydrogen storage and thermal batteries	1 Jul 2023	30 Jun 2026
2.5.2	Integrate optimum hydrogen export method (solid state hydrogen, liquid organic hydrogen carriers or liquid hydrogen) into co-electrolysis pilot plant	1 Jul 2027	30 Jun 2029
2.6.1	15 PhDs completed in RP2	1 Jul 2020	30 Jun 2030

Future Energy Exports (FEnEx) CRC MILESTONE SUMMARY TABLE			
Research Program 3 – Digital Technologies and Interoperability			
3	Generally aligned with the goal of advancing Digital Technologies & Interoperability but not specifically aligned with any of the other RP3 Milestones	1 Jul 2020	30 Jun 2030
3.1.1	Review of existing production and maintenance information standards and prioritised use cases for key operational process areas (production/maintenance; transactional /analytical data) as needed to develop data-exchange and communication systems	1 Jul 2020	30 Jun 2021
3.1.2	Extended implementation and demonstration of standards-based data-exchange systems for LNG and other energy sector plants using pilot data sets. Support tools evaluated and further improved using experimental data	1 Jul 2027	30 Jun 2029

3.2.1	Selection of key communication pathways and initial communication infrastructure design (bus, languages) and demonstration with initial information standards for priority process areas	1 Jul 2021	30 Jun 2023
3.2.2	Adaption of digital ecosystem architecture to expanded information standards and extended use case coverage	1 Jul 2023	30 Jun 2025
3.2.3	Evaluation of new architectural and language concept integration, as well as adaptation of architectures to changing partner requirements in line with improvements and updates in industry information standards	1 Jul 2025	30 Jun 2026
3.2.4	Adaption and finalisation of digital ecosystem architectures with an extended suite of demonstrated information standards	1 Jul 2028	30 Jun 2030
3.3.1	Techniques and specifications for integration of improved process control system designs into existing architecture developed, demonstrated and evaluated using experimental data sets for priority operations. Additional areas for improvement identified	1 Jul 2020	30 Jun 2022
3.4.1	Integrated system for visualisation, control, & data exchange to enable remote plant operations based on initial information standard definitions and sample data set schemas, demonstrated and tested through workshops and pilots	1 Jul 2022	30 Jun 2024
3.4.2	Refined second generation remote plant operation solutions demonstrated in realistic scale plant implementations	1 Jul 2025	30 Jun 2027
3.5.1	Digital twin models extracted and described incorporating prediction and anomaly identification techniques. Models and frameworks for plant lifecycle priority areas implemented and evaluated on pilot data	1 Jul 2026	30 Jun 2028
3.6.1	15 PhDs completed in RP3	1 Jul 2020	30 Jun 2030

Future Energy Exports (FEnEx) CRC **MILESTONE SUMMARY TABLE**			
Research Program 4 – Market and Sector Development			
4	Generally aligned with the goal of advancing Digital Technologies & Interoperability but not specifically aligned with any of the other RP3 Milestones	1 Jul 2020	30 Jun 2030
4.1.1	Exploration of challenges and opportunities for LNG and hydrogen energy exports in Australia's transition to Net Zero by 2050	1 Jul 2021	30 Jun 2024
4.1.2	Identification of energy and sector development trends and megatrends to inform commercial decision-making in high potential energy export markets	1 Jul 2024	30 Jun 2027
4.2.1	Mapping of key industry, government and community stakeholders in hydrogen and LNG energy supply chains, with key barriers and drivers of energy product usage identified	1 Jul 2020	30 Jun 2021
4.2.2	Generation of final spatio-temporal maps for hydrogen and LNG energy market futures, and diagnostic tools for energy industry to drive domestic and export market adoption of product	1 Jul 2026	30 Jun 2029
4.2.3	Industry workshops, conference and event presentations and publication of industry documentation to facilitate engagement	1 Jul 2029	30 Jun 2030
4.3.1	Evaluation of community perceptions of the global energy transition including the future of LNG and hydrogen energy export markets	1 Jul 2020	31 August 2022
4.3.2	Policy recommendations and community guidelines developed and disseminated for effective interventions to balance the needs of export and domestic market development to industry and government	1 Jul 2022	30 Jun 2025
4.4.1	Analysis and identification of key skill and training needs (eg. digital, technical, commercial) to achieve transitions to future energy sources	1 Jul 2020	31 August 2023
4.5.1	Diagnostic tools piloted with employee surveys of energy businesses, to assess and model barriers and enablers to technology adoption and innovation.	1 Jul 2025	30 Jun 2026
4.5.2	Models for improving business structures, systems and processes to support energy technology uptake developed and refined using data collected and stakeholder interviews	1 Jul 2025	30 Jun 2028
4.6.1	14 PhDs completed in RP4	1 Jul 2020	30 Jun 2030