

ANNUAL REPORT 2020-2021



Image courtesy of Star of the South



Australian Government
Department of Industry, Science,
Energy and Resources

AusIndustry
Cooperative Research
Centres Program



Contents

About the Blue Economy CRC	3
△ Chair's Report	5
Executive Summary	6
△ Highlights and Achievements	7
△ Case Studies	13
△ Risks and Impediments	18
△ Research Programs	20
△ Education and Training	57
△ Intellectual Property Management	59
△ CRC Future Plans and Transition Management	60
△ Participants	61
△ Third Parties	62
Governance - Board, Committees and Key Staff	63
Financial Report	69





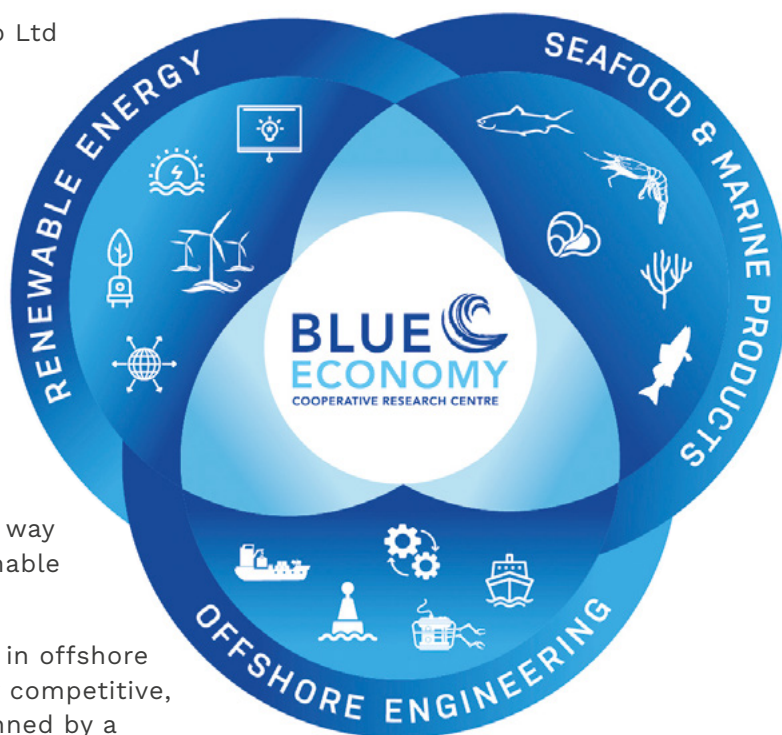
About the Blue Economy CRC

Established in 2019, the Blue Economy CRC-Co Ltd (ABN 64 634 684 549) is an independent not-for-profit company limited by guarantee and a Cooperative Research Centre under the Australian Government's CRC Program.

With a 10-year life and a budget above \$329 million, the Blue Economy CRC brings together 40 industry, government, and research partners from ten countries with expertise in aquaculture, marine renewable energy, maritime engineering, environmental assessments and policy and regulation.

Through targeted industry-focussed research and training, the Blue Economy CRC paves the way for innovative, commercially viable and sustainable offshore developments and new capabilities.

Our vision is that our blue economy industries in offshore aquaculture and renewable energy are globally competitive, at the forefront of innovation and are underpinned by a robust environmental planning and management framework which consumers trust and value.



KEY FACTS Year in review

40 
PARTICIPANTS
FROM 10 
COUNTRIES

FUNDING
SECURED 
TIL 2029

 **6 STAFF**
EMPLOYED

5 **RESEARCH**
PROGRAMS

RESEARCH SYNTHESIS REPORT RELEASED

11 **PROJECTS** UNDERWAY 

17 **PROPOSALS** UNDER DEVELOPMENT

16 **SCHOLARSHIPS**
PHD AWARDED

7 **MILESTONES**
ACHIEVED 

Blue Economy CRC's Participants





Chair's Report

Greg Johannes
Chair
Blue Economy CRC



The future of the world's oceans is a growing area of focus in international discussions about sustainability and growth.

Australia is one of fourteen nations to commit in late 2020 to managing 100% of its national waters sustainably by 2025 under the auspice of the 'High Level Panel for a Sustainable Ocean Economy'. And the arrival of 2021 has seen us enter the United Nations Decade of Ocean Science for Sustainable Development.

Realising both the Panel's vision and wider global objectives for the oceans will require major transformations in many areas that align with the Blue Economy CRC's core research programs – regulation, ocean accounting, offshore aquaculture, blue carbon, social licence, renewable energy generation and engineering among them.

The Blue Economy CRC is well placed to make a significant contribution to national and international aspirations for our oceans.

This year we entered the third phase in our development, following the substantial program of work in our first year to get the organisation up and running, and then to commission our first set of scoping projects. We have now moved firmly into the strategic investment phase.

Over the year we secured important infrastructure to support our research effort across our life and commenced a series of major projects. We are particularly excited about the agreement we've entered to acquire a hydrogen microgrid. This is currently under construction and is due to be commissioned in the first half of 2022.

Our work is now being guided by foundation documents like our Research Investment Framework, and the Research Synthesis Report and the Research Roadmaps that emerged from more than 15 scoping projects and detailed discussions with our participants. These discussions focused on their priorities, our capabilities, and the key research questions for the future.

Unfortunately, our ability to engage directly with our Participants face-to-face has continued to be frustrated by COVID. However, during the year we held our Annual Participants Workshop both physically and virtually in Brisbane.

The CEO and I made the trip across to Western Australia to spend time with current and potential future research partners, and our committee structure and highly successful webinar series have continued to support deep and meaningful engagement.

We have also made an important down payment on the research and industry workforce of the future, developing and commencing our PhD program. This has seen active engagement of industry in the development and oversight of each PhD scholarship.

Throughout this period, the Board has continued its focus on strategic leadership and good corporate governance.

Our Strategic Plan is in place and underpinned by the key values of being innovative, collaborative and supportive, and on behaving with integrity and embracing excellence. And we have refined our suite of policies and procedures, including identifying principles for admitting new participants and focusing closely on our approach to IP management and risk.

The Directors have been reappointed by the sole member of the Company for another term – some for two years and some for three. And during the course of the year, another five Participants have elected to become members of the Company.

Moving forward, we continue to recognise the challenge of bringing in new resources to ensure we can realise the Australian Government's full funding commitment, and discussions with a range of potential Participants are underway.

I want to thank my fellow Board members for their support and hard work throughout the year, and for their enthusiasm about the challenges and opportunities ahead. And on their behalf, I want to congratulate the CEO and his team for their amazing work and achievements in 2020/21. If they were jugglers, I would long ago have lost count of the number of balls they manage to keep in the air at the same time.

Most importantly, I want to thank our Participants and other research and funding partners. They have engaged with great energy and passion throughout the year, driving us to think bigger and work harder to realise the opportunities we all can see in the blue economy.



Executive Summary

- » The Blue Economy CRC's Strategic Plan was released in July 2021. This document outlines our objectives, approach, and priorities for the coming years for research, commercialisation and adoption, capability and capacity building, engagement, and corporate activities. The Plan was developed by the Board, Participants, and Program Leaders, to guide our approach and direction over the life of the Blue Economy CRC.
- » The Annual Participant Workshop was held in March 2021 in Brisbane as a joint in-person and online event. With 100 in person and 168 online attendees representing most of our Participants, the three-day workshop was a fantastic opportunity for our industry, research and government partners to collaborate.
- » The outputs of 19 completed Projects have been provided to our Participants and are leading to changed practices, commercialisation, publications, and further research.
- » The outputs and recommendations of the initial scoping projects were incorporated into the Blue Economy CRC's Research Synthesis Report. Working with our Participants to understand need and capability, these outcomes have been used to develop our research roadmaps which, along with the recently developed Research Investment Framework, are guiding the Blue Economy CRC's research investments.
- » The Blue Economy CRC's hydrogen microgrid is under construction to be delivered in the first half of 2022 with a commercial offtake agreement being negotiated.
- » Our commercialisation activities have commenced with the development of two provisional patents.
- » The Blue Economy CRC is playing an active role in policy development at the International, National and State level with strategic inputs to renewable energy, hydrogen and aquaculture policy.
- » The Blue Economy CRC awarded, in partnership with our Participants, 16 PhD Scholarships in 2020-2021 putting us well on track to meet our target of 50 PhDs over the life of the CRC.
- » We have focussed on our engagement with our Participants and the broader blue economy sector with our nine industry-focussed webinars averaging 115 attendees, our website being continuously improved and the development of an active general and social media presence.
- » Five Board members were reappointed following their inaugural terms.
- » The Blue Economy CRC is in advanced discussions with a range of potential Participants to join the Blue Economy CRC to enhance the CRC's capacity, capability, and resources.



Image 1: Floating offshore windmill developed by Saitec Offshore.

Image courtesy of Saitec Offshore



Highlights and Achievements

Blue Economy CRC Research Investment Framework

The Blue Economy CRC released its new [Research Investment Framework](#). The framework articulates how the Blue Economy CRC will seek proposals for new R&D projects and how it will determine which proposals receive funding to proceed. The Framework provides critical information for all Blue Economy CRC Participants and other external organisations interested in becoming involved in our extensive research program. The Blue Economy CRC can accept EOI submissions at any time via the Connect portal, for both Scoping Studies and General Projects and has replaced the open call approach launched in 2019.

Research Projects

The Blue Economy CRC completed 19 Projects in 20-21 and engaged deeply with our 40 industry, research and government Participants to understand their objectives and priorities, and the current state-of-play for the industry. To the extent that we have protected commercial IP and commercial in confidence information provided by Participants, edited versions of the final reports were made available via the Blue Economy CRC Connect community platform and the website. See <https://blueeconomycrc.com.au/past-projects/>

Nine Projects are underway on renewable energy, fish pen infrastructure, environmental monitoring, risks and opportunities, and ethics values and social licence in the blue economy. These projects have a lifetime value of \$10.2M with the Blue Economy CRC cash contribution of \$4.4M. See link to current projects. <https://blueeconomycrc.com.au/projects/>

The Blue Economy CRC has allocated funding for a further Project to investigate the opportunities and challenges for the oyster industry in the blue economy, which will start in late 2021.

Together with the US Department of Energy Pacific Northwest National Laboratory <http://www.pnnl.gov>, the Blue Economy CRC will be reviewing the global energy requirements of offshore aquaculture as a market for ocean energy, commissioned by the International Energy Agency (IEA) Ocean Energy Systems (OES) Technology Collaboration Program <http://www.ocean-energy-systems.org>.

This 12-month General Project will build off understanding gained through the energy assessments scoping study project (*Offshore/High Energy Aquaculture Systems - Energy Demand Analysis*) completed in 2020. Project Agreements are in preparation.

The Blue Economy CRC has commissioned the development of an additional 17 Projects. These Expressions of Interest are currently in preparation, expected to be submitted in August/September 2021 with submission to the Scientific Advisory Committee for feedback in Q2 2021-2022.

Image 2: Dr David Plew setting up an aquatic eddy covariance lander for the non-invasive measurement of the sediment-seawater oxygen exchange.

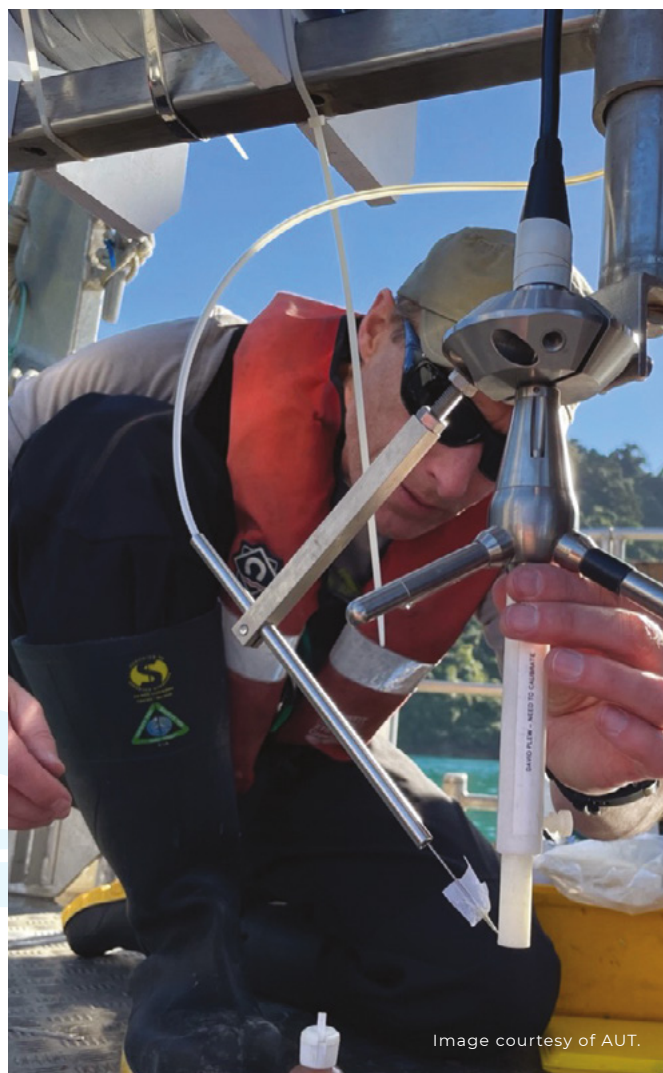


Image courtesy of AUT.



Highlights and Achievements:

Research Synthesis Report

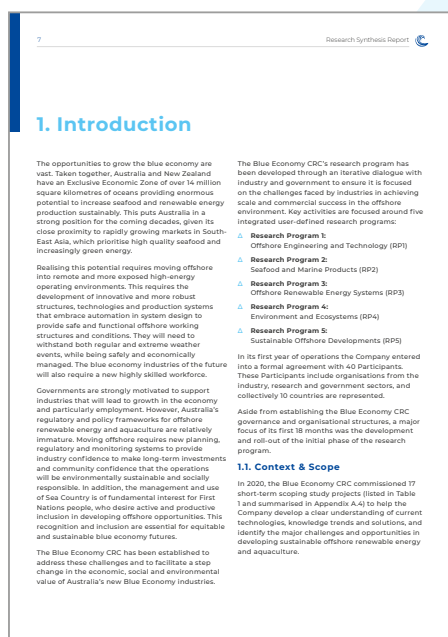
The Blue Economy CRC has prepared a summary of our completed projects – the Research Synthesis Report: Scoping Study Projects 2020. A Proposed Research Agenda for the Blue Economy CRC. March 2021 – which presents a synthesis of the outputs of the scoping studies, compiling prioritised research challenges into a single multi-disciplinary industry-focused research program. This was a significant body of work and a critical step towards meeting the Blue Economy CRC's milestones.

Drawing the five Research Programs together, the Research Synthesis Report includes a future investment plan that takes account of both immediate industry needs/priorities identified from the completed studies and the Participants workshop and reviews and future research opportunities/imperatives aligned to the objectives of the Blue Economy CRC and Blue Economy CRC Commonwealth Milestones. The Research Synthesis Report also identifies where new Participants/partners can assist the Blue Economy CRC to meet its objectives. The Research Synthesis Report was prepared by the Research Executive with support from the Scientific Advisory Committee and Participants and approved by the Board. The Research Synthesis Report was a focus of attention at the Annual Participants Workshop.

Commercialisation/IP

The Blue Economy CRC received a provisional patent for offshore fish enclosure concepts resulting from Blue Economy CRC Project work. The novel fish pen design is being developed for large-scale commercial fin fish production in open ocean conditions (see Case Study 2). A project to further the development of these novel offshore fish pens 'Novel Offshore Fish Farm Design: Phase 1 (Conceptual Development)' (Total Budget \$2.02M, with \$450k Blue Economy CRC cash) is currently under review.

The Blue Economy CRC has commenced preparation of a provisional patent for a collar-tie component of traditional fish pens. This novel approach to connecting the net to the pen collar by joining two ropes with a breaking strain of greater than 10ton promises to significantly reduce the maintenance costs and increase the durability of traditional fish pens currently used by our industry participants. It also has significant commercialisation potential beyond aquaculture across a broad range of maritime operations (see Case Study 3).



Highlights and Achievements:

CRC Hydrogen Microgrid Infrastructure

The Blue Economy CRC is currently developing a fully operational commercial-scale hydrogen electrolyser to support the decarbonisation of offshore industries including shipping and aquaculture. Late in 2020, the Blue Economy CRC, along with Partners Optimal Group and University of Tasmania, with the Macquarie Group, acquired key [R&D infrastructure to develop an offshore hydrogen microgrid](#), that will come online in Tasmania in the first half of 2022. This new infrastructure includes a 700kW electrolyser manufactured by ITM power, a 65kW Capstone hydrogen turbine, and a microgrid developed by Optimal Group.



This is a project of many firsts. It will be the largest hydrogen electrolyser in Tasmania and amongst the largest in Australia. The first hydrogen Capstone microturbine to be deployed in Tasmania and only the second in Australia and indeed worldwide. On the current research program schedule, it should be the first hydrogen microgrid to be installed offshore. Optimal is delighted to be a part of the ground-breaking Blue Economy CRC research program and to be selected to provide these key components.

Craig Dugan, Chief Executive Officer from Optimal Group.



This hydrogen infrastructure will initially start onshore and will be configured to support early-stage transport and maritime development activities, consistent with the [National Hydrogen Strategy](#) and [Tasmanian Government's Industry Activation Study](#), with Partners the Tasmanian Government, Optimal Group, Pitt & Sherry and Griffith University. The long-term aim is to develop this into an offshore renewable energy system, encompassing offshore renewable energy conversion technologies coupled to a hydrogen microgrid to provide high-reliability clean energy for our maritime industries of the future. The microgrid will support research and development through its capacity to emulate real-world scenarios relevant to offshore industries. Projects underway and planned will investigate:

- » renewable energy system technologies for offshore, off-grid applications, including hydrogen generation, hydrogen storage and hydrogen-powered vessels;
- » hydrogen microgrids to support offshore industries, including aquaculture; and
- » opportunities to add value to hydrogen production by electrolysis by utilising the oxygen co-product in the aquaculture industry.



Image 3: The project was presented by Pitt & Sherry at the [2021 Tasmanian Energy Development Conference](#) held from 23-24 June 2021 in Devonport, Tasmania.



Highlights and Achievements:

Blue Economy Zones

Another exciting step in exploring the offshore environment is the concept of a Blue Economy Zone (BEZ), to provide a testbed site for trialling all aspects of developing sustainable economic activities offshore and continue to meet the CRC's milestones. This will include developing policy, regulatory and monitoring/reporting procedures as well as a future at-sea testing of technology. In the initial phase of a multi-year endeavour to establish a BEZ in the Bass Strait, the Blue Economy CRC has worked closely with the Governments to propose a regulatory environment for offshore marine farming in Commonwealth waters.

Fieldwork commenced in December 2020 in Bass Strait with placing of moorings and commencement of physical data collection (such as waves, currents, temperature, etc.), and a seabed and mobile fauna survey. The collection of baseline data at the site is providing an early indication of the suitability of the area for aquaculture and renewable energy production platforms and systems and will support marine spatial planning and site selection for future developments offshore. The project summary can be found [here](#).



Image 4: Data collection in Bass Strait.

First Publications

Research Program 1, Offshore Engineering and Technology has published their findings from the Project, Multi-purpose offshore/high energy platforms: concepts and applications (1.20.004), led by Dr Nagi Abdussamie (AMC-UTAS), in the [Journal of Process Safety and Environmental Protection](#). The paper focuses on challenges relating to the reliability of Multi-Purpose Offshore-Platforms (MPOPs). The referred article is the first publication by the Blue Economy CRC and a result of the close collaboration between colleagues from academia and industry.

Blue Economy CRC Research Director, Professor Irene Penesis and CEO Dr John Whittington have published a chapter about Australia's blue economy in a new book '[Preparing a Workforce for the New Blue Economy: People, Products and Policies](#)'. The book discusses the new blue economy, how industries will develop, and how to train the next generation workforce. The book provides a broad range of case studies, covering oil spills, commercial fishing, data protection and harvesting, sustainability and weather forecasting, all presented to highlight the educational requirements of the future workforce and potential economic opportunities. The book chapter outlines opportunities in Australia's new blue economy industries focusing on offshore aquaculture and offshore renewable energy and the role of the Blue Economy CRC in realising those.

Education and Training

The Blue Economy CRC granted scholarships to 12 PhD projects through a dedicated funding round, with four PhD students commencing in 2020-2021. In addition, three PhD students commenced studies under scholarships awarded as part of the first round of General Projects, while two other PhD scholarships were awarded, and the students selected, via stand-alone applications. Taking co-funding arrangements into account, 16 PhD scholarships were awarded in 2020-2021.

Milestones

The Blue Economy CRC is meeting its research output targets, with seven milestones completed during 2020-2021. The Blue Economy CRC has now successfully completed 12 of its contracted Australian Government milestones with a further 91 milestones in progress.

Establishment of five Research Program Advisory Committees

Consistent with the Blue Economy CRC's obligations under the Grant Agreement, we have established five Research Program Advisory Committees (RPACs) to 'guide and evaluate Research Program (RP) activity and review outcomes in order to (i) increase the research impact of that Research Program; and (ii) enhance the global integration of the Blue Economy CRC's research activities. Each of the five RPACs is an independent group that includes external experts. All five Research Program Advisory Committees have now commenced a schedule of meetings, with 10 meetings held during this reporting period.



Highlights and Achievements:

New Member of the Research Executive

The Blue Economy CRC welcomed a new member to the Research Executive team, Dr Kosala Gunawardane, an Electrical Engineer and Senior Lecturer in the Faculty of Design and Creative Technologies at Auckland University of Technology (AUT). Kosala has joined the Offshore Renewable Energy program as a Deputy Program Leader bringing her valuable research experience in DC microgrids and renewables. See Kosala's profile at <https://academics.aut.ac.nz/kosala.gunawardane/about>.

Formal Submissions

The Blue Economy CRC provided a submission to the [Australian Government's proposed Offshore Clean Energy Infrastructure Proposed Framework](#). The submission notes the Blue Economy CRC's support for the development of a stable framework that is a positive step towards ensuring a diverse energy supply (and energy security) through the inclusion of offshore wind and other clean energy in Australia's renewable energy mix. The development of the framework provides guidance for the industry and other stakeholders as well as policy and decision-makers.

The Blue Economy CRC provided a submission to [House of Representatives Standing Committee on Agriculture and Water Resources: Australian Aquaculture Sector Inquiry](#) terms of reference 'Australian Aquaculture: Opportunities and Barriers to Expansion'; and 'Current Regulatory Framework – Directions for the Future'. The submission notes the considerable innovation within the Australian aquaculture sector as it has developed and expanded. Offshore aquaculture, like other offshore activity, is likely to face high start-up costs and risks. The Blue Economy CRC's innovative research programs links experimental systems and commercial facilities.

Blue Economy CRC provided input into [IMOS' draft five-year plan \(2022-2027\)](#). The Blue Economy CRC emphasised its support for a collaborative approach to data, technology development and its application. We continue to work with IMOS on options for collaboration on data management. The National Collaborative Research Infrastructure Strategy (NCRIS) program supports a range of infrastructure needs, including in the marine sphere via funding support for IMOS, supporting vessel days for the Marine National Facility RV Investigator, helping support a national coastal fleet of vessels and the National Sea Simulator.

Blue Economy CRC has provided a submission to the Draft [Tasmanian Renewable Energy Action Plan 2020](#). The submission highlights that the Blue Economy CRC is well placed to support the focus of The Tasmanian Renewable Energy Action Plan (the Action Plan), to

- (i) transform Tasmania into a global renewable energy powerhouse,
- (ii) Make energy work for the Tasmanian community; and
- (iii) Grow the Tasmanian economy and provide jobs.

2021 Participants Workshop

The 2021 Blue Economy CRC Participant Workshop was held from 24-26 March 2021 in Brisbane. Despite the challenges associated with COVID-19 and restrictions on travel and meetings, the event was a great success, bringing together participants from our research, government, and industry partners to collaborate, workshop and network across the three-day event. The workshop was a hybrid event, combining both online and in-person attendees with approximately 100 attending in person and a further 168 online (including overseas) over the course of the three days. The event consisted of a jam-packed program including an opening address from Senator the Hon Jonathon Duniam, keynote presentation from Russell Reichelt, Australia's Ocean Panel Sherpa, High Level Panel for a Sustainable Ocean Economy and, theme and panel discussions and floating ideas sessions from our industry and research experts. At the Workshop, we presented our Research Synthesis Report with one of the outcomes being a series of research roadmaps that build on our activity to date, our milestones and the research needs identified by industry. Post-workshop surveys demonstrated a high level of satisfaction with the workshop.



Image 5: Participants Workshop 2021.



Highlights and Achievements:

Webinars

During the year we launched a webinar series to support engagement and collaboration across the Blue Economy CRC and beyond. Participants and/or external parties are invited to showcase their skills and expertise and the Blue Economy CRC can highlight research and successes as they occur over coming years.

There have been nine webinars held during this annual report period, covering topics as listed below:

- » Machine Learning – Adding Power to the Toolbox
- » Harnessing Australia's Offshore Wind for a Clean Energy Future
- » Offshore Aquaculture Units and Support Vessels: Challenges and Industry Approaches
- » Hydrogen in the Blue Economy
- » How We Farm Salmon
- » Advances in Fish Pen Designs and Mooring Systems
- » Biogeochemical Modelling Tools and Applications
- » Multipurpose Platform and Co-location of Aquaculture & Wind Farms
- » Facilitating Consenting and Deployment of Marine Energy Devices through Risk Retirement

Overall, there have been 1028 registered attendees who were logged on across all of the above webinars, with the highest number of registrations for a single webinar being 153 attendees to view the Multipurpose Platform and Co-location of Aquaculture & Wind Farms webinar. The presenters for this webinar included Dr.-Ing. Frank Adam of Rostock University, Germany; Prof Maurizio Collu of Strathclyde University, United Kingdom and was facilitated by Prof CM Wang of University of Queensland and Research Program Leader at the Blue Economy CRC.

The recordings of these webinars can be found on the Blue Economy CRC's events page at <https://blueeconomycrc.com.au/events>.

Website, Connect and Newsletters

During this period we:

- » Significantly upgraded the website <https://blueeconomycrc.com.au> to provide detail on the Blue Economy CRC Research Projects and Education and Training Program.
- » Continued to work with TurnKey CRC on the Blue Economy CRC's community platform Connect to improve user experience, proposal templates, quarterly progress reporting and in-kind reporting.
- » Issued a quarterly newsletter to all our Participants and those registered to receive the Blue Economy CRC's latest news.



Image 6: [Blue Economy CRC website](https://blueeconomycrc.com.au).

Governance

The Board of the Blue Economy CRC is comprised of 5 independent non-executive Directors. The Directors have been reappointed by the member for a further term and the Board has elected Greg Johannes to continue as Chair for a further 2 years term. During the year, another five Participants have elected to become members of the Company.

The Board has continued to provide strategic leadership and good corporate governance with the development of a Strategic Plan, identification and management of risk, and the ongoing development of policies and procedures, including for IP management, a Research Investment Framework and Principles for admitting new participants. The sub-Committees of the Board are active with Directors Chairing regular meetings of the Participants Advisory Committee, the Finance, Audit and Risk Management Committee, the Communications Advisory Committee, and the Scientific Advisory Committee.



Case Studies

CASE STUDY 1

Offshore Wind Potential for Australia

Globally, offshore wind energy generation is growing rapidly but the general view in Australia has been that its role will be limited here. However, offshore wind merits serious consideration. Globally, the cost of offshore wind is falling rapidly; high capacity factor wind can diversify clean energy generation; and it can connect into the network and displace current coal-based generation across regions (Newcastle/Hunter, Bass Strait/La Trobe Valley) to utilise existing infrastructure.

The *Offshore Wind Potential for Australia* (3.20.007) project commenced in 2020-2021 and evaluated the feasibility and potential of offshore wind to contribute to Australia's energy needs. It also identifies barriers to its large-scale development.

The Blue Economy CRC summarised the outputs of this work in a new [report](#) on Australia's offshore wind energy potential which called for a renewed consideration of the substantial contribution offshore wind could move to Australia's future clean energy mix.

The research found Australia has very high quality and abundant offshore wind resources close to the existing transmission grid.

More than 2,000 GW could potentially be installed within 100 km of current substations and excluding environmentally restricted and low wind areas – far in excess of total current electricity generation (see figure on technical energy potential of offshore wind sites below).

The Project brought together expertise from CSIRO, the Institute for Sustainable Futures, University of Technology Sydney; Saitec Offshore; and the Maritime Union of Australia with contributions from the Electrical Trades Union, Australian Manufacturing Workers' Union and Australian Council of Trade Unions.

Since publication of the report, we have seen the introduction of legislation to establish a regulatory framework for the development of offshore renewable energy in Commonwealth waters (which was Recommendation 1 of the report). We have also since seen the Australian Energy Market Operator release the [Inputs, Assumptions and Scenarios report](#) for the 2022 Integrated Systems Plan which incorporates offshore wind for the first time (Recommendation 3).

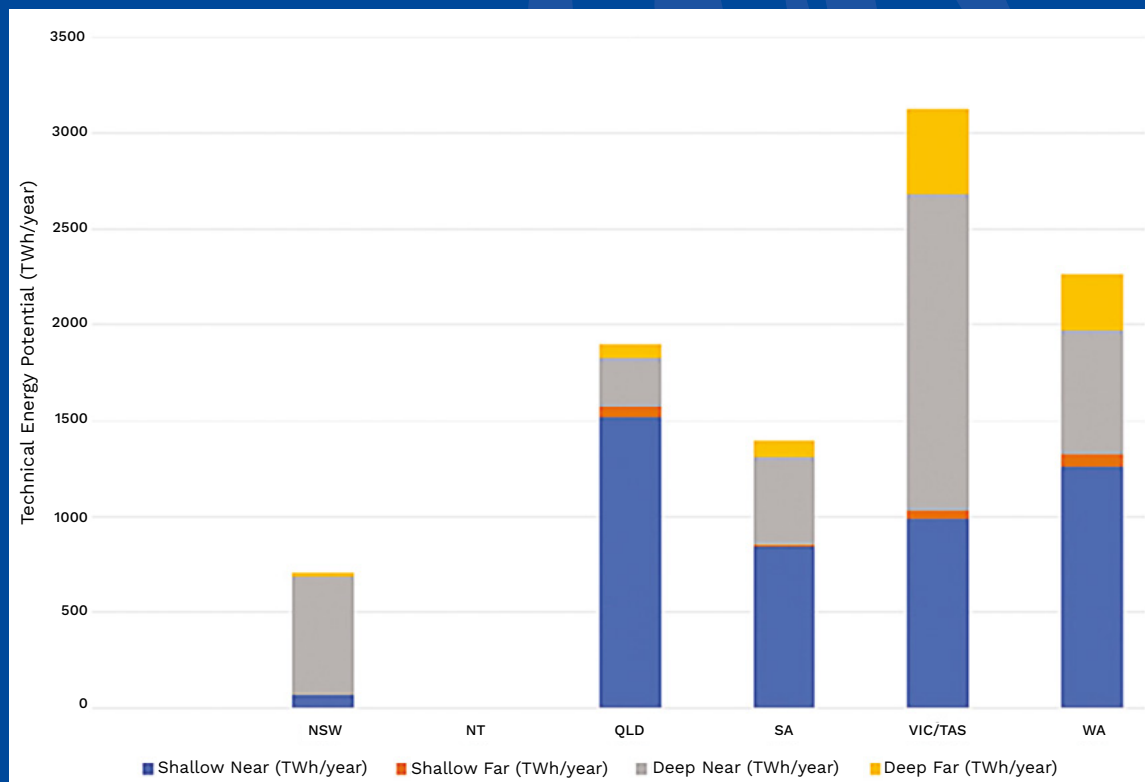


We know that a net zero emission, renewable energy-powered economy is necessary to limit the worst impacts of climate change. Australia has highly skilled seafarers and offshore oil and gas workers capable of constructing offshore wind projects. The development of an offshore wind industry would provide the opportunity for these workers to transition into the important work of delivering Australia's clean energy future.

Paddy Crumlin, Maritime Union of Australia National Secretary.



Case Studies



Technical energy potential (TWh/year) of shallow (<60 m) and deep-water (60 m to 1000 m) offshore wind sites near to (<50 km) and far from (50 km to 100 km) the Australian coastline, for sites < 100 km from electricity substations and transmission lines. The national technical energy potential was calculated at 9,396 TWh/year, far exceeding Australia's current electric generation of 265 TWh/year in 2019 and demonstrating the technical potential for energy exports as hydrogen, for instance (Offshore Wind Potential for Australia Project Blue Economy CRC [final report](#)).

Some other key findings and recommendations from the report include:

△ Marine allocation of space for offshore renewable energy projects should be considered.

With many offshore wind projects already in the development pipeline, Australia would benefit from proactive consideration, via Marine Spatial Planning, to resolve potential conflicts in uses of the marine domain and ensuring it remains sustainably managed. This can help Australia meet its international commitments, such as Australia's pledge through the High Level Panel for a Sustainable Ocean Economy to sustainably manage 100% of the ocean area under national jurisdiction by 2025. Additional work is occurring through the Blue Economy CRC to consider the issues relating to marine allocation of space.

△ The permitting process should support the development of local supply chain capacity to maximise investment and jobs and community benefit.

Offshore wind can develop into a significant source of employment in the maritime 'blue economy'. Our study found employment potential ranging between 3,000 – 4,000 jobs (lower scenarios) to 5,000 – 8,000 jobs each year (high scenario) annually from 2030. Australia's share of manufacturing and supply chain activity in most renewable energy sectors is low and the range depends significantly on the local share of supply chain employment.



Case Studies

Δ Baseline data needs to be collected on environmental and social dimensions of offshore wind energy.

The social acceptability of offshore renewable energy in Australia is largely untested, and indeed, environmental effects are largely unknown in the southern hemisphere. More research and collection of baseline data is required to understand the effects of offshore renewable energy on ocean and local communities, and on economies and local environments. Global knowledge gained in reducing the potential environmental effects of offshore wind turbines must be transferred to an Australian context. This work should not be left to individual companies, and the value of shared data agreements should be recognised.

Δ Offshore wind energy should be incorporated into planning for the National Hydrogen Strategy and other renewable energy assessments.

The opportunity for offshore wind to play an integral role under 'energy superpower' demand scenarios should be recognised. With the scale of electricity required to realise the objectives of the National Hydrogen Strategy, offshore wind could be an important source of power located adjacent to many ports and industrial facilities to meet increased demand associated with large industrial loads, electrification of other energy sectors, or for the production of hydrogen to meet the needs of industrial applications such as steel and aluminium production, or for export. Further research is required to understand the potential of offshore wind energy for hydrogen, and offshore wind should be incorporated into planning for the National Hydrogen Strategy.

The final report was launched via a webinar in July 2021, which attracted over 600 attendees. An offshore wind industry panel discussion followed the launch, where a panel of 7 offshore wind developers with an Australian presence introduce their project interests and outline the opportunities and challenges they see for an Australian offshore wind sector.

CASE STUDY 2

First Patent Filed for Novel Offshore Fish Farm Design

Australia, with the World's third largest Exclusive Economic Zone, has enormous potential to use the oceans to sustainably increase seafood and renewable energy production. Realising this potential requires moving from coastal into offshore, more exposed high-energy operating environments, requiring new production systems that can withstand both regular and extreme weather events, while being safely and economically managed.

The Blue Economy CRC commissioned a study to provide a comprehensive review of fish pen designs and mooring systems internationally and identify potential improvements to current fish pen designs used by the Australian and New Zealand aquaculture industry to ensure their survivability in exposed offshore environments. Twelve partners of the Blue Economy CRC contributed expert knowledge to the study involving a total of 26 researchers, engineers and aquaculture production experts.

The scoping study project Review of Fish Pen Designs and Mooring Systems (1.20.005) report highlighted that current nearshore fish pens, mooring systems and supporting infrastructure may be damaged and less reliable when deployed in offshore/high energetic sites. Owing to the harsh environmental conditions at offshore sites, offshore fish pen designs must be made either very large and strong or be submerged to move away from the strong surface waves. Although several designs of offshore fish pens have been built recently such as the Norwegian Ocean Farm 1 (see Ocean Farm 1 figure below), they involve a large capital expenditure per kilogram of salmon produced. The Norwegian Ocean Farm 1, with a height of 69 m and a diameter of 110 m, costs around NOK 700 million and can hold around 1.6 million salmon in different chambers. Construction costs could be reduced by elevating or submerging fish farm structures and their interactions with surface wave conditions.

Case Studies

The recommendation made in the study is to develop durable and cost-effective fish pen designs for the aquaculture industry suitable for Australian and New Zealand offshore conditions.



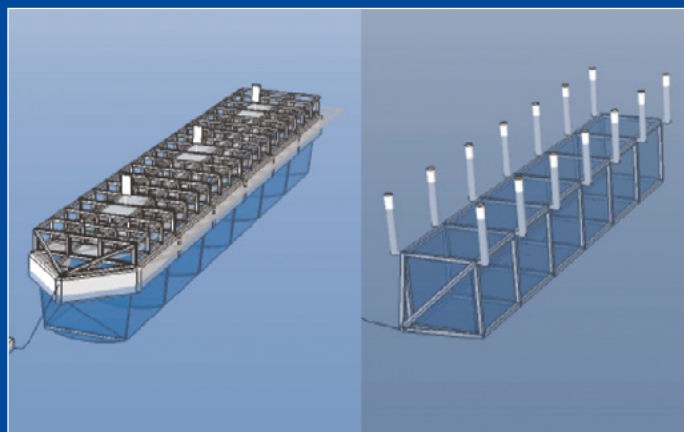
Ocean Farm 1.

Through interactive dialogue with the project participants, two novel fish pen designs have been identified and patented by the Blue Economy CRC.

The SeaDipper and SeaFisher patented fish pen designs are modular and can be elevated or submerged from strong surface waves. Their design allows their estimated costs to be less than half of existing offshore fish pen designs (such as Ocean Farm 1) for a comparable fish stock capacity.

The SeaDipper elevates the space framework on top of floating buoyancy bodies to escape the high surface wave energy. There is adequate space to 'dip' the fish pens into the water underneath the structural framework and between the floating bodies. This vertical arrangement allows a division of the steel structure into smaller sections which reduce material and cost. Furthermore, it creates additional advantages like an elevated and safe working platform for staff and automated technology and a roof area that provides enough space for wind and solar energy production.

In the case of the SeaFisher, its submergence ability is activated by inflation and deflation of a buoyancy collar. The submerged position protects the SeaFisher from strong surface waves. The floating position at the surface of the sea enables safe and efficient working conditions to transfer the young fish into the pen, harvest and perform maintenance. For seakeeping, the SeaFisher concept includes an anchored floating semi-submersible platform that creates an extendable space for storage, mooring, energy (wind) and freshwater production and other required infrastructure.



Sea Dipper and Seafisher (invented by J. Baumeister of Griffith University, C.M. Wang, and Y.I. Chu of University of Queensland).

A roadmap has been developed by the Blue Economy CRC to develop these patented and novel offshore fish pen designs, for specific offshore sites identified in Australia and New Zealand. In consultation with the salmon aquaculture and marine engineering companies, the first phase of research will include; establishing the environmental and operational conditions for Australian and New Zealand proposed farming sites; structural and hydrodynamic analysis of the fish pen and mooring systems to quantify the strength, stiffness and stability requirements of the entire system are being met; and engagement across other research programs to inform fish production, site selection, site characterisation, renewable energy production and storage requirements.



Case Studies

CASE STUDY 3

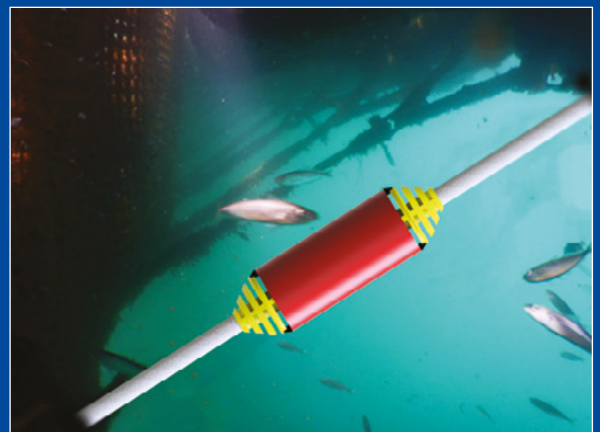
Development of a Prototype Collar-Tie for Floating Fish Pens

The mechanism for attaching fish farming nets to floating pens in the current inshore farming environment was identified at a workshop in 2019 as a critical wear point of the structures in a high energy, offshore farming environment.

The General Project Developing a Robust Collar-Tie (1.20.006) led by University of Queensland with Tassal Group, is focused on improving the resilience of rope-to-rope connections which have been identified as a major wear point in offshore aquaculture structures. The project has focused on the development of a collar-tie replacement, undertaken alongside the collection of sensor data. Typical fish pens vary in size and net material type, with each pen having between 60 and 200 collar-tie assemblies. The project has developed a new, robust, and commercializable product that can be applied to many more components across a range of offshore structures, benefitting the wider marine industries.

The prototype collar-tie eliminates issues with chafing and wear, is robust, cost-efficient, and easy to fit. The new collar-tie design has surpassed the 100kN (10 tonne) breaking load limit. The design has also several other key features which are unique on the market.

- △ Completely metal-free (does not use any shackles)
- △ Capable of transferring close to 100% of the breaking strain of the rope
- △ Easy to assemble and disassemble without tools (even after the ultimate load test, the assembly could be disassembled within seconds and without any tools or force)
- △ All components apart from the rope ends can be re-used/recycled
- △ Streamlined design
- △ Concept can be adopted to other rope types and diameters
- △ Design and prototype injection moulding process can be applied to other connections can be made using the same concept



CAD image superimposed on the existing collar-tie installation (not to scale).

Tassal Group's Head of Aquaculture, Mark Asman said the findings of the project would play a significant role in the company's farming operations in some of the roughest waters on Earth. "With the salmon industry moving further offshore there is a real need to ensure we can keep our equipment where it's needed for the long term. Not only is this important for protecting our people and livestock, but also in reducing and hopefully eliminating marine debris."

The prototype is undergoing field-testing on fish pens deployed at Tassal's West of Wedge site and will be further refined into a commercially viable product ready for manufacture.



Risk and Impediments

The Finance Audit and Risk Management Committee (FARM) provides advice to the Board on matters related to financial management and performance, risk management and audit. The FARM is comprised of two Directors (one of whom is the Chair) and an independent member with expertise in risk.

The Board prioritised risk identification and management in FY20-21 with a facilitated workshop. The company has developed a formal strategic and operational risk register that is regularly reviewed by the FARM.

COVID-19 has created significant complications and impediments to the Blue Economy CRC. Travel restrictions have impacted collaborative research across multiple jurisdictions, our ability to collaborate in person with our international Participants and the recruitment of PhD students.

The Blue Economy CRC has made extensive use of video conferencing and virtual events, including our webinar series and a hybrid in-person/virtual three-day Participants Meeting. It has structured its research program to account for limited opportunities for field-based research and travel. The Blue Economy CRC has also worked with our Participants and others to assist international students enrol in PhD Programs with our Participating Universities.

COVID-19 has impacted some Participants, ability to meet their financial and in-kind obligations. The Blue Economy CRC has worked with these Participants to defer their contributions for up to a year and then review their payment schedule. The total of Participant contributions deferred represents less than 10% of the Blue Economy CRC budgeted revenue.





Risks and Impediments

As reported in the FY2019-2020 Annual Report a significant risk emerged during the negotiation of the Participants Agreement. Several potential Participants chose to not participate in the Blue Economy CRC and several other Participants chose to reduce their level of contribution from that committed during the bid process. The net effect of these withdrawals and lowered contributions was to reduce the total aggregate contributions, inclusive of the Australian Government grant, from \$329 million to \$227 million over the 10-year life of the Blue Economy CRC.

The Blue Economy CRC is continuing to manage this risk by actively seeking additional Participant contributions to match the reprofiled commitment of the Australian Government. The Blue Economy CRC has developed the principles and processes for the admission of new Participants and is in late-stage negotiations with several new Participants to join the Blue Economy CRC. In addition, the Blue Economy CRC is attracting additional Project funds for specific Projects. The Blue Economy CRC is currently on a positive trend to meet the contribution target.

A further risk has been the relatively slow utilisation of in-kind commitments to the Blue Economy CRC. The Blue Economy CRC is focused on ensuring that the BECRC's in-kind commitments are effectively captured and recorded and has upgraded the Connect platform to improve ease and functionality of in-kind reporting for Participants.

The total cumulative Participant in-kind contribution to the end of FY2020-2021 is significantly less than budgeted. It is the CRC's expectation that Participants will make up this shortfall over the coming years as Projects come online.

The slow expenditure of in-kind is due to the delayed start to the Blue Economy CRC's larger research projects with the first projects not commissioned until 9 months into the life of the CRC,

the onset of COVID-19 which necessitated in running virtual and desk-based projects for much of 2020, and the limited travel and resource-intensive laboratory and field-based research. The low in-kind usage is consistent with the CRC's cash balance which has accumulated over this period.

Recognising this, the ability of projects to utilise in-kind Blue Economy CRC resources is a key criterion in the design and commissioning of new Projects. The target is that each Project being currently commissioned is to achieve an in-kind to cash ratio of approximately three to one. Achieving this will ensure that our in-kind commitments are being utilised in proportion to our cash and will realise the expenditure of our current in-kind 'balance' over the coming three years.

As outlined above, the nature of the first two years of research was not conducive to significant in-kind usage. The commencement of research with significant offshore fieldwork, the commissioning of the Blue Economy CRC's hydrogen infrastructure and ensuring a strong in-kind contribution to each commissioned project will accelerate the use of both staff and non-staff in kind.

Blue Economy CRC has started the development of a new strategic initiative to provide Participants with dashboards that allow them to easily manage their contribution over time. The easy access to this information will allow Participants to monitor and deploy their contributions where they matter most to have a positive impact on the goals they are trying to achieve.

Overall, while the Blue Economy CRC's activity has been challenged by COVID-19 and the Participant contribution shortfall, these risks are being managed appropriately and the Blue Economy CRC remains on track to deliver on the program.





Research Programs

Professor Irene Penesis - *Research Director*
Blue Economy CRC



RESEARCH

To achieve its purpose, the Blue Economy CRC's activities focus on five interconnected Research Programs; Offshore Engineering and Technology, Seafood and Marine Products, Offshore Renewable Energy Systems, Environment and Ecosystems, and Sustainable Offshore Developments, developed through dialogue with industry and other Participants. Combined, these programs will deliver the knowledge to enable current and new industries to increase seafood and renewable energy production. This includes developing technologies and production systems that can withstand both regular and extreme weather events, while being safely and economically managed. It will deliver the knowledge to underpin new planning, regulatory and monitoring systems that encourage and support sustainable capital-intensive operations while giving the community confidence that the operations will be environmentally sustainable and socially responsible. Our research is focused on our Partners' needs, is environmentally and socially responsible, and will have a demonstrable commercial impact.

The Blue Economy CRC has made significant progress in 2020-2021 towards reaching our research objectives.

The Blue Economy CRC completed 19 Projects and engaged deeply with its 40 industry, research and government participants to understand their objectives and priorities, and the current state-of-play for the industry (<https://blueeconomycrc.com.au/past-projects>). These were expertly guided and developed collaboratively with Participants by the Research Executive. These projects have helped solidify collaborative relationships between and across researchers and end-users within the CRC, to ensure that our industry partner's needs and challenges have been captured.

The Blue Economy CRC has prepared a single document – the Research Synthesis Report: Scoping Study Projects 2020. A Proposed Research Agenda for the Blue Economy CRC. March 2021 – which presents a synthesis of the outputs of the scoping studies, compiling prioritised research challenges into a single multi-disciplinary industry-focused research program. This was a significant body of work and a critical step towards meeting our mission and highlights the work of the Blue Economy CRC in addressing national and international priorities. The Blue Economy CRC's overarching research and development (R&D) plan (next page) captures the short-, medium and long-term R&D opportunities which are described in more detail in the five research program roadmaps.

There are currently 9 Projects underway on renewable energy, fish pen infrastructure, environmental monitoring, risks and opportunities, and ethics values and social licence in the blue economy, see <https://blueeconomycrc.com.au/projects>. Progress undertaken in these projects has been provided in the Research Program updates below.

These projects are a solid beginning, to be complemented by others already underway and staged into the future to shape the overall research agenda. A warm thanks to all our Participants, Research Executive Team, Scientific Advisory Committee and Board for their resolve to work collaboratively to develop the Blue Economy CRC's future research agenda.



SHORT TERM — MEDIUM TERM — LONG TERM





The Blue Economy CRC's research program has been developed through an iterative dialogue with industry and government to ensure it is focused on the challenges faced by industries in achieving scale and commercial success in the offshore environment. Key activities are focused around five integrated user-defined research programs developed through iterative dialogue with industry:



Program 1: Offshore Engineering and Technology	Program 2: Seafood and Marine Products	Program 3: Offshore Renewable Energy Systems	Program 4: Environment and Ecosystems	Program 5: Sustainable Offshore Developments
Provides engineering solutions that create healthy aquaculture growing conditions that use the latest technologies for construction, installation, automation, monitoring and maintenance of offshore infrastructure.	Developing innovative aquaculture systems to provide solutions in animal and plant husbandry and feed design.	Developing and testing marine renewable devices suited to offshore conditions that support energy export and storage to support aquaculture and other sectors, remote islands and communities and on-grid generation.	Delivering innovative solutions for modelling and monitoring to understand the environmental impacts of new offshore developments.	Creating new 'fit for purpose' policies, regulatory instruments and sustainable business development and commercialisation models.

Sofar Ocean wave buoy provides real-time ocean condition data from the designated wave energy site near Seal Island King George Sound, Albany.





RESEARCH PROGRAM 1

Offshore Engineering and Technology



The Offshore Engineering and Technology program will design stand-alone, integrated offshore aquaculture and renewable energy infrastructure. It brings together industrial engineering expertise to collaborate with the aquaculture and offshore renewable energy sectors to build the required infrastructure for integrated offshore operations and supported by a new generation of supply and service vessels/vehicles that can be powered by green energy such as green hydrogen as an alternative marine fuel. Intellectual Property will emerge in the design of sea-pen infrastructure, support systems for safe operation (e.g., anchoring devices), innovative maintenance technologies (e.g., anti-corrosive or antifouling devices), and monitoring (e.g., advanced materials for longevity and structural reliability; inbuilt sensors in composite materials to detect failure in offshore platforms). Commercial prototypes will be developed for monitoring and maintenance using robotics, artificial intelligence, integrated sensors, and real-time visualisation.

PROGRAM LEADER

Professor Chien Ming Wang

University of Queensland



DEPUTY PROGRAM LEADER

Dr Nagi Abdussamie

Australian Maritime College,
University of Tasmania



RP1 Roadmap Description

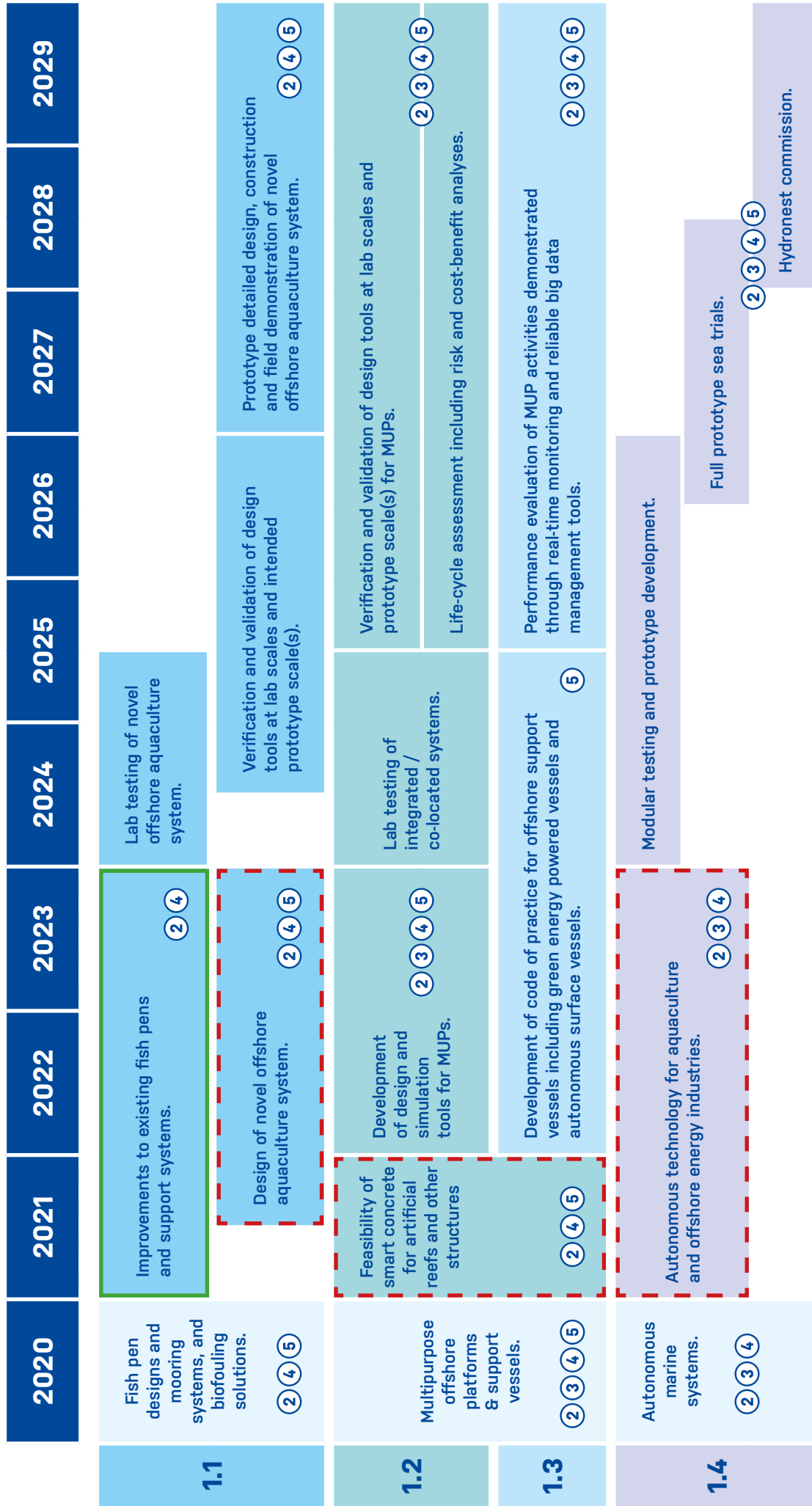
The Offshore Engineering and Technology roadmap contains key projects for short-, medium- and long-term research activities, linkages with other RPs research, and cross-cutting research projects. The roadmap shows the pathway in meeting the Commonwealth Milestones to deliver improved and novel offshore aquaculture farm designs that are supported by remote and autonomous technologies for operation and maintenance to improve the safety of workers and assets. Moreover, multipurpose platforms will be designed to be in close proximity to the fish farms to support renewable energy production and storage plants, store feedstock and equipment. Such a synergetic co-location of an aquaculture farm and energy system facility will create a step change production of seafood and renewable energy productions in sterile offshore sites in Australia and New Zealand. Offshore Engineering and Technology program aims to develop risk mitigation measures by providing autonomous service and maintenance devices, operational guidelines and procedures as well as best practices, high fidelity design tools for the offshore infrastructure that can operate in harsher environment and seek new solutions to decarbonise the blue economy through the use of green energy such as green hydrogen as an alternative marine fuel for the infrastructure systems and support vessels. Program activities work towards successful demonstrations over the 10-year timeframe of the CRC. The later phase of the roadmap remains less defined, allowing flexibility as the program grows within a rapidly evolving research landscape.





RP1 ROADMAP

Started Priority to get started in 2021 X RP Connections





RP1: Offshore Engineering and Technology

RP1 Highlights and Achievements

In 2020-2021, five Scoping Study projects were completed for Offshore Engineering and Technology program. These addressed:

#1

Identification of Australian regulations and design of vessels and infrastructure necessary to service offshore multi-purpose aquaculture platforms.

#2

Potential role of and improvements to autonomous marine systems (AMS) in delivering safe and financially viable offshore fish farms and renewable systems.

#3

Identification of the research to be undertaken to provide offshore biofouling solutions.

#4

Identification of multi-use floating offshore/high energy platforms and concepts as a corner stone to develop viable infrastructure for Australian waters; and

#5

Assessment of existing inshore fish pens performance and their suitability for offshore applications. Identification of design improvements for both inshore and offshore environments.

The [Aquaculture vessel requirement study \(1.20.001\)](#) identified the gaps to be addressed within the existing regulations, together with the vessel infrastructure requirements, necessary to support future offshore multi-purpose platforms. The Study concluded that notwithstanding the existing National Standard for Commercial Vessels (NSCV) rules can be applied for the future aquaculture vessels, it is not fit for purpose and there is an opportunity to develop a new Standard that better reflects the use of aquaculture vessels in offshore waters. With the relationship developed with the Australian Marine and Safety Authority (AMSA) during this research project, an opportunity exists for the Blue Economy CRC to develop a code of practice specifically for the offshore aquaculture platforms and vessels.

The [Autonomous marine systems at offshore aquaculture and energy sites study \(1.20.002\)](#) focussed on the imperative of developing reliable means for the inspection and maintenance of offshore multi-purpose facilities. Detailed consultation with industry partners revealed a lack of adequate technology to meet operational needs in sensing, command, and control systems (together with precise location-finding). Reduction of risk to people and business was identified as a key concern. The Study found that across all elements of the required technology, the support of the Blue Economy CRC would assist progression to commercially viable solutions. The Study proposed that the Blue Economy CRC targets mid-stage technology development to accelerate the translation of academic research through to scalable solutions.

The [Biofouling challenges and possible solutions study \(1.20.003\)](#) reviewed the serious challenges posed by biofouling for the aquaculture, sensing and monitoring, and marine renewable energy sectors of the blue economy. The increased labour requirements in managing biofouling in offshore areas will increase financial burdens and production inefficiencies across these major industries. Consequently, the development of a targeted and interdisciplinary research and development roadmap will be essential to address this problem. The Study identified an immediate need to develop a simple, robust, and fast biofouling cleaning and collection system, and find possible beneficial uses for the collected organisms.



RP1: Offshore Engineering and Technology

The [Multi-purpose offshore/high energy platforms: concepts and applications study \(1.20.004\)](#) determined that Multi-Purpose Offshore Platforms (MPOPs) can be a viable option for future offshore developments in Australia. However, these installations must be cost-effective, reliable and have a minimal impact on the ecosystem. Currently, there is a strong interest in floating offshore wind development, and hence it opens opportunities to future MPOP projects for both offshore renewable energy and aquaculture industries. The effects of floating offshore wind turbines, in both normal and idle modes, on aquaculture operations require further detailed study. In this respect, the offshore oil and gas industry was identified as a valuable source of experience, data, and engineering standards for the design of reliable MPOPs.

The [Review of fish pen designs and mooring systems study \(1.20.005\)](#) identified the challenges for aquaculture activity in offshore environments and examined fish pen designs in terms of suitability for these locations. This included a review of the mooring systems and anchor foundations utilised for fish pens. The following future research topics were recommended: (1) making aquaculture systems storm proof; (2) co-location of aquaculture and renewable energy farms; (3) developing analysis tools for offshore fish pens; and (4) developing closed containment systems for aquaculture in exposed sites. From the research undertaken in this Study, a novel fish pen design was proposed for further research and development. A patent has been sought to cover this new intellectual property.

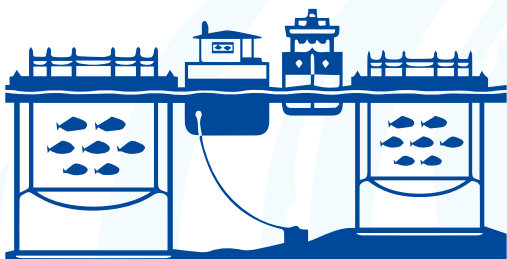
[Developing a robust collar-tie project \(1.20.006\)](#), a 42-month project led by the University of Queensland commenced in early 2020-21. This project is focused on the development of a collar-tie replacement, which has been identified as a wear point in existing aquaculture systems. It has produced a new collar-tie design that has Finite Element Analysis (FEA) validation of withstanding very high forces. The Blue Economy CRC is patenting this novel design (see Case Study 3). The project team includes a PhD student funded by the Blue Economy CRC, also based at the University of Queensland.

The combined research by Offshore Engineering and Technology program across these five Scoping Studies (together with preliminary results from the General Project), was distilled into a research roadmap as part of the Blue Economy CRC's Research Synthesis Report. The roadmap will guide the Program's research for the remainder of the Blue Economy CRC's lifetime.

Looking ahead, a number of other Projects are under active development, aligned with the research direction conveyed in the roadmap. These include a project on generating wave-power from an aquaculture barge, a project to further advance novel fish pen designs, another on the design of more robust systems for feeding farmed species offshore, and a project on autonomous technologies for offshore oyster farming. The development of these (and other) research projects has been informed by both: (i) expert advice from the Research Program Advisory Committee; and (ii) detailed consultation with industry Participants across various sectors.

A PhD scholarship project commenced at the end of 2020-2021, which will examine the use of multispectral imagery to enhance offshore aquaculture operations. The student is based at the University of Queensland. A number of other PhD scholarships have been approved, with the associated students expected to commence during 2021-2022. These PhDs will produce theses on a range of topics, such as the development of MPOPs, improving underwater autonomous devices and the hydrodynamic analysis of fish pen designs.

The team of 1.20.004 project recently published their findings on challenges relating to reliability of MPOPs in the [Journal of Process Safety and Environmental Protection](#). This is the outcome of the close collaboration between colleagues from academia and industry as a part of the Blue Economy CRC scoping study. The team believes that this is just the very beginning and more rigorous research is required for realising the huge potential of MPOPs for the Australian aquaculture and renewable energy industries.





RP1: Offshore Engineering and Technology

Establishment of the RP1 Advisory Committee

The Research Program Advisory Committee (RPAC) for the Offshore Engineering and Technology program is an independent group chosen specifically because of their expertise, knowledge and international networks in this subject area.

- » Professor Torgeir Moan, Emeritus Professor, Norwegian University of Science and Technology, Trondheim, Norway
- » Professor Yuriy Drobyshevski, Founder and Principal Consultant, NavTec Pt Ltd, Australia
- » Dr Kwanghoe Jung, General Manager, Research Technology Centre, Hyundai Engineering and Construction, Korea
- » Dr Maurizio Collu, Reader, Naval Architecture, Ocean and Marine Engineering, University of Strathclyde, Glasgow, United Kingdom
- » Dr José Joaquín Hernández-Brito, CEO of PLOCAN, Canary Islands, Spain

Their purpose is to provide guidance and advice to the Research Program Leadership Team and enhance the global integration of the Blue Economy CRC's research activities.

RP1 Closing Remarks from Program Team

Offshore Engineering and Technology program has developed a systematic approach to provide engineering solutions to complex problems in the aquaculture and energy industries as outlined in the 10-year roadmap of R&D projects. Through a strong collaboration from industry and academia, research teams are proceeding to conduct cutting edge R&D on the next generation standalone offshore fish and seaweed farms; multipurpose platforms for supporting farming operations and maintenance; autonomous marine systems for monitoring, maintaining and risk mitigation; and further research into green hydrogen-powered vessels and floating artificial reefs identified as potential R&D projects in Australia.

The R&D projects being developed to meet the articulated milestones, and build capability and skilled manpower to conduct best-practice research and engineering on Blue Economy CRC commercial priorities. The program will continue to provide the engineering backbone to Blue Economy CRC cross-program projects; ensuring their success in satisfying the objectives and making concepts into reality. The program team recognises the challenges in building infrastructure in energetic offshore sites but researchers, practising engineers and industry personnel are confident in delivering innovative solutions through their ongoing collaboration.





RESEARCH PROGRAM 2

Seafood and Marine Products



The Seafood and Marine Products program will support existing and emerging aquaculture industry in moving offshore and develop offshore aquaculture systems that provide viable and sustainable growth opportunities for this sector. Commercialisation opportunities include novel aquaculture system designs for emerging species in collaboration with the Offshore Engineering program, and new marine products, as well as the development of supply chain aquaculture activities. Identification and development of premium sustainable seafood products for domestic and new export markets will ensure consumer expectations are met.

PROGRAM LEADER

Professor Chris Carter

Institute of Marine and Antarctic Studies,
University of Tasmania



DEPUTY PROGRAM LEADER

Professor Lindsey White

Auckland University
of Technology



RP2 Roadmap Description

This year in the Seafood and Marine Products program, we have built the frameworks and underpinning structures for R&D on production and products. This is because the current status of industry moves into offshore and high energy sites dictates the priority questions for local industry. These are now emerging more clearly and the program is well placed to respond as demonstrated by the transformation of Scoping Projects into General Projects.

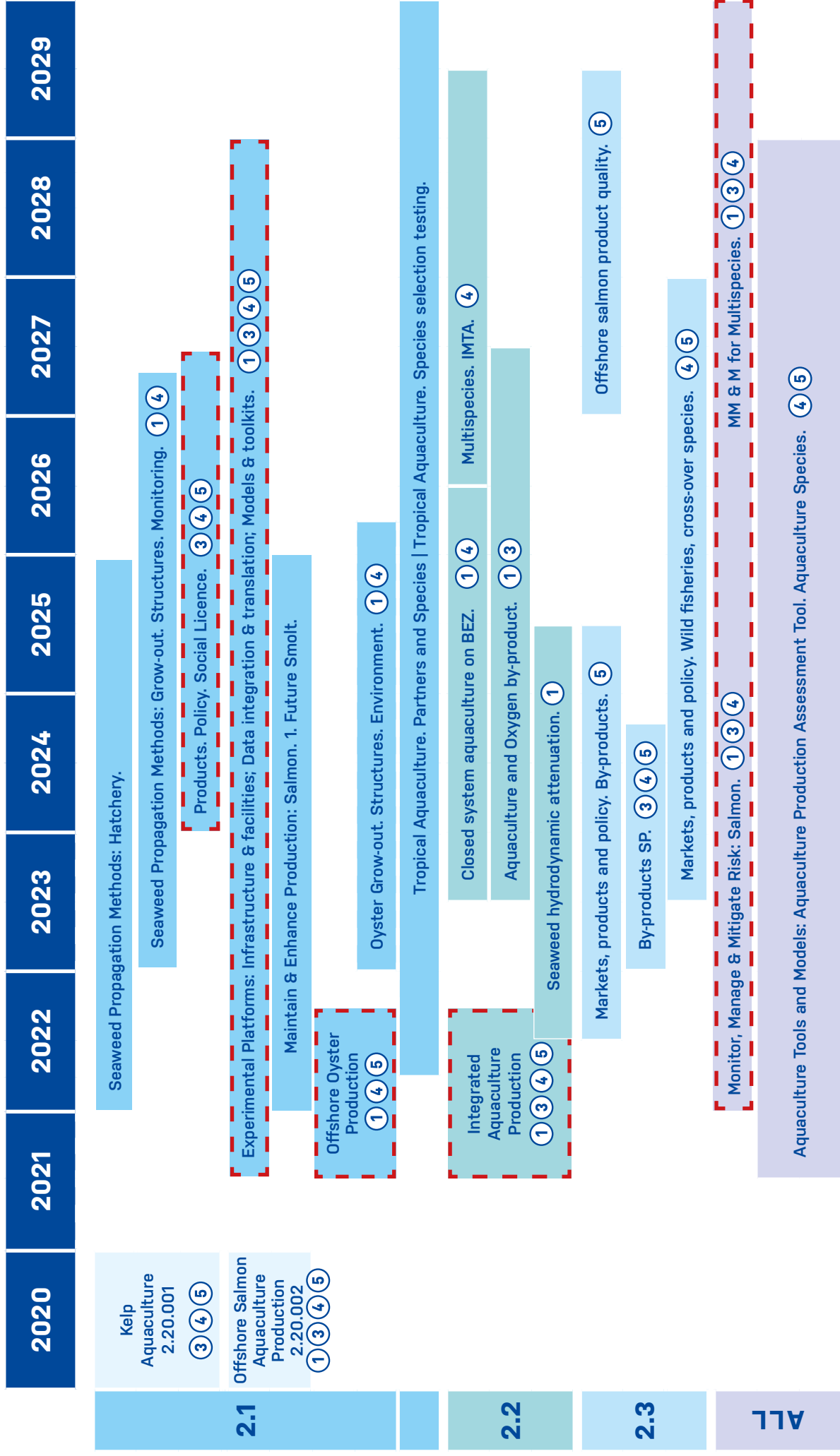
The completed scoping projects provided important information about knowledge gaps to advancing offshore aquaculture in two sectors: established salmon aquaculture and a rapidly emerging opportunity around starting seaweed aquaculture. To achieve similar outcomes, three further scoping projects on oysters, aquaculture integration and pathways to marine products were recognised for development. An oyster aquaculture industry priority is to explore the transition from coastal to offshore deep-water sites. The focus for aquaculture integration will build on the three sector projects to understand how to develop pathways to multi-species and to integrate aquaculture with other CRC activities, particularly renewable energy.

The need for new knowledge on seaweed propagation methods is a priority for the early research in a project that will change emphasis over time to focus on grow-out methods and build on the hatchery outputs. Research priorities to support production identified by the scoping project are currently reflected in progress in several general projects (see below) including advanced approaches to mitigating biosecurity risks, an industry-wide need to understand future smolt production strategies and capability development. To build capability for industry, including complex tasks around translating land-based experimental information to commercial situations, there will be projects based around CRC Post-doctoral Fellows. *Experimental Platforms for Aquaculture Production* considers experimental approach around the research – commercial nexus. Consideration of commercial and existing modelling tools will be done by combining aquaculture production assessment and species selection and build capability in this complex field. As approaches to offshore aquaculture production become clearer the opportunities for marine products will emerge and the final Scoping Project will clarify what the CRC should consider.



RP2 ROADMAP

Started Priority to get started in 2021 X RP Connections





RP2: Seafood and Marine Products

RP2 Highlights and Achievements

In 2020-2021, two Scoping Study Projects were carried out:

#1

Salmon aquaculture in offshore/high energy sites that is sustainable and allows industry a choice about where to farm salmon and a pathway for industry expansion and diversification, and

#2

Sustainable and integrated seafood and marine products that come from multiple species and maximise the efficient capture, use and recycling of energy and key nutrients.

The [Kelp aquaculture scoping study \(2.20.001\)](#) project engaged with industry and other stakeholders to determine priority seaweed species of commercial interest. Three seaweed groups for offshore seaweed aquaculture were identified – *Asparagopsis*, kelps (several species), and *Durvillaea* (bull kelp). In the case of all three groups, there is currently insufficient production to meet market demand. A long-term research program, in two main phases, was recommended to expand production, in offshore facilities. Phase 1 will develop knowledge and capability in basic biology, hatchery and grow-out methods for offshore cultivation (designed for offshore cultivation but developed using inshore sites) and examine how these seaweeds attenuate hydrodynamic forces around offshore structures.

Phase 2 (2026-2029) will transfer knowledge to offshore arrays, with a view to optimising grow-out methods, spatial array designs, infrastructure requirements and hydrodynamic attenuation

The [Key challenges for offshore/high energy salmon aquaculture production \(2.20.002\)](#) study produced a comprehensive assessment of contemporary research and identified critical knowledge gaps in the conduct of salmon aquaculture in offshore/high energy ocean conditions. Through intensive collaboration with the aquaculture industry, the topics for five major research initiatives were identified:

- (1) real-time remote monitoring of fish welfare;
- (2) strategy for smolt production (integrating onshore, inshore, and offshore sites);
- (3) development of analysis tools for both production assessment and species selection;
- (4) devise a breeding strategy, based on appropriate genomic examples; and
- (5) re-develop all elements of growth cycle management, including biotic and abiotic factors.

Several General Projects were under active development during 2020-2021. Considerable progress has been made in advancing partnerships with the Climate Foundation, Southern Ocean Carbon Company and Kelp Blue 42, and we are currently developing several seaweed aquaculture projects that encompass *Durvillaea* spp., *Macrocystis pyrifera* and *Undaria pinnatifida*. Future discussions with the RPAC will refine thinking about designing pathways to achieve integrated aquaculture systems, seaweed aquaculture and recent advances in offshore salmon aquaculture.

A PhD scholarship project commenced at the end of 2020-2021, which will examine the relationships between swimming and long-term changes to physical and chemical characteristics of King (Chinook) salmon. It presents a pre-emptive opportunity to investigate swimming, identified as a key aspect offshore adaptation, and start to address commercial questions including nutrient requirements, feed and feeding management and product quality. The student is based at the Cawthron Institute in Nelson, New Zealand.



RP2: Seafood and Marine Products

Establishment of the RP2 Advisory Committee

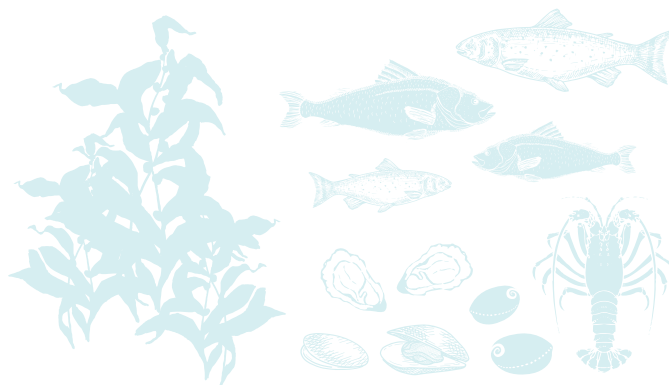
Below is the Research Program Advisory Committee (RPAC) for the Seafood and Marine Products program. The RPAC is an independent group chosen specifically because of their expertise, knowledge and international networks in this subject area. Their purpose is to provide guidance and advice to the Research Program Leadership Team and enhance the global integration of the Blue Economy CRC's research activities.

- » Dr Nikos Papandroulakis, Research Director, Institute of Marine Biology, Hellenic Centre for Marine Research, Anávyssos, Greece
- » Jo Kelly, Chief Executive Officer, Australian Seaweed Institute, Brisbane, Australia
- » Dr Sonia Rey Planellas, Lecturer in Animal Behaviour and Welfare Institute of Aquaculture, University of Stirling, Scotland UK
- » Dr Mari Moren, Director of Research, Norwegian Institute of Food, Fisheries and Aquaculture Research (NOFIMA), Bergen, Norway
- » Prof Bela H. Buck, Head of Unit Marine Aquaculture, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven, Germany

Their purpose is to provide guidance and advice to the Research Program Leadership Team and enhance the global integration of the Blue Economy CRC's research activities.

RP2 Closing Remarks from Program Team

The Seafood and Marine Products program has successfully moved forward in setting up R&D for salmon and seaweed aquaculture. The strategy ensures that R&D is matched with capability building and underpinned by sound approaches and suitable facilities for conducting best-practice research on local commercial priorities. This foundation will support the program's activity as it expands out of temperate areas into other regions and widens the scope to consider multi-species systems and integration. Increasing capability will allow further contributions to cross-program projects as well as continue to build a platform for production biology orientated research and development. We recognise there are challenges around aligning industry progress into offshore high energy sites with R&D projects and with attracting partners for aquaculture in other regions and using different systems including multi-species and Integrated Multi-Trophic Aquaculture (IMTA). We believe RP2 is achieving the goal of having underpinning capability to meet these.





RESEARCH PROGRAM 3

Offshore Renewable Energy Systems



The Offshore Renewable Energy Systems (ORES) program aims to advance the technological and commercial readiness of emerging offshore renewable energy technologies, so they can fulfil their potential to decarbonise offshore industries – including aquaculture – and export energy as electricity and hydrogen. Commercialisation opportunities include the design and development of renewable energy conversion devices; microgrid technologies for producing electricity and hydrogen offshore; optimal solutions for offshore energy storage. In addition to energy production, the ORES program will also focus on essential resources for aquaculture such as freshwater (via desalination) and oxygen (for hatchery and fish culture).

RP3 Roadmap Description

The Offshore Renewable Energy Systems program roadmap highlights research already underway, projects to be considered for short- medium- and long-term research activities, connections with research in other RPs, and cross-cutting research projects. The roadmap outlines a proposed path to meet milestones targeting the development and demonstration of an integrated, off-line offshore renewable energy (ORE) system, while simultaneously seeking to build opportunity and market demand for the program outputs (offshore renewable electricity, displacing diesel and hence reducing emissions in off-grid applications; ORE in grid connected scenarios to increase renewable energy penetration in Australia's electricity system; hybrid energy systems for blue economy applications; and hydrogen, for export opportunities and application in blue economy sectors). Program activities work towards successful demonstrations over the 10-year timeframe of the CRC. The later phase of the roadmap remains less defined, allowing flexibility as the program grows within a rapidly evolving research space.

PROGRAM LEADER

Dr Mark Hemer
CSIRO



DEPUTY PROGRAM LEADER

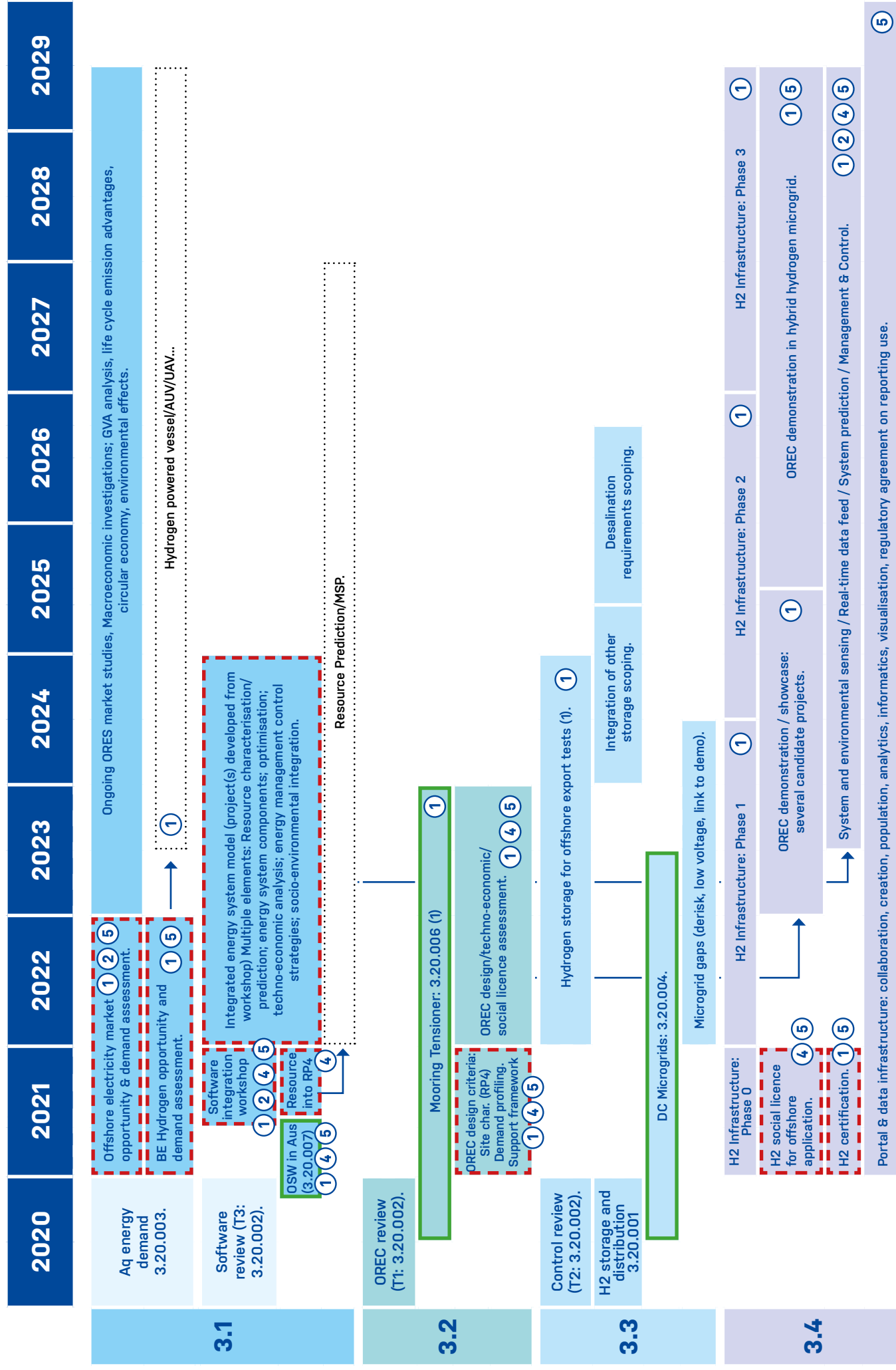
Professor Evan Gray
Griffith University



DEPUTY PROGRAM LEADER

Dr Kosala Gunawardane
Auckland University of Technology







RP3: Offshore Renewable Energy Systems

RP3 Highlights and Achievements

In 2020-2021, four Scoping Study projects were completed for the Offshore Renewable Energy program. These addressed:

#1

Hydrogen storage and distribution technologies and their potential applicability to the Blue Economy CRC and enterprises supported by it, for a range of energy scales;

#2

Existing and proposed offshore renewable energy system concepts to assess their suitability for Australian offshore/high energy conditions and potential end-users;

#3

The energy resource requirements of offshore/high-energy aquaculture systems; and

#4

The potential for developing offshore wind energy in Australia.

The [Hydrogen storage and distribution study \(3.20.001\)](#) considered the technological suitability of particular hydrogen carriers and storage technologies, for deployment to provide power to the Blue Economy CRC's various initiatives. In a collaboration with several major industry partners, the Study focussed on the energy investment needed to store and distribute hydrogen, received and delivered in standard states, and accounting for all steps in the process chain. The Study provides a foundation for further work to assess the economic viability of proposed hydrogen storage and/or distribution methods, by quantifying costs across the entire process chain.

[Offshore/high energy sustainable hybrid power systems \(3.20.002\)](#) was a Study involving a large number of partners across the energy and research sectors. It addressed the numerous challenges associated with employing renewable energy conversion technologies in offshore environments; building hydrogen microgrids that are robust in this environment; and modelling the components of a hydrogen microgrid and the entire energy system. It found that a more market-oriented and coordinated approach across all sectors is necessary to progress this industry in Australia and that a demonstration project of an offshore hydrogen microgrid would provide a strong catalyst for enabling successful cooperation.

The [Offshore/high energy aquaculture systems - energy demand analysis study \(3.20.003\)](#) aimed to address the limited understanding of the energy-intensive resource demands of the aquaculture sector in an offshore/high energy environment. It drew on the advice of three large aquaculture companies, and supplementary in situ monitoring, to undertake a techno-economic energy systems analysis. The Study found that the daily stationary electrical demand for an offshore salmon facility of the minimum feasible size is approximately 6000 kWh/day, with an additional 9000 kWh/day load for vessel transport. It also proposed that, under the scenarios modelled, the optimal technology to provide electricity at lowest cost to the facility would be an off-grid hybrid diesel energy system.

[Offshore wind energy in Australia \(3.20.007\)](#) was a Study of the potential for this source of energy to be pursued on a large scale in Australia, as it is currently in numerous locations internationally. A high-level mapping exercise was used to evaluate the quality of Australia's offshore wind energy resources, investigating 12 suitable locations around the Australian coast that are adjacent to energy infrastructure and demand centres. A comparison of this energy source against onshore wind and solar energy was undertaken to investigate its potential value within Australia's wider electricity market. The technically accessible resource was estimated to be 2,233 GW, far in excess of current and projected Australian electricity demand. The Study made recommendations covering five main themes necessary to develop this industry in Australia, which included government regulation and planning, commercialisation pathways, and skills planning and training to support a workforce transition from fossil fuels-based industries.



RP3: Offshore Renewable Energy Systems

From these Studies, we produced a roadmap for building offshore renewable energy opportunities for Australia. The proposed research activities span the development and support of emerging technologies and markets, for both electricity and hydrogen in the offshore environment. The Offshore Renewable Energy program is supporting significant infrastructure projects with the view to demonstrate technologies and Australian capabilities to supply.

The first General Project to be undertaken is the [DC microgrids for offshore applications \(3.20.004\)](#) project, which commenced in the first Quarter of 2020-2021. It aims to progress the findings of the associated Scoping Study (3.20.002) by examining the barriers to setting up pure-DC microgrids, rather than a DC microgrid coupled with an AC grid connection. The project is currently progressing a bench-scale pure-DC hydrogen microgrid, which will allow experiments necessary to understand and resolve various technical issues. The project team includes a PhD student (with another being recruited), and a full-time postdoctoral research fellow.

The second General Project launched during 2020-2021 was the [Mooring tensioner for WECs – MoTWEC \(3.20.006\)](#) project, led by industry Participant Carnegie Clean Energy Limited. The 'MoTWec' project is tackling the challenge of producing efficient and cost-effective electrical energy through the conversion of wave energy. The project will develop, proof test and demonstrate a novel energy storage element, the Mooring Tensioner, enabling the use of rotary electrical generators for Wave Energy Converters (WEC). The delivered efficiency advantages will significantly enhance the competitiveness of WEC technologies, thereby supporting the supply of low-cost energy to the onshore grid, offshore platforms and aquaculture sites. The Project is currently at the stage of testing the mechanical properties of candidate materials from which the mooring tensioner will be constructed. The project team includes a PhD student, and a full-time postdoctoral research fellow is to be recruited.

Other General Projects under active development for commencement in 2020-2021 include:

- (i) a project to test a scale prototype of a particular wave power generation device offshore at Albany, Western Australia;
- (ii) collaboration with Pacific Northwest National Laboratory (PNNL) to address the International Energy Agency (IEA) – Ocean Energy Systems study on the energy requirements of offshore aquaculture (as a market for ocean energy); and
- (iii) the development of software models for analysing the performance/characteristics of Hydrogen DC Microgrid design.

The development of these (and other) research projects will continue to be informed by both:

- (i) expert advice from the Research Program Advisory Committee; and
- (ii) detailed consultation with industry Participants across various sectors.

While no stand-alone PhD scholarship projects commenced in 2020-2021, funding has been awarded for two such projects expected to begin during 2021-2022. A stipend will be provided for a PhD based at the Auckland University of Technology to investigate control strategies for the energy management of low-voltage DC micro-grids. In addition, a PhD to be based at Griffith University will receive a stipend top-up towards their techno-economic modelling of hydrogen storage and distribution for blue economy industries.





RP3: Offshore Renewable Energy Systems

Establishment of the RP3 Advisory Committee

Below is the Research Program Advisory Committee (RPAC) for the Offshore Renewable Energy Systems program. The RPAC is an independent group chosen specifically because of their expertise, knowledge and international networks in this subject area. Their purpose is to provide guidance and advice to the Research Program Leadership Team and enhance the global integration of the Blue Economy CRC's research activities.

- » Vicky Coy, Head of Innovation Projects, ORE Catapult, UK
- » David Hume, Marine Energy Manager, Pacific Northwest National Laboratory, US
- » Srikanth Narasimalu, Program Director (Renewables: Wind and Marine), National Technical University, Singapore
- » Trond Stromgren, Senior Advisor Renewable Energy and Hydrogen Value Chain / Head R&D, Ocean Hyway Cluster, Norway
- » Miranda Taylor, CEO, National Energy Resources Australia

RP3 Closing Remarks from Program Team

The Offshore Renewable Energy Systems program has outlined a clear roadmap for building offshore renewable energy opportunities for Australia.

The Offshore Renewable Energy Systems program has a broad scope. Research activities span the development and support of emerging technologies and markets, for both electricity and hydrogen in the offshore environment.

The program is supporting significant infrastructure projects with the view to demonstrate technologies and Australian capabilities to supply. The first of these is the Hydrogen Microgrid Demonstration project. These infrastructure-focused activities are balanced by enabling research, strongly connected to other Blue Economy CRC research programs. Recommendations from the Blue Economy CRC Offshore Wind Potential for Australia study are already being implemented across the Australian landscape, and are set to support sustainable growth and investment in a new industrial sector for Australia.





RESEARCH PROGRAM 4

Environment and Ecosystems



The Environment and Ecosystems program will evaluate the environmental footprint of the infrastructure, culture systems and energy generating devices used by offshore industries. The program connects with the Sustainable Offshore Developments program to develop management systems to regulate and monitor environmental impact and interactions of offshore aquaculture and renewable energy with each other and with other marine sectors. Through effective integration and coordination with the Offshore Engineering, Seafood and Marine Products and Offshore Renewable Energy programs novel monitoring systems are being developed to monitor the impacts of the offshore environment on the health, maintenance and performance of species, infrastructure, and devices respectively. Novel monitoring systems will also be developed in parallel, including models and user interfaces to deliver real-time data and information for use by government, industry, and the public. The program will span all the environmental considerations from deployment through operations to decommissioning – specifically spanning from marine spatial planning to site selection, real-time forecasts for maximal operation performance and safety through to evaluating the value of offshore production versus near/onshore alternatives.

PROGRAM LEADER

Dr Beth Fulton
CSIRO



DEPUTY PROGRAM LEADER

Professor Chris Frid
Griffith University



DEPUTY PROGRAM LEADER

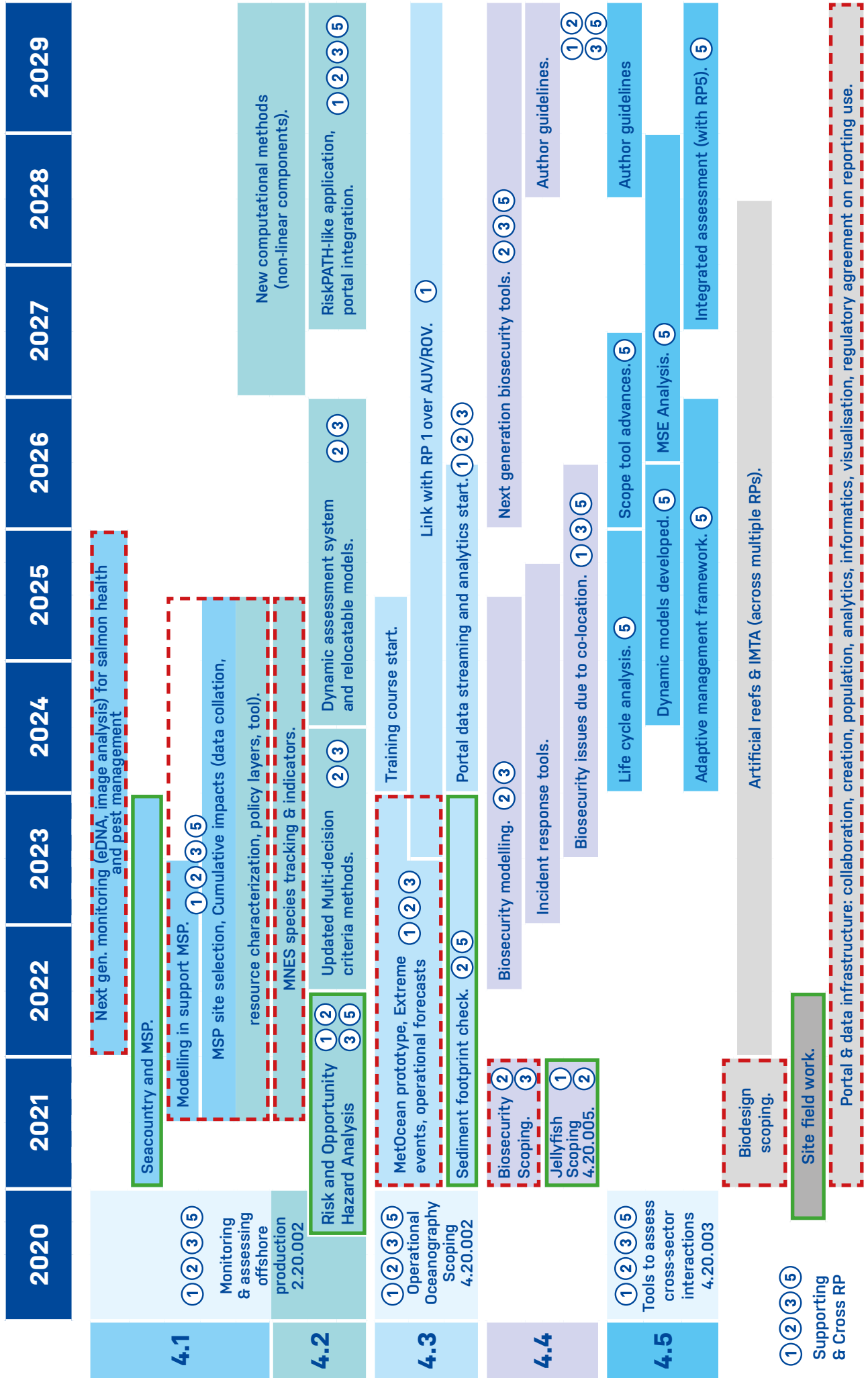
Dr Remo Cossu
University of Queensland



RP4 Roadmap Description

The Environment and Ecosystems program roadmap lays out the progression of work from planning to operations and assessments. The completed scoping studies have identified where regulator and user needs exist around marine spatial planning and site selection in offshore environments (particularly in terms of identifying applicable criteria and setting reasonable monitoring and response triggers); focusing on operational oceanography in support of operations (which demands innovation in forecasts at the scale of weeks-month, something not currently possible); and tools for assessing cross-sector interactions that are dynamic and include the energy and aquaculture sectors (traditionally such tools have only existed for fisheries, with simple maps used for other sectors and planning).

The recommendations from the scoping studies are the basis for a staged roll out of work to contribute to a national marine spatial planning process, develop supporting tools for planning, resource characterisation, site selection and cumulative effects assessments. Supporting digital tools, such as a hazard registry, relocatable models and dynamic assessment tools, are being developed in parallel to support this work and at sea deployments in other research program's (particularly within the Blue Economy Zone). The general direction and timing of biosecurity focused work has also been planned, with details to be resolved once the scoping study for this area is complete. During the mid-years of the Blue Economy CRC work focuses on adaptive management and associated assessment processes, including life cycle analysis. This work will reflect the form(s) of production being supported in the other research programs.





RP4: Environment and Ecosystems

RP4 Highlights and Achievements

In 2020-2021, three Scoping Study projects were completed. These addressed:

#1

Comprehensive and up to date assessment of the 'state of the art' and 'knowledge gaps' associated with the impacts of offshore/high energy aquaculture activities and energy generation on the marine environment;

#2

Identification of Australian aquaculture and energy industry modelling requirements, in terms of products, with a focus on end-user requirements; review of existing models, analysis tools, forecasting systems and emerging AI methods, and identify opportunities for refinement of operational modelling; and

#3

Review of the decision support tools for identifying trade-offs and synergies among emerging blue industries and existing offshore/high energy human activities. By identifying the tools needed to support planning, this proposal will help identify environmental, economic and social wins and help streamline impact assessments for legislative approvals processes.

The early work of the Environment & Ecosystems Research Program has been highly inclusive, with the three Scoping Studies and General Project on risks & opportunities drawing the majority of Blue Economy CRC Partners, whilst providing a voice for some of the smaller Participants. This inclusive approach has given the Program's team a deep appreciation of industry's needs and formed a firm foundation for the roadmap to address these critical research gaps. It has also seen the research program reach out to regulatory bodies around the nation (State and Federal government departments), ensuring any planning products are of maximal benefit to all Australian jurisdictions and marine estate users. The international RPAC and some of the international participants (e.g. DNV GL) have noted that the methods being used are international benchmark setting in scope and vision. This puts Australia well ahead in being sure of the veracity of assumptions associated with offshore production and environmental footprints, as well as having the world's most comprehensive understanding of the multi-dimensional risks and opportunities associated with offshore economic activities.

The [Monitoring and assessing offshore/high energy production structures \(4.20.001\)](#) study considered the challenges of establishing sustainable economic activities in offshore areas and how marine spatial planning and site selection tools could act to stimulate commercial activities, as well as deliver social benefits such as employment opportunities in ways that protected the marine ecosystem. A key finding being that new tailored criteria are needed. Combined with cost-efficient monitoring strategies (which can be adapted as technology evolves or new technology comes online) these provide clarity to developers and other stakeholders and assurances

to society through transparent evidence-based approaches. The key challenge is to deliver solutions that are suitable for assessing environmental impact and satisfy regulatory requirements while adapting as climate change reshapes conditions.

The [Operational modelling for offshore aquaculture & energy \(4.20.002\)](#) study focused on what's required from hydrodynamic modelling to support further sustainable development of offshore production. A key need identified by the project team was for tools that can forecast conditions at scales relevant to the operational deployment of remote sensing platforms (like ROV's) or for knowing when the best window is for getting staff in the water or onto a structure for maintenance or other key tasks. The logistics of operating offshore safely mean that the time needed to mobilise a crew is longer than current, reliable forecasts can achieve. Models that can inform planning in the period 10 days to a few weeks would greatly increase efficiency with operators able to plan safe work programs in a cost-effective manner.

The [Tools to assess cross-sector interactions \(4.20.003\)](#) study concentrated on tools for assessing cross-sector interactions. While many mapping programs exist, there are few if any tools that look at interactions around offshore sectors. Of the tools that do consider trade-offs many are quite difficult to use. In addition, the work highlighted that no one tool will meet everyone's needs and that any tools developed need to balance complexity (to capture the many interacting components) with ease of use and communication – no one can use the information if they can't understand it or access it.



RP4: Environment and Ecosystems

The [Use of image recognition technology to mitigate impacts of marine wildlife on aquaculture \(4.20.005\)](#) study found that a successful prototype jellyfish image detection system demonstrates that a jellyfish alert system could be developed for use by the Tasmanian salmon industry. It is recommended to develop a jellyfish alert system specific to the Tasmanian industry and then expanding the system to become globally relevant by training the network to identify jellyfish in fish pens from other regions of the world.

Representatives of each of the Scoping Study project teams met with the Program's leadership team for a half-day workshop to consider the gaps and opportunities highlighted by the scoping studies and to map out research priorities to build off that understanding and deliver to the milestones.

The first General Project to commence in 2020-2021 was [Risks & opportunities for The blue economy \(4.20.006\)](#) which will deliver an integrative characterisation of risk across all parts of the CRC – engineering and technology, production, energy, sustainability and policy. This project is a partnership involving 17 Blue Economy CRC Participants – the largest of any Blue Economy CRC project to date. After reviewing the international literature on potential hazards, the project team is now turning to the Australian context and a workshop has just been completed involving many CRC participants and several external experts. This workshop laid out how hazards could influence offshore production and what specific aspects need to be considered to make this useful in Australian and New Zealand waters.

General Project [A Novel Approach to Measuring the Depositional Footprint of the Blue Economy \(4.20.004\)](#) is in the early stages of assessing the footprints of offshore farms and whether they leave a long-term signature in offshore sediments. The social license for such a move, however, will rely on our ability to quantify that there is no impact. The team have been undertaking deployment/recovery and operational trials of their Chamber Lander in Queen Charlotte Sound (in New Zealand's

South Island). The team has also installed their new Membrane Inlet Mass Spectrometer (MIMS) for the collection and analysis of seawater. The project has established strong linkages with the aquaculture industry, environmental management authorities and scientists.

The Blue Economy CRC seeks to initiate and facilitate the integration of sustainable mariculture and renewable energy production activities, on behalf of its industry Participants, and the creation of an appropriate framework to establish special marine activity zones - Blue Economy Zones - in Australian waters. The General Project [Baseline Survey of The Blue Economy Zone \(Phase II\) \(4.21.002\)](#) underway is aiming to characterise a marine area for emerging blue economy R&D activities in Bass Strait that can support sustainable offshore aquaculture and renewable energy developments.

The analysis of baseline survey data will provide critical environmental information and early notification of the suitability of the area for aquaculture and renewable energy production platforms and systems. The scientific approaches developed in this project will be transferrable to other potential and appropriate areas around Australia and support marine spatial planning and site selection for future developments offshore.

There were no stand-alone PhD scholarships actually commenced in 2020-2021, but funding has been awarded for three such projects. Two of these scholarships have been awarded and those students are expected to commence studies during 2021-2022, both to be based at Griffith University. A stipend will be provided for a PhD for the project 'Exploiting of filter-feeding bivalves as a natural sampling platform', while another will be funded to research the topic 'An ecosystem based blue economy on Sea Country'. In addition, a PhD scholarship on the ecology of biofouling communities impacting salmon aquaculture has been funded, but selection of the student (to be based at the University of Tasmania) is pending.





RP4: Environment and Ecosystems

Establishment of the RP4 Advisory Committee

Below is the Research Program Advisory Committee (RPAC) for the Environment and Ecosystems program. The RPAC is an independent group chosen specifically because of their expertise, knowledge and international networks in this subject area. Their purpose is to provide guidance and advice to the Research Program Leadership Team and enhance the global integration of the Blue Economy CRC's research activities.

- » Dr Andrea E. Copping, Pacific Northwest National Laboratory (US) and University of Washington, Washington USA
- » Ian Hutchison, Director (Operations), Aquatera Asia Pte Ltd, Orkney, UK
- » Neil Anthony Sims, CEO, Ocean Era LLC Hawaii, USA
- » Professor Simon Thrush, Institute of Marine Science, University of Auckland, NZ
- » Professor Selina Stead, Head, Institute of Aquaculture, University of Stirling, UK

RP4 Closing Remarks from Program Team

Initiating a near-decade-long research program – especially one spanning the diverse domains and interests of the environmental aspects of the Blue Economy CRC – is challenging, even without throwing in a global pandemic to spice up the experience. However, as Roosevelt is reported to have said “a smooth sea never made a skilled sailor” and the need to work closely in such a transformational time has created connections likely not possible otherwise.

The scoping studies have created an exceptionally well advised and firm foundation while initial work in the Blue Economy Zone sees the knowledge, approaches and tools being applied at scale. This all argues well for rapid advances to be made in the coming months and years. All indications are that it will serve Australia well.





RESEARCH PROGRAM 5

Sustainable Offshore Developments



The Sustainable Offshore Developments program will profile, and advocate for, the regulatory frameworks that will provide confidence for the aquaculture and renewable energy industries to invest, while also giving the public confidence that offshore developments operate to the highest environmental standards for sustainability and ecosystem integrity. Strong linkages with the Environment and Ecosystems program in the design of appropriate monitoring and evaluation performance metrics, will support ongoing environmental assessment and health monitoring. Collaboratively with the Offshore Engineering and Technology, Seafood and Marine Products and Renewable Energy Systems programs, this program will evaluate the performance of different aquaculture and offshore renewable energy systems as well as the financial, environmental and societal benefits of co-location and integration of activities across different users and different sectors.

RP5 Roadmap Description

The Sustainable Offshore Developments program provides a sequential and integrated focus to research project development, highlighting core milestones and synergies and across Blue Economy CRC programs. The roadmap builds on research foundations established by the initial scoping studies and the first General Projects and has been shaped by active involvement by a range of Blue Economy CRC Partners. The roadmap highlights the opportunities for ongoing work as data and information emerge from projects in RP 1, 2, 3 and 4. Milestones 5.1 – 5.4 are set to direct research themes and projects for the rest of the Blue Economy CRC. As all programs are inter and cross-linked to achieve the overall goals of the Blue Economy CRC, it is also important to present cross-program linkages shown in the program roadmap (see below). From immediate/short-term to long term plans, all five programs are well cross-connected to deliver core outcomes and values of the Blue Economy CRC. For example, Blue Economy Zone, Marine Spatial Planning and Artificial Reefs Projects are cross-program activities. Sustainable Offshore Developments program also leads First Nations and the blue economy, Environmental Management Accounting and Ocean Account, and Market Analysis to contribute to other programs as well as the Blue Economy CRC.

PROGRAM LEADER

Professor Marcus Haward

Institute of Marine
and Antarctic Studies,
University of Tasmania



DEPUTY PROGRAM LEADER

Dr Leo Dutra

CSIRO



DEPUTY PROGRAM LEADER Associate Professor Ki-Hoon Lee

Griffith University





RP5: Sustainable Offshore Developments

RP5 Highlights and Achievements

In 2020-2021, four Scoping Study projects were completed. These addressed:

#1

Methods for evaluating the economic value and impact of sustainable offshore developments, for both their market and non-market outputs;

#2

A research pathway to integrate blue economy governance arrangements and establish a single integrity-based certification system for these industries;

#3

Blue economy supply chains and the logistics challenges of supplying to an offshore/high energy environment; and

#4

The requirement for establishing a strategic policy and regulatory research agenda for blue economy industries.

The [Economic assessment of blue economy \(5.20.001\)](#) study was predicated on the fact that decision-making and policy formulation for the blue economy must be based on a robust accounting of its outputs. The Study reviewed the wide range of existing economic assessment frameworks for sustainable offshore developments. In the case of market value, the Study proposed that a Satellite Account for the Sea (SAS) is an important tool to represent the contribution of the blue economy to the national economy. Development of the SAS will require the coordination of data sharing across various organisations. There is a clear lack of quantitative research on non-market values in the blue economy, though these are of particular relevance in the marine setting. This is another priority area in the future research program.

The [Integrating blue economy governance integrity research \(5.20.002\)](#) study addressed several key aims of the Blue Economy CRC, including the examination of, and advocacy for, the regulatory frameworks to promote confidence for the aquaculture and renewable energy industries to invest in new offshore developments. In addition, it is essential that such developments are carried out under the highest environmental standards for sustainability and ecosystem integrity. Through numerous interviews and workshops with stakeholders from a range of sectors, critical definitional issues were addressed, together with blue economy values and integrity system features being identified. This process also highlighted the complexities around the certification of blue economy outputs. A future research program was recommended involving three major projects, one of which was commenced in 2020-2021 (as described below).

[Logistics challenges to offshore/high energy co-location of aquaculture & energy industries \(5.20.003\)](#) was a study that began from the fact that development of new and co-located offshore/high energy aquaculture and energy businesses will require an integrated approach to manage their supply chains. This Study developed a general framework for mapping supply chains within the blue economy, including this integrated chain. It also proposed future directions for overcoming logistics challenges and a four-stage program to inform further research in developing an integrated and planned approach to managing supply chains.

The [Developing a policy and regulatory research plan for Australia's emerging blue economy \(5.20.004\)](#) study recognised the importance of a strategic policy and regulatory research agenda to provide appropriate circumstances for the aquaculture and renewable energy sectors to operate in new environments. The project team engaged with Blue Economy CRC stakeholders (industry, government and research providers) through a survey and a focus group, together with a systematic literature review, to develop a research plan designed to address the identified priority areas. The study noted that the Blue Economy CRC is uniquely placed to make a significant contribution to the policy agenda for offshore energy, deep ocean aquaculture and multi-use platforms in Australasia.



RP5: Sustainable Offshore Developments

The Sustainable Offshore Developments program roadmap builds on research foundations established by these Scoping Studies (together with preliminary findings from the two initial General Projects) and has been shaped by the active involvement by a range of Blue Economy CRC Participants and external organisations.

Two General Projects commenced in 2020-2021, the first being [Mapping and analysis of blue economy policy and legislative arrangements \(5.20.007\)](#). This Project, which has arisen from the 5.20.004 Scoping Study, aims to address the need for improved knowledge of the existing policy and legislative arrangements around offshore industrial activities. This is the beginning of a process to ultimately deliver greater certainty as to the conduct of blue economy activities by commercial entities. By using an innovative approach based on computer-generated graphs, this project will deliver:

- (i) a map of the existing policy and legislative arrangements as they relate to blue economy uses, activities and resources;
- (ii) cross-sector analyses to identify gaps and overlaps that may hinder blue economy activities; and
- (iii) a searchable online database of the policy and legislative arrangements in that will assist stakeholders involved in decision-making and planning.

The other General Project started this year was [Ethics, values and social licence in the Blue Economy \(5.20.005\)](#). This project is one of the three larger research initiatives that were recommended by the 5.20.002 Scoping Study and recognises that ethical concerns about the proposed blue economy activities can threaten the social license for their operations. In close collaboration with a number of industry Participants, this project will produce a world-first account of the ethical values at stake in the blue economy. It will provide key outputs that help blue economy-based companies inform funders, Boards and communities to secure the social license to operate in new environments. The project is funded to include a PhD student, and the selected applicant is expected to commence during 2021-2022.

Both of these General Projects conducted online workshops, which have provided opportunities for the broader Blue Economy CRC community to engage with the detail of the topics being researched. More generally, a key feature of the Program's activities during 2020-2021 was interaction with an ever-increasing number of Blue Economy CRC industry Participants, both Australian and overseas-based.

Several other General Projects are being developed for formal submission during 2021-2022. These include projects on:

- (i) blue economy environmental management accounting and integrated reporting; and
- (ii) First Nations and cultural values of the blue economy.

In addition, a Scoping Study on the establishment of artificial reefs (to support benthic eco-systems) is in advanced development.

One stand-alone PhD scholarship commenced in 2020-2021, with the student based at the University of Tasmania to research the topic 'Responses to risk: Blue economy explorations using behavioural economics'. In addition, funding was awarded in 2020-2021 for a PhD scholarship project titled 'Science, technology and decision-making in the blue economy – addressing knowledge gaps'. The selected student, who will also be based at the University of Tasmania, is expected to commence in the first half of 2021-22.





RP5: Sustainable Offshore Developments

Establishment of the RP5 Advisory Committee

Below is the Research Program Advisory Committee (RPAC) for the Sustainable Offshore Developments program. The RPAC is an independent group chosen specifically because of their expertise, knowledge and international networks in this subject area. Their purpose is to provide guidance and advice to the Research Program Leadership Team and enhance the global integration of the Blue Economy CRC's research activities.

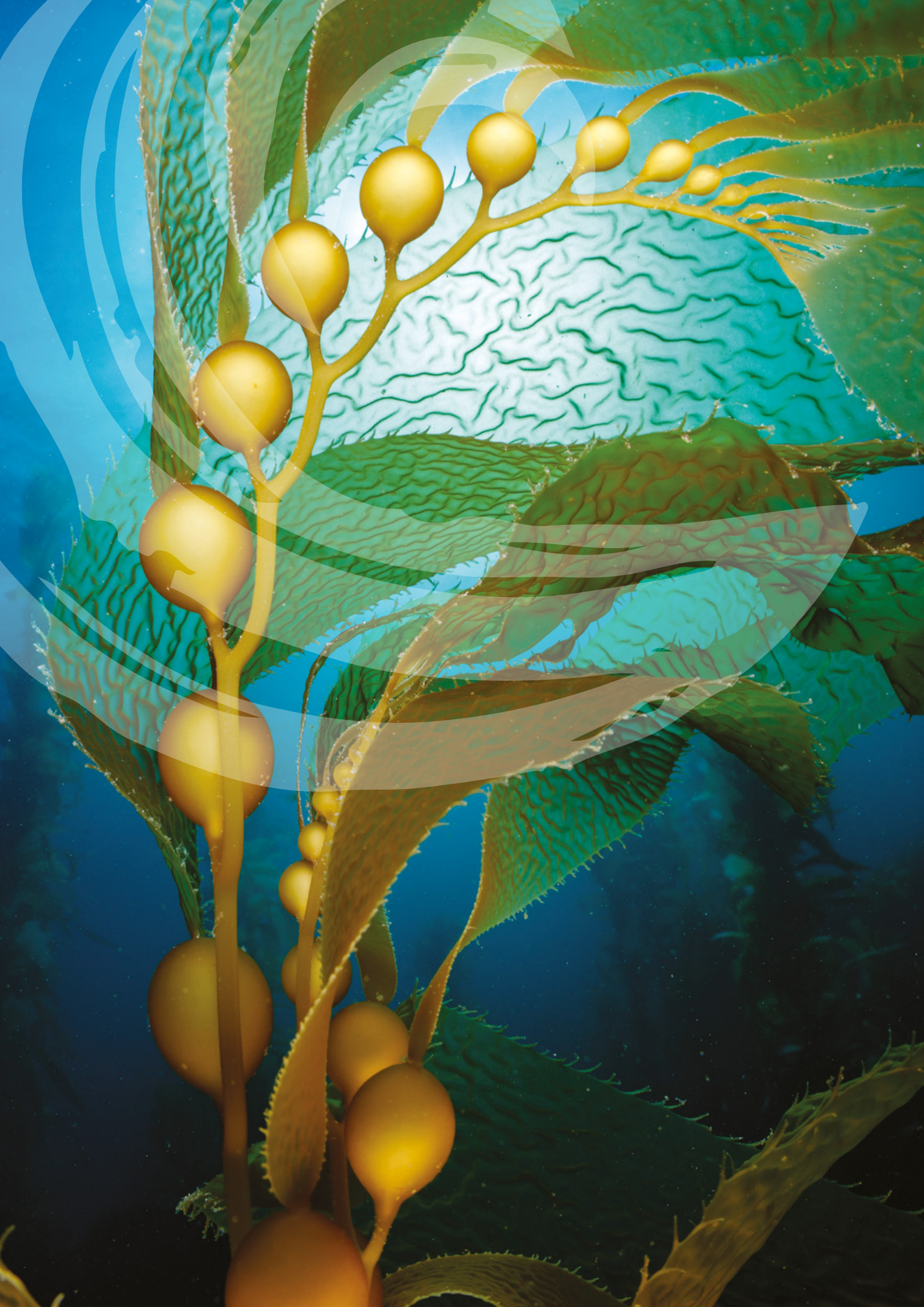
- » Cameron Grebe, Head, Environment Division, NOPSEMA (National Offshore Petroleum Safety and Environmental Management Authority) Australian Government
- » Dr Oliver Thébaud, Director, AMURE - Center for the Law and Economics of the Sea, IFREMER (L'Institut Français de Recherche pour l'Exploitation de la Mer) Université de Bretagne Occidentale Brest, France
- » Professor Tiffany Morrison, ARC Centre of Excellence for Coral Reef Studies, James Cook University

RP5 Closing Remarks from Program Team

The Sustainable Offshore Developments Program has outlined a clear roadmap for the program for the coming years. The work to date has provided a strong foundation for the roadmap and identified key areas for development.

The work on mapping and analysis of blue economy policy and legislative arrangements is already being used by partners. The work on ethics and values highlights the factors underpinning social acceptability of proposed blue economy initiatives into offshore high energy sites. The Sustainable Offshore Developments Program has a broad research scope, key to its success has been to identify collaborative opportunities in projects across the CRC that meet industry partner needs and interests, as well as addressing agreed milestones.







Blue Economy CRC Projects 2020-2021

CURRENT PROJECTS:

For active Projects, Summaries can be found on the Blue Economy CRC website at <https://blueeconomycrc.com.au/projects>.

1.20.006 *Developing a Robust Collar-Tie*

Lead Organisation: The University of Queensland

Project Leader: Michael Heitzmann

Blue Economy CRC Participant Organisations Involved: The University of Queensland, Tassal Group Limited

Project Duration: 36 Months

Project Status: Current



3.20.004 *DC Microgrids for Offshore Applications*

Lead Organisation: Griffith University

Project Leader: Evan Gray

Blue Economy CRC Participant Organisations Involved: Griffith University, Optimal Group Australia Pty Ltd, Pitt & Sherry (Operations) Pty Ltd, University of Tasmania

Project Duration: 36 Months

Project Status: Current



3.20.006 *Mooring Tensioner for WECs - MoTWEC*

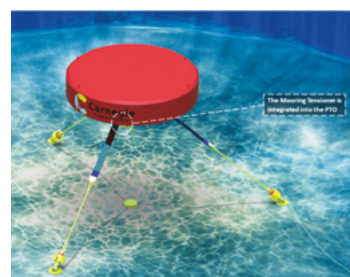
Lead Organisation: Carnegie Clean Energy Limited

Project Leader: Alexandre Pichard

Blue Economy CRC Participant Organisations Involved: Carnegie Clean Energy Limited, Advanced Composite Structures Australia Pty Ltd, Climate-KIC Australia Ltd, The University of Queensland

Project Duration: 36 Months

Project Status: Current





Blue Economy CRC Projects 2020-2021: Current

4.20.004 A Novel Approach to Measuring the Depositional Footprint of the Blue Economy

Lead Organisation: Auckland University of Technology

Project Leader: Kay Vopel

Blue Economy CRC Participant Organisations Involved: CSIRO, Griffith University, The New Zealand King Salmon Pty Ltd, DPIPWE, University of Tasmania, Tassal Group Limited, East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Auckland University of Technology

Project Duration: 36 Months

Project Status: Current



4.20.006 Risks and Opportunities for the Blue Economy

Lead Organisation: Commonwealth Scientific and Industrial Research Organisation (CSIRO)

Project Leader: Beth Fulton

Blue Economy CRC Participant Organisations Involved: The University of Queensland, Huon Aquaculture Company Pty Ltd, Tasmanian Oyster Research Council Limited, DPIPWE, CSIRO, Carnegie Clean Energy Limited, DNV GL Australia Pty limited, University of Tasmania, Griffith University, Macquarie University, BMT Commercial Australia Pty Ltd, SAITEC SA, Pacific Engineering Systems International Pty Limited, Petuna Aquaculture Pty Ltd, The New Zealand King Salmon Pty Limited, Cawthron Institute, Sabella SA, OceanPixel Pte. Ltd

Project Duration: 18 Months

Project Status: Current



5.20.005 Ethics, Values and Social Licence in the Blue Economy

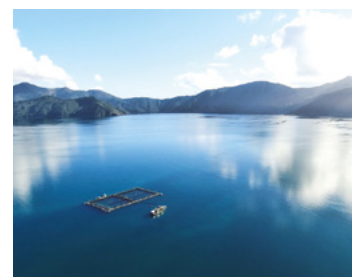
Lead Organisation: Griffith University

Project Leader: Charles Sampford

Blue Economy CRC Participant Organisations Involved: Griffith University, BMT Commercial Australia Pty Ltd, University of Tasmania, Carnegie Clean Energy Limited, The New Zealand King Salmon Pty Limited, Tassal Group Limited, DPIPWE

Project Duration: 36 Months

Project Status: Current





Blue Economy CRC Projects 2020-2021: Current

5.20.007 *Mapping and Analysis of Blue Economy Policy and Legislative Arrangements*

Lead Organisation: The University of Queensland

Project Leader: Pedro Fidelman

Blue Economy CRC Participant Organisations Involved: The University of Queensland, University of Tasmania, BMT Commercial Australia Pty Ltd, DPIPWE

Project Duration: 12 months

Project Status: Current



CRC.20.001 *Developing a Framework for a Blue Economy Zone Economy*

Lead Organisation: University of Tasmania

Project Leader: Philip Marsh

Blue Economy CRC Participant Organisations Involved: University of Tasmania

Project Duration: 5 Months

Project Status: Current



CRC.21.002 *Baseline Survey of the Blue Economy Zone (Phase II)*

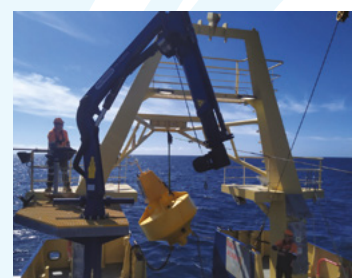
Lead Organisation: The University of Queensland

Project Leader: Remo Cossu

Blue Economy CRC Participant Organisations Involved: The University of Queensland, CSIRO, Tassal Group Limited, Xylem Water Solutions Australia Limited, Griffith University, University of Tasmania

Project Duration: 9 Months

Project Status: Current



CRC.21.002 *Baseline Survey of the Blue Economy*

Blue Economy CRC Projects 2020-2021

COMPLETED PROJECTS:

For completed Projects, Summaries and/or Final Reports can be found on the Blue Economy CRC website at <https://blueeconomycrc.com.au/past-projects>.

1.20.001 *Aquaculture Vessel Requirement Scoping Study*

Lead Organisation: BMT

Project Leader: Chris Shearer

Blue Economy CRC Participant Organisations Involved: BE CRC, BMT, DNV GL Australia Pty Limited, SINTEF OCEAN AS, University of Tasmania

Project Duration: 6 Months

Project Status: Completed



1.20.002 *Autonomous Marine Systems at Offshore Aquaculture and Energy Sites*

Lead Organisation: Australian Maritime College, University of Tasmania

Project Leader: Damien Guihen

Blue Economy CRC Participant Organisations Involved: University of Tasmania, Auckland University of Technology, Cawthron Institute, CSIRO, Griffith University, Tasmania Department of Primary Industries, Parks, Water and Environment, Tassal Group Limited, The University of Queensland, Xylem Water Solutions Australia Limited

Project Duration: 6 Months

Project Status: Completed



1.20.003 *Biofouling Challenges and Possible Solutions*

Lead Organisation: The University of Queensland

Project Leader: Martin Veidt

Blue Economy CRC Participant Organisations Involved: The University of Queensland, Advanced Composite Structures Australia Pty Ltd, Auckland University of Technology, Carnegie Clean Energy Limited, CSIRO, East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Ghent University, Huon Aquaculture Company Pty Ltd, SINTEF OCEAN AS, Tassal Group Limited, University of Tasmania, Xylem Water Solutions Australia Limited

Project Duration: 6 Months

Project Status: Completed





Blue Economy CRC Projects 2020-2021: Completed

1.20.004 *Multi-Purpose Offshore/High Energy Platforms: Concepts and Applications*

Lead Organisation: Australian Maritime College, University of Tasmania

Project Leader: Nagi Abdussamie

Blue Economy CRC Participant Organisations Involved: University of Tasmania, BMT, Cawthorn Institute; CSIRO, DNV GL Australia Pty Limited, Griffith University, Macquarie University, National University of Singapore, The New Zealand Institute for Plant and Food Research Limited, The University of Queensland, University of Western Australia

Project Duration: 6 Months

Project Status: Completed



1.20.005 *Review on Fish Pen Designs and Mooring Systems*

Lead Organisation: The University of Queensland

Project Leader: Chien Ming Wang

Blue Economy CRC Participant Organisations Involved: The University of Queensland, Advanced Composite Structures Australia Pty Ltd, BMT, CSIRO, East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Griffith University, Huon Aquaculture Company Pty Ltd, SINTEF OCEAN AS, Tassal Group Limited, The New Zealand King Salmon Pty Limited, Universidad Austral de Chile, University of Tasmania

Project Duration: 6 Months

Project Status: Completed



2.20.001 *Kelp Aquaculture Scoping Study*

Lead Organisation: Institute of Marine and Antarctic Studies, University of Tasmania

Project Leader: Jeff Wright

Blue Economy CRC Participant Organisations Involved: University of Tasmania, Auckland University of Technology, Australian Abalone Growers Association, Australian Seaweed Institute, Marinova Pty Ltd, Southern Blue Reef Pty Ltd, Tasmanian Oyster Research Council Limited, The University of Queensland, Universidad de los Lagos

Project Duration: 6 Months

Project Status: Completed





Blue Economy CRC Projects 2020-2021: Completed

2.20.002 *Key Challenges for Offshore/High Energy Salmon Aquaculture Production*

Lead Organisation: Institute of Marine and Antarctic Studies, University of Tasmania

Project Leader: Chris Carter

Blue Economy CRC Participant Organisations Involved: University of Tasmania, Auckland University of Technology, Cawthron Institute, CSIRO, Food Innovation Australia Ltd, Gibson's Limited trading as Skretting Australia, Huon Aquaculture Company Pty Ltd, Tasmania Oyster Research Council Limited, Tassal Group Limited, The New Zealand King Salmon Pty Limited

Project Duration: 6 Months

Project Status: Completed



3.20.001 *Hydrogen Storage and Distribution*

Lead Organisation: Griffith University

Project Leader: Evan Gray

Blue Economy CRC Participant Organisations Involved: Griffith University, BOC Australia, CSIRO, Optimal Group Australia Pty Ltd

Project Duration: 6 Months

Project Status: Completed



3.20.002 *Offshore/High Energy Sustainable Hybrid Power Systems*

Lead Organisation: Griffith University

Project Leader: Evan Gray

Blue Economy CRC Participant Organisations Involved: Griffith University, Auckland University of Technology, BMT, Carnegie Clean Energy Limited, Climate-KIC Australia Ltd, CSIRO, ITM Power Pty Ltd, Optimal Group Australia Pty Ltd, Sabella SA, SAITEC SA, University of Tasmania, University of Western Australia

Project Duration: 6 Months

Project Status: Completed





Blue Economy CRC Projects 2020-2021: Completed

3.20.003 *Offshore/High Energy Aquaculture Systems – Energy Demand Analysis*

Lead Organisation: CSIRO

Project Leader: Mark Hemer

Blue Economy CRC Participant Organisations Involved: CSIRO, Energia Marina SpA, Huon Aquaculture Company Pty Ltd, Tasmanian Oyster Research Council Limited, Tassal Group Limited, The New Zealand King Salmon Pty Limited, Universidad Austral de Chile, University of Tasmania

Project Duration: 6 Months

Project Status: Completed



3.20.007 *Offshore Wind Potential for Australia*

Lead Organisation: CSIRO

Project Leader: Mark Hemer

Blue Economy CRC Participant Organisations Involved: CSIRO, SAITEC SA

Third Party Organisations Involved: University of Technology Sydney, Maritime Union of Australia, Electrical Trades Union, Australian Manufacturing Workers' Union

Project Duration: 3 Months

Project Status: Completed



4.20.001 *Monitoring and Assessing Offshore/High Energy Production Structures*

Lead Organisation: Griffith University

Project Leader: Chris Frid

Blue Economy CRC Participant Organisations Involved: Griffith University, BMT, CSIRO, Sabella SA, Tassal Group Limited, The University of Queensland, University of Tasmania, University of Western Australia

Project Duration: 6 Months

Project Status: Completed



4.20.002 *Operational Modelling for Offshore Aquaculture and Energy*

Lead Organisation: CSIRO

Project Leader: Emlyn Jones

Blue Economy CRC Participant Organisations Involved: CSIRO, BMT, Carnegie Clean Energy Limited, Griffith university, Huon Aquaculture Company Pty Ltd, University of Western Australia

Project Duration: 6 Months

Project Status: Completed





Blue Economy CRC Projects 2020-2021: Completed

4.20.003 *Tools to Assess Cross-Sector Interactions*

Lead Organisation: Griffith University

Project Leader: Mischa Turschwell

Blue Economy CRC Participant Organisations Involved: Griffith University, CSIRO, Tasmania Department of Primary Industries, Parks, Water and Environment, Ghent University, University of Tasmania

Project Duration: 6 Months

Project Status: Completed



4.20.005 *Use of Image Recognition Technology to Mitigate Impacts of Marine Wildlife on Aquaculture Australia*

Lead Organisation: Griffith University

Project Leader: Kylie Pitt

Blue Economy CRC Participant Organisations Involved: Huon Aquaculture Company Pty Ltd, Tassal Group Limited, Griffith University, University College Cork – National University of Ireland, Cork

Project Duration: 6 Months

Project Status: Completed



5.20.001 *Economic Assessment of Blue Economy*

Lead Organisation: Australian Maritime College, University of Tasmania

Project Leader: Oanh Nguyen

Blue Economy CRC Participant Organisations Involved: University of Tasmania, Griffith University

Project Duration: 6 Months

Project Status: Completed





Blue Economy CRC Projects 2020-2021: Completed

5.20.002 *Integrating Blue Economy Governance Integrity Research*

Lead Organisation: Griffith University

Project Leader: Charles Sampford

Blue Economy CRC Participant Organisations Involved: Griffith University, BMT, Carnegie Clean Energy Limited, University of Tasmania

Project Duration: 6 Months

Project Status: Completed



5.20.003 *Logistics Challenges to Offshore/High Energy Co-Location of Aquaculture and Energy Industries*

Lead Organisation: Australian Maritime College, University of Tasmania

Project Leader: Peggy Chen

Blue Economy CRC Participant Organisations Involved: University of Tasmania, BMT, Climate-KIC Australia Ltd, Tasmanian Department of Primary Industries, Parks, Water and Environment, Food Innovation Australia Ltd, Griffith University, Tasmania Oyster Research Council Limited, Tassal Group Limited

Project Duration: 6 Months

Project Status: Completed



5.20.004 *Developing a Policy and Regulatory Research Plan for Australia's Emerging Blue Economy*

Lead Organisation: BMT

Project Leader: David Rissik

Blue Economy CRC Participant Organisations Involved: BMT, Climate-KIC Australia Ltd, The University of Queensland, University of Tasmania

Project Duration: 6 Months

Project Status: Completed





Education and Training

Training Courses and Workshops

Developing a workforce for the future blue economy is an integral part of the Blue Economy CRC. The Blue Economy CRC's education and training program provides an unprecedented scale of research opportunities, with fully and co-funded Higher Degree by Research (HDR) PhD scholarships across its five Research Programs. The Blue Economy CRC is an ideal work environment for talented graduates to conduct commercially viable research to tackle the technical challenges facing our blue economy industries and develop detailed cross-disciplinary knowledge.

PhD Scholars Program

PhD Scholars are part of a professional research team solving real industry problems, with access to world-class research facilities. The Blue Economy CRC aims to provide opportunities and funding for postgraduate students to enrich their research experience with short-term placements in relevant organisations, including government, private and university organisations, in both Australia and overseas. PhDs are being linked to industry-driven research topics and students will, as part of their candidacy, they will be embedded with partners to help ensure they are work-ready and are connected to potential employers.

The Blue Economy CRC is aiming to deliver approximately 50 PhD graduates over its lifetime. PhD students are sought through direct expressions of interest, via the Blue Economy CRC website and awarded in either General Projects, or stand-alone research scholarship projects.

The PhD Scholars Program aims to develop and commercialise leading-edge research and produce graduates with hands-on industry experience to help create a highly-skilled workforce. Hence our PhD Scholars have opportunities to develop their industry knowledge and relevance, through additional training and international networking opportunities associated with the Blue Economy CRC.

The call for General Projects at the end of 2019 was the first opportunity for project proposals containing PhD students to be submitted to the Blue Economy CRC for consideration. Through this call, six PhD Scholarships were awarded, with four students having commenced by June 2021. In late 2020, the first funding round specifically for PhD scholarships was launched, with a call to Participants to lodge proposals for PhD projects. By June 2021, funding had been granted to a total of 12 scholarships, including two for stipend top-ups.

In respect to this round, four students were selected and commenced during 2020-2021, while a further five are expected to commence during 2021-2022.

Prior to the launch of the dedicated funding round in 2020, two other stand-alone PhD scholarships were awarded, and the students selected, during 2020-2021. In both cases, the commencement of the scholarship recipients was delayed because of the restrictions on overseas arrivals to Australia due to COVID-19. More generally, COVID-19 has had an impact on the PhD program due to the complications it has added to the selection of students where no suitable local candidates were found. Despite of the pandemic impact, on its third year since inception, 34% of the target of 50 PhD students have been enrolled, and therefore, Blue Economy CRC is on a good position to deliver on its PhD Scholars Program.

A range of measures and programs were developed for the Blue Economy CRC's education and training program that are designed to add value to industry participants and researchers alike. This included options for industry placement of early career researchers, international exchanges of staff and researchers, training opportunities, and an active program of events to provide opportunities for professional development, networking, public outreach and knowledge exchange. These initiatives are expected to gain momentum in 2021-2022, once the current restrictions on interstate and international travel begin to be lifted.

With a focus on industry partner and end-user needs, the Blue Economy CRC will work with partners to deliver a range of targeted and appropriate short (summer) courses and Master Class programs. These will inform industry and government of the latest developments and offer all industry Participants (as with postgraduates) access to undertaking a PhD, placements, field experience, and opportunities to present findings at national and international forums.

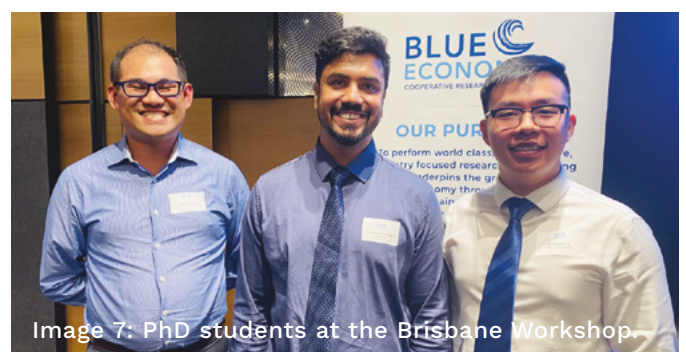


Image 7: PhD students at the Brisbane Workshop.

Education and Training

Table 1: Details of all active PhD Scholars.

Student	Start	Expected Completion	Research Program	Project Title	Host Institution	Supervisory Team	Country of Origin
Akshay Harikumar	2020	2023	1	Developing a robust collar-tie	The University of Queensland (UQ)	Michael Heitzmann (UQ) Martin Viedt (UQ) Brad Evans (Tassal)	India
Neil Salam	2020	2023	3	DC microgrids for offshore applications	Griffith University (GU)	Evan Gray (GU) Junwei Lu (GU) Craig Duggan (Optimal Group) Bob Gregg (Pitt & Sherry)	Malaysia
Yuan Zhen Cai	2021	2024	3	Development of a mechanical tensioner for wave energy harvesting	The University of Queensland (UQ)	Michael Heitzmann (UQ) Martin Viedt (UQ) Rodney Thomson (ACS-A)	China
Aaron Hibberd	2021	2024	4	Investigating Thresholds in the Metabolic Response of Sediment to Organic Enrichment	University of Tasmania (UTAS)	Scott Hadley (UTAS) Jeff Ross (UTAS) Karen Wild-Allen (CSIRO) Joel Cooper (Tassal)	Australia
Mingyuan Ma	2021*	2023	1	Hydrodynamic analysis of offshore fish cages	Griffith University (GU)	Hong Zhang (GU) Dong Jeng (GU) Lex Mulchay (Pacific ESI)	China
Avik Nandy	2021	2024	1	Use of multispectral imagery to enhance aquaculture operations	The University of Queensland (UQ)	Simon Albert (UQ) Alistair Grinham (UQ) Remo Cossu (UQ) Stuart Phinn (UQ) Josh Soutar (Xylem) Ian Duthie (Oysters Tasmania)	Australia
Leteisha Prescott	2021	2025	2	The effects of sustained swimming on long-term changes to Chinook salmon form and composition	University of Tasmania (UTAS)	Chris Carter (UTAS) Jayson Semmens (UTAS) Matt Miller (Cawthron Institute) Jane Symonds (Cawthron Institute)	Australia
Amara Steven	2021	2025	5	Blue economy explorations using behavioural economics	University of Tasmania (UTAS)	Darla Hatton-MacDonald (UTAS) Hanne Nielsen (UTAS) Swee-Hoon Chuah (UTAS) Mary McKay (CSIRO) Stephanie Thornton (AEOG)	Australia

* Top-up for an existing PhD, commenced in 2019.

Intellectual Property Management

The Blue Economy CRC has comprehensive Intellectual Property (IP), data management and security policies and procedures that all Blue Economy CRC staff, the Board, Advisory Committee members and students with a formal association with the Blue Economy CRC, are to follow. This obligation also encompasses project Participants, researchers, program leaders, Participant organisations, third parties and collaborators, and any custodians or managers of data involved in a project or collaborating with the Blue Economy CRC.

The IP Framework provides guidance to the officers of Blue Economy CRC and our research and commercial partners on the management of IP by the Company. The IP framework provides an overview of the management of IP in Blue Economy CRC, and the inter-relationship between IP and data (that will be generated or collected by the Company). The Blue Economy CRC anticipates the creation of datasets which will have the potential to be of national interest/significance. The management and security of data is the subject of the (separate) Blue Economy's Data Management Framework. Our IP principles are consistent with the National Principles of Intellectual Property Management for Publicly Funded Research.

The Blue Economy CRC's constitution and corporate structure (a tax-exempt company limited by guarantee) require the Company to own the IP created in the course of its business. To achieve its Purpose the Company will licence the IP that it creates to its Participants on terms that allows those Participants to effectively utilise the IP in ways that see the benefits reach the CRC's target end-users.

All Blue Economy CRC Project Participants are required to identify and report all pre-existing IP to be used in the project and anticipated IP to be produced, before commencement and execution of the Project Agreement. Project Participants are required to provide updates during the implementation of the project, and at the completion of the project. The company is required to maintain an Agreement Material Register containing all IP created by the Company.

During FY 2020-2021 the Company filed a provisional patent for an offshore fish enclosure concept resulting from Blue Economy CRC Project work. The novel fish pen design is being developed for large-scale commercial fin fish production in open ocean conditions. The inventors are Professor CM Wang, Y Chu, and Professor J Baumeister. A project to further the development of these novel offshore fish pens 'Novel Offshore Fish Farm Design: Phase 1 (Conceptual Development)' (Total Budget \$2.02M, with \$450k Blue Economy CRC cash) is currently under development.

The Company also commenced a provisional patent application for a collar-tie component of traditional fish pens successfully developed through a BECRC Project. The inventors are Dr M Heitzmann, A Harikumar, Dr B Evans and P Heard. This novel approach to connecting the net to the pen collar by joining two ropes with a breaking strain of greater than 10 tonne promises to significantly reduce the maintenance costs and increase the durability of traditional fish pens currently used by our industry participants. It also has significant commercialisation potential beyond aquaculture across a broad range of maritime operations.





CRC Future Plans and Transition Arrangements

The Blue Economy CRC was established as a not-for-profit public company limited by guarantee in July 2019. The Australia Government has provided funding for 10 years, through to 2029. With 8 years to run before the cessation of Commonwealth Grant funding and agreed Participant funding the company has not made firm plans on the CRC's future beyond the current agreements.

The Blue Economy CRC has put in place, through our Constitution and licensing arrangements, processes to manage to ensure that any IP or other surplus assets of the Company are protected and can be transparently distributed, in the event of the Company winding up.

At the Blue Economy CRC's Participants Workshop held in 2021, a spin off company of a previous CRC was invited to present to the Participants about life-beyond the CRC and the lessons learned from transitioning from being a CRC. These lessons have been considered in the management of current Projects and IP protection and licensing and will be further considered as the CRC's future and transition arrangements are considered over the coming two years.

The company's Constitution allows for a for-profit company to be established, wholly owned by the Blue Economy CRC. Consideration is being given to establishing this Company as a vehicle for commercialisation which may endure beyond the current CRC Agreement.



Participants

The Blue Economy CRC has forty Participants as of 30 June 2021.

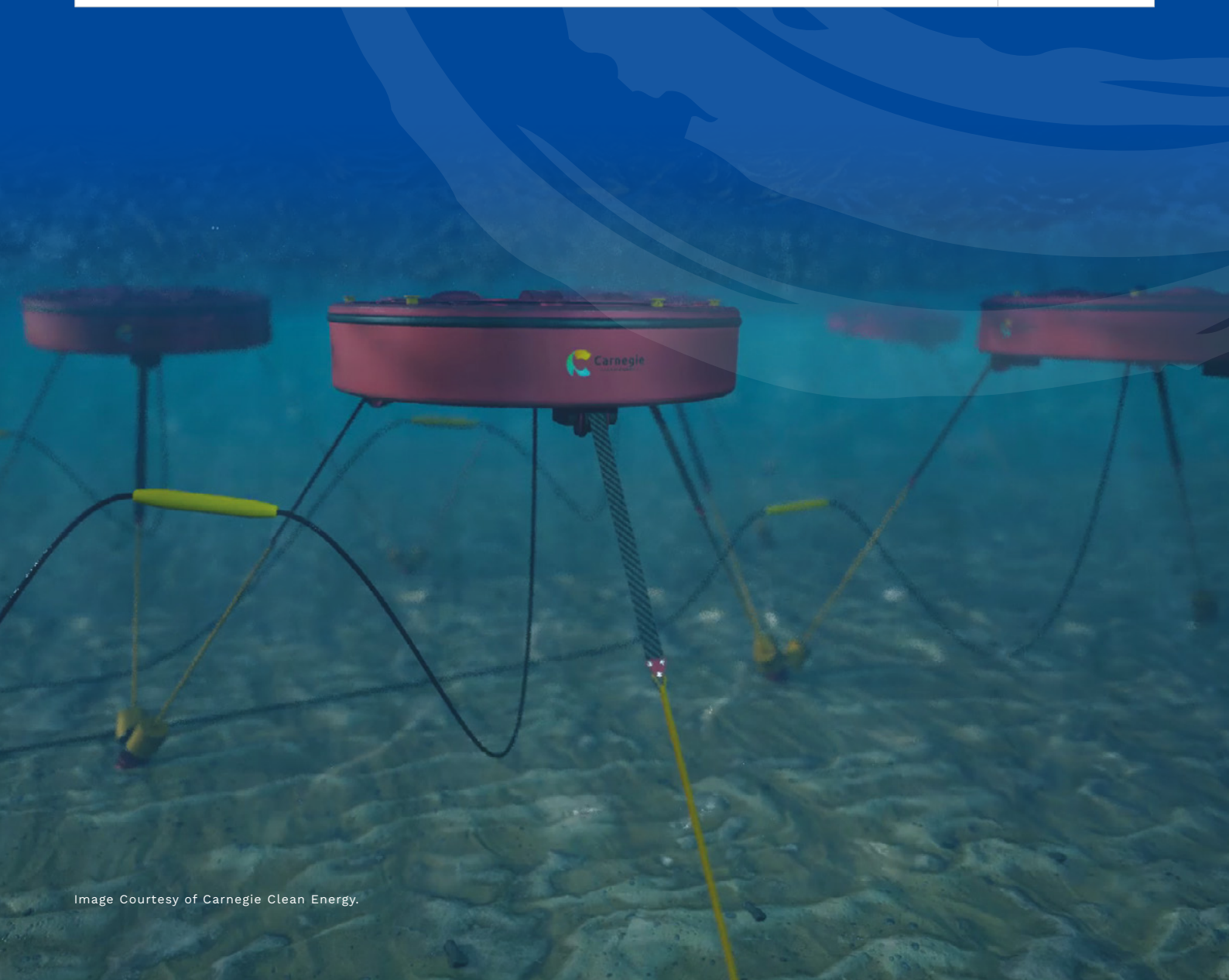
Participant Name	ABN/ACN
Advanced Composite Structures Australia Pty Ltd	15 144 940 876
Auckland University of Technology	N/A
BMT Commercial Australia Pty Ltd	54 010 830 421
Carnegie Clean Energy Limited	69 009 237 736
Cawthron Institute	9429047263277
Climate-KIC Australia Ltd	95 616 047 744
CSIRO (CSIRO)	41 687 119 230
DNV GL Australia Pty Limited	14 154 635 319
Dredging N/A (Australia) Pty Limited (DEME)	44 001 088 197
East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences	N/A
Energia Marina SpA (MERIC)	N/A
Food Innovation Australia Ltd	50 164 124 609
Ghent University	N/A
Gibson's Limited trading as Skretting Australia	23 009 476 064
Griffith University	78 106 094 461
Huon Aquaculture Company Pty Ltd	86 067 386 109
Macquarie University	90 952 801 237
National University of Singapore	N/A
OceanPixel Pte. Ltd.	N/A
Optimal Group Australia Pty Ltd	72 159 359 127
Pacific Engineering Systems N/A Pty Limited	49 002 776 276
Petuna Aquaculture Pty Ltd	62 009 485 581
Pitt & Sherry (Operations) Pty. Ltd.	67 140 184 309
Sabella SA	N/A
SAITEC, SA	42 611 590 017
SINTEF OCEAN AS	N/A
Southern Blue Reef Pty Ltd	65 166 483 861
Tasmanian Department of Primary Industries, Parks, Water and Environment	58 259 330 901
Tasmanian Oyster Research Council Limited	31 050 205 297
Tassal Group Limited	15 106 067 270
Technology Centre for Offshore and Marine, Singapore Ltd.	N/A
The New Zealand Institute for Plant and Food Research Limited	N/A
The New Zealand King Salmon Pty Limited	54 063 201 856
The University of Queensland	63 942 912 684
Universidad Austral de Chile	N/A
University College Cork - National University of Ireland, Cork	N/A
University of Auckland	N/A
University of Tasmania	30 764 374 782
University of Western Australia	37 882 817 280
Xylem Water Solutions Australia Limited	28 000 832 922



Third Parties

The Blue Economy CRC has ten third party participants involved in projects as of 30 June 2021.

Participant Name	ABN/ACN
Australian Abalone Growers Association	98 225 665 336
Australian Seaweed Institute	78 628 082 664
Marinova Pty Ltd	17 103 342 801
Universidad de los Lagos	N/A
BOC Australia	88 003 183 417
University of Technology Sydney	77 257 686 961
Maritime Union of Australia	93 047 659 794
Electrical Trades Union	24 379 005 569
Australian Manufacturing Workers' Union	59 459 725 116
Australian Council of Trade Unions	67 175 982 800





Governance

Board, Committees and Key Staff

The Blue Economy CRC-Co Ltd (ABN 64 634 684 549) is an independent organisation that manages the Blue Economy CRC and is a Company Limited by Guarantee, incorporated in July 2019.

Participants in the CRC are eligible to become company members. At the end of the reporting period, the Blue Economy CRC-Co Ltd had six members. The Blue Economy CRC is registered with the Australian Charities and Not-for-Profits Commission (ACNC) and is income tax exempt. The key legal agreements establishing the Blue Economy CRC-Co Ltd are:

- △ Blue Economy CRC Constitution
- △ CRC Grant Agreement between the Australian Government CRC Program and Blue Economy CRC-Co Ltd
- △ Participants Agreement between all participants and Blue Economy CRC-Co Ltd.

Blue Economy CRC-Co Ltd is governed by an independent skills-based board which is made up of five independent directors, one of whom acts as Chair. The Board provides oversight of the Blue Economy CRC's strategic direction, performance, and activities. The initial Directors (as named in the Blue Economy CRC-Co Ltd Constitution) were nominated and elected by the Participants and remained in office at the end of the reporting period following re-election in June 2020 – some for two-year and some for three-year terms - by the sole member of the Blue Economy CRC-Co Ltd at the time.

There are four sub-committees which are listed overleaf.

Directors

Name	Role	Appointed	Number of Meetings Held While in Office	Number of Meetings Attended
Greg Johannes	Chair	5th July 2019	7	7
Gunilla Burrowes	Director	5th July 2019	7	7
Greg Vickery	Director	5th July 2019	7	7
Rhys Edwards	Director	5th July 2019	7	6
Nick Elliott	Director	5th July 2019	7	7

Financial Audit and Risk Management Committee (FARM)

The purpose of the Finance, Audit and Risk Management (FARM) Committee is to provide advice to the Board of the Blue Economy CRC on issues to do with financial management and performance, risk management and audit. The FARM Committee met on three occasions in 2020-2021.

Name	Role	Organisation
Rhys Edwards	Director, Chair of FARM	See Director Profile
Greg Vickery	Director, Member	See Director Profile
Alicia Leis	Member	Partner, Audit, Assurance & Advisory, WLF Advisory & Accounting

Scientific Advisory Committee (SAC)

The purpose of the Scientific Advisory Committee (SAC) is to provide advice to the Board of Blue Economy CRC-Co Ltd (the Board) in relation to the relevance, scientific rigour, funding and performance of the R&D Projects to be undertaken under the auspices of the Blue Economy CRC. The SAC met on four occasions in 2020-2021.

Name	Role	Organisation
Dr Nick Elliott	Director, Chair of SAC	See Director Profile
Dr Raymond Bannister	Member	Senior Environmental Officer, EPA Tasmania
Dr Nic Bax	Member	Director Marine Biodiversity Hub, CSIRO
Dr Brad Evans	Member	Senior Manager Breeding and Research, Tassal
Dr David Rissik	Member	Head of Business Development, BMT
Dr Maren Wellenreuther	Member	Science Group Leader, Plant and Food Research, The New Zealand Institute for Plant and Food Research
Prof Stewart Frusher	Independent Member	Adjunct Professor, Centre for Marine Socioecology, IMAS-UTAS
Prof Ian MacKinnon	Independent Member	Faculty of Science and Engineering, QUT
Dr Martin Renilson	Independent Member	Director, Renilson Marine Consulting



Participants Advisory Committee (PAC)

The Participants Advisory Committee (PAC) reports directly to the Board and provides advice on matters such as the Blue Economy CRC's overall strategic direction and priorities for participant engagement. The PAC's role includes helping the Blue Economy CRC increase participant engagement and providing market intelligence through networks and industry engagement. The PAC met on two occasions in 2020-2021.

Name	Role	Organisation
Greg Johannes	Director, Chair of PAC	See Director Profile
Prof Mohan Krishnamoorthy	Member (until May 2021)	Pro-Vice-Chancellor (Research Partnerships), The University of Queensland
Terry Bailey	Member	Executive Dean, College of Sciences and Engineering / Executive Director, Institute for Marine and Antarctic Studies, University of Tasmania
Dr ir Margriet Drouillon	Member	Chief Business Officer, The Aqua UGent consortium
Stephanie Thornton	Member	Cluster Manager, Australian Ocean Energy Group
Dr Ian Dutton	Member	Director Marine Resources, The Department of Primary Industries, Parks, Water and Environment
Prof Udaya K. Madawala	Member	Professor Faculty of Engineering, The University of Auckland
Phillipa Ormandy	Member	Business Director, CSIRO
Sue Grau	Member (until June 2021)	CEO, Tasmanian Oyster Research Council Ltd
Jonathan Fiévez	Member	CEO, Carnegie Clean Energy Limited
Mark Asman	Member	Head of Aquaculture, Tassal Group Limited

Communications Advisory Committee (CAC)

The purpose of the Communication Advisory Committee (CAC) is to provide advice to the Board of Blue Economy CRC-Co Ltd (the Board) on issues to do with internal and external communication-related matters to support the effective operation of Blue Economy CRC-Co. The CAC met on three occasions in 2020-2021.

Name	Role	Organisation
Gunilla Burrowes	Director, Chair of CAC	See Director Profile
Vanessa Fairweather	Member	Communications Manager – Blue Economy CRC
Pene Snashall	Member	Corporate Communications & Community Relations Manager – Huon Aquaculture
Nathalie Almonacid	Member	R&D and EMMAP Coordinator - MERIC
Jacque Ray	Member	Petuna Aquaculture (Managing Director - Timmins Ray Public Relations)
Genevieve Worrell	Member	Media and Communications Coordinator - University of Queensland
Angela Williamson	Member	Tassal Senior Manager - People & Communities

Team

Name	Organisation	Role	Time Commitment
Dr John Whittington	Blue Economy CRC	CEO	95%
Prof Irene Penesis	Blue Economy CRC*	Research Director	100%
Jonathon Brown	Blue Economy CRC	Business Manager & Company Secretary	100%
Vanessa Fairweather	Blue Economy CRC**	Communications Manager	Contractor
David Hope	Blue Economy CRC*	Research Executive Officer	100%
Leslie Cowdery	Blue Economy CRC	Research Program Support Officer	100%
Dianne Schwagermann	Blue Economy CRC	Executive Administration Officer	100%

*On secondment from the University of Tasmania

**Contractor

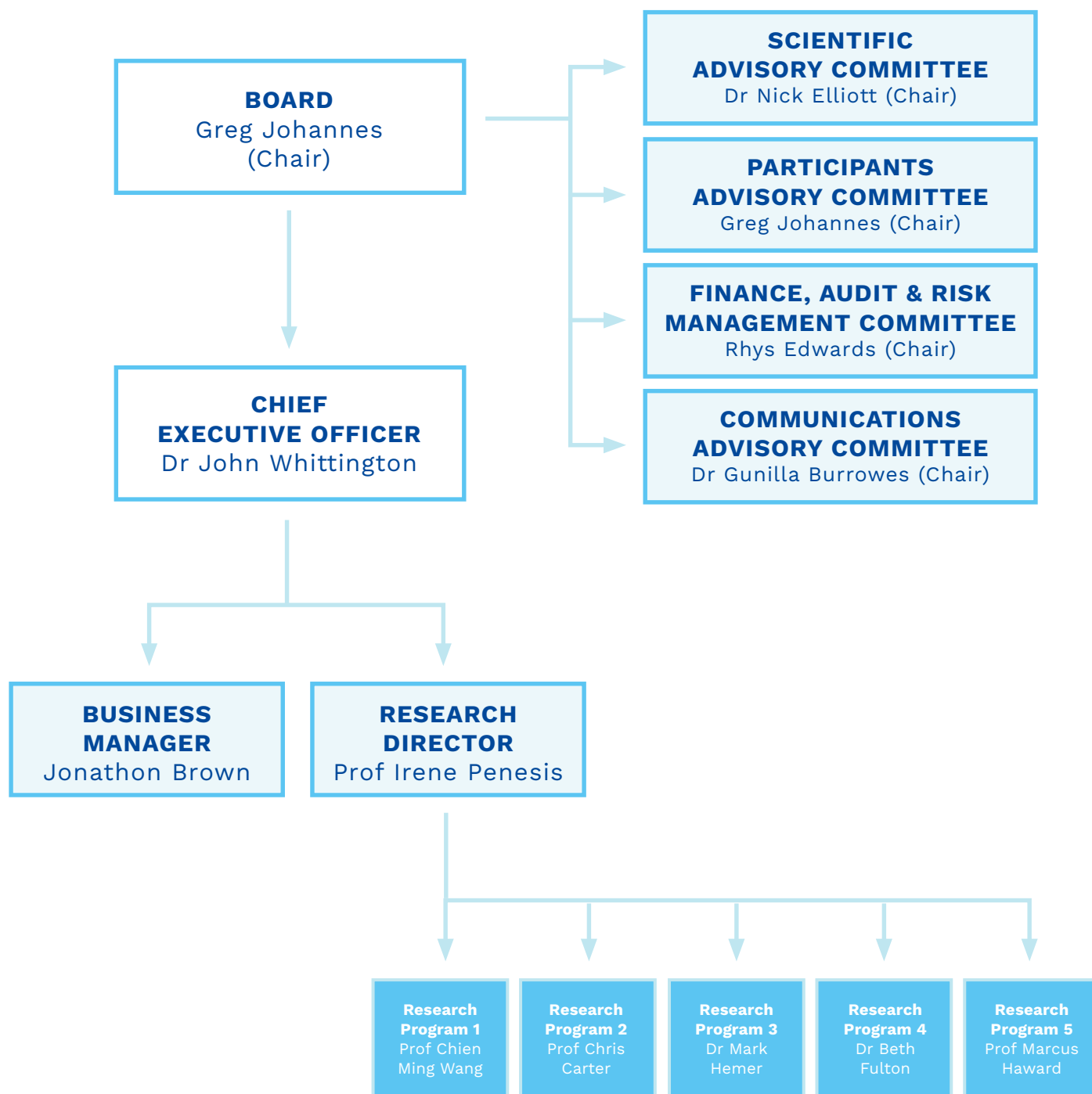


Program Leaders and Deputy Leaders

Name	Organisation	Role	Time Commitment
Prof Chien Ming Wang	University of Queensland	Research Program 1 - Leader	60%
Dr Nagi Abdussamie	University of Tasmania	Research Program 1 - Deputy Leader	40%
Prof Chris Carter	University of Tasmania	Research Program 2 - Leader	60%
Prof Lindsey White	Auckland University of Technology	Research Program 2 - Deputy Leader	40%
Dr Mark Hemer	CSIRO	Research Program 3 - Leader	60%
Prof Evan Gray	Griffith University	Research Program 3 - Deputy Leader	40%
Dr Kosala Gunawardane	Auckland University of Technology	Research Program 3 - Deputy Leader	20%
Dr Beth Fulton	CSIRO	Research Program 4 - Leader	60%
Dr Remo Cossu	The University of Queensland	Research Program 4 - Deputy Leader	20%
Prof Chris Frid	Griffith University	Research Program 4 - Deputy Leader	20%
Prof Marcus Haward	University of Tasmania	Research Program 5 - Leader	60%
Assoc Prof Ki-Hoon Lee	Griffith University	Research Program 5 - Deputy Leader	20%
Dr Leo Dutra	CSIRO	Research Program 5 - Deputy Leader	20%



Blue Economy CRC Organisational Chart





Australian Government
Department of Industry, Science,
Energy and Resources

AusIndustry
Cooperative Research
Centres Program

Blue Economy CRC-Co Ltd
ACN 634 684 549

Financial Report for the period 1 July 2020 to 30 June 2021



Contents

2	Directors Report
7	Independence Declaration
8	Statement of Profit or Loss
9	Statement of Financial Position
10	Statement of Cash Flows
11	Statement of Movements in Equity
12	Notes to the Financial Statements
24	Directors Declaration
25	Independent Auditor's Report



Directors' Report

Blue Economy CRC-Co Ltd

For the year ended 30 June 2021

The Directors of Blue Economy CRC-Co Limited ("the Company") present their report, together with the financial statements of the entity for the period 1 July 2020 to 30 June 2021 and the Independent Audit Report.

Directors details

The following persons were Directors of the company during the whole period since incorporation up to the date of this report:

Greg Johannes	(Appointed 5 July 2019)
Gunilla Burrowes	(Appointed 5 July 2019)
Greg Vickery	(Appointed 5 July 2019)
Rhys Edwards	(Appointed 5 July 2019)
Nick Elliott	(Appointed 5 July 2019)

Objectives

To undertake the principal activities the Company draws together the knowledge, skills and experience of 40 Participant organisations from industry, research and government, based around Australia and internationally.

The Company's short-term objectives are to:

- Continue to develop and implement an industry led research portfolio with a network of Participants, from research, industry, and government;
- Implement a Higher Degree by Research Education Program to support the development of a trained workforce for the future;
- Coordinate Participant cash and in-kind contributions together with funding from the Australian Government to undertake the research and training activities and commercialise the outcomes of research.

The Company's long-term objective is to perform world class, collaborative, industry focused research and training that underpins the growth of Australia's Blue Economy through increased offshore sustainable seafood production and renewable energy.



Strategy for achieving the objectives

To achieve these objectives, the Company is undertaking research and training across five research programs consistent with our Research Road Maps:

Program 1: Offshore Engineering & Technology

Provides engineering solutions for aquaculture and renewable energy that use the latest technologies for construction, installation, automation, monitoring and maintenance of offshore infrastructure.

Program 2: Seafood & Marine Products

Developing innovative offshore aquaculture systems to provide solutions in animal and plant husbandry and feed design.

Program 3: Offshore Renewable Energy Systems

Developing and testing marine renewable energy devices suited to offshore conditions that support energy export and storage to support aquaculture and other sectors, remote islands and communities and on-grid generation.

Program 4: Environment & Ecosystems

Delivering innovative solutions for modelling and monitoring to understand the environmental impacts of new offshore developments.

Program 5 Sustainable Offshore Developments

Creating new fit for purpose policies and regulatory instruments and sustainable business development and commercialisation models.

Principal activities

The principal activity of the Company during the course of the financial year was the administration of the Blue Economy Cooperative Research Centre. There were no significant changes in the nature of the activities for the Blue Economy CRC-Co during the year.

Performance measures

The company's principal obligations arise from CRC Grant Agreement 20180101 between the Blue Economy CRC and the Commonwealth Government. The Blue Economy CRC delivers these obligations by developing and undertaking projects whose outputs contribute to meeting the contracted milestones. The company has developed software-based systems to track progress towards meeting milestones.

Meetings of Directors

During the financial year, 7 meetings of directors were held. Attendances by each director were as follows:

Directors Meetings

	Number eligible to attend	Number attended
Greg Johannes	7	7
Gunilla Burrowes	7	7
Greg Vickery	7	7
Rhys Edwards	7	6
Nick Elliott	7	7



Information on directors

Name: Greg Johannes

Title: Chair of the Board

Qualifications: BA (Hons)

Experience and expertise: Greg Johannes has more than 20 years of leadership experience in the Australian public, private, not-for-profit and research sectors. His roles have included being Head of the State Service and Secretary of the Department of Premier and Cabinet in Tasmania.

In 2015 he was made a National Fellow of the Institute of Public Administration Australia for his outstanding contribution to the public sector in Australia over many years. Greg has a deep interest in the marine science community and has previously been on the boards of both the Antarctic Climate and Ecosystems CRC and the Institute for Marine and Antarctic Studies.

He now runs his own consulting company, helping boards, CEOs and senior managers and leaders address complex development and organisational issues.

Special responsibilities: Chair of the Participants Advisory Committee

Name: Gunilla Burrowes

Title: Board Director

Qualifications: BE (Elec), MPhil, PhD & GAICD

Experience and expertise: An electrical engineer with a broad range of industry and academic experience, Gunilla is passionate about innovation, entrepreneurship, technology commercialisation and improving diversity and inclusion in the workplace. She has a Master of Philosophy in Engineering Education and a Doctorate in Underwater Swarm Sensor Networks.

In 2000, she founded an underwater tech company, BlueZone Group with her husband which now has two offices in Newcastle and Perth. Gunilla is also co-founder of a consultancy, Gender Matters that advises organisations on gender equity and has a unique approach to mitigating cognitive bias in decision-making.

Gunilla is the inaugural Chair of Eighteen04 (an inspirational co-working and incubator space for companies scaling in the clean tech and smart city area) and inaugural board member of Hunter iF project (an open consortium of leading organisations in the Hunter to support the growing startup ecosystem in the region). She is a member of the Hunter Angels and has been an Angel investor for over 10 years. Gunilla is also a member of the SmartCrete CRC Board. She has been a National Vice President of Engineers Australia, awarded an Honorary Fellow of Engineers Australia in 2017 and invited as a Fellow of the Australian Academy of Technology and Engineering in 2019.

Special responsibilities: Chair of the Communications Advisory Committee

Name: Greg Vickery AO

Title: Board Director

Qualifications: BA/LLB (UQ), Grad Dip Dispute Resolution (Bond Uni) and FAICD

Experience and expertise: Greg Vickery is an experienced company and commercial lawyer and company director based in Brisbane. Graduating in Law from the University of Queensland he was for 40 years a partner of the firm now known as Norton Rose Fulbright at which he is now a part time consultant. He is a Fellow of the Australian Institute of Company Directors and is currently a director of several companies including Burrells Stockbroking P/L and Australia & International Holdings Ltd. He has previously been a director of several companies including Ergon Energy Retail, Queensland Energy Resources and Russo Higher Education P/L. He has previously been President of the Qld Law Society and chaired its Legal Education Committee for many years. He is currently Chair of the Law Council of Australia's Business & Human Rights Committee as well as being a member of its Integrity Committee. He was for many years a member of Federal Treasury's Companies and Markets Advisory Committee (CAMAQ). He was for 7 years the Honorary Consul in Queensland for the Republic of Indonesia and he remains an



active member of the Australia Indonesia Business Council. He is a qualified and experienced commercial mediator. He has for over 40 years been an active Red Cross volunteer, working mainly in the areas of fund raising and governance. He was for 8 years the national President of Australian Red Cross, for 6 years a member of the Governing Board of the International Red Cross & Red Crescent Societies and for 8 years an elected member of the prestigious International Standing Commission of Red Cross & Red Crescent Societies (including 4 years as its Chair). In 2001 he became a member of the Order of Australia (AM) for services to law and legal education. In 2013 he was made an Officer of the Order of Australia (AO) for his governance and leadership of international humanitarian organisations.

Special responsibilities: Member of the Finance, Audit & Risk Management Committee

Name: Dr Nick Elliott

Title: Board Director

Qualifications: BSc (Hons), PhD

Experience and expertise: Dr Nick Elliott has extensive marine and aquaculture research and industry knowledge, experience and achievements built through his 33-year career at CSIRO. He is internationally recognised for his research leadership, education and management. A PhD graduate from the University of Tasmania his research experience has included biomonitoring of heavy metals, genetics applied to fisheries, and the application of genetics, physiology, and innovative technologies to advance aquaculture production. His vision and leadership resulted in the internationally recognised selective breeding team at CSIRO, as well as collaborative innovative research in biotags and opportunities for industry expansion offshore. Nick has co-supervised over 15 post-graduate students and mentored many careers. His mission is to continue to see the transformation of the Australian aquaculture sector through collaborative research and education and is committed to the use and integration of rapidly advancing technologies. Nick brings abundant knowledge of aquaculture and research management to the Board, including over 10 years on the Tasmanian Fisheries Research Advisory Board

Special responsibilities: Chair of the Scientific Advisory Committee

Name: Rhys Edwards

Title: Board Director

Qualifications: B.Ec (Hons), MSc. Comparative Social Research

Experience and expertise: Rhys Edwards is the principal of RDME Consulting a boutique consulting firm working with governments, universities, and the private sector.

Rhys is an experienced organisational leader having worked at the highest levels of the public sector including six years as Secretary of the Department of Premier and Cabinet in Tasmania. He has a strong background in governance, leadership, economic development, innovation, and major project facilitation.

Rhys is an honorary senior research fellow at Melbourne University, a moderator for the Cranlana Centre for Ethical Leadership, a fellow of the Australian Institute of Company Directors and a Salzburg Global Fellow.

Rhys enjoys working with clients at the intersection of government, education, social enterprise, and the private sector to create new models for change and growth.

Special responsibilities: Chair of the Finance, Audit & Risk Management Committee



Company Secretary

Jonathon Brown BBus

Jonathon Brown has held the role of company secretary since 29 January 2020. Jonathon also acts as the Business Manager of the Company. Jonathon has held several senior executive positions across various industries in both Australia and New Zealand. Prior to joining Blue Economy CRC Co Ltd Jonathon held the position of General Manager & previously Financial Controller & Company Secretary with co-operative hospitality company, Edgewater Resort in New Zealand.

Jonathon holds a Bachelor of Business from the University of Tasmania and has over 10 years' experience in business management, finance and advisory, having worked for KPMG and a number of global hospitality & vacation exchange companies across Australia and New Zealand.

Contributions on winding up

In the event of the company being wound up, ordinary members are required to contribute a maximum of \$10 each. At 30 June 2021 the total amount that members of the Company are liable to contribute if the Company is wound up is \$10.

Auditor's Independence Declaration

A copy of the Auditor's Independence Declaration for the period ended 30 June 2021 is included in this financial report and forms part of the Directors' Report.

Signed in accordance with a resolution of the Board of Directors.

Chair, Blue Economy CRC-Co Ltd

Director, Blue Economy CRC-Co Ltd

Dated this 25th day of Oct 2021



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Australia

DECLARATION OF INDEPENDENCE BY DAVID PALMER TO THE DIRECTORS OF BLUE ECONOMY CRC-CO LTD.

As lead auditor of Blue Economy CRC-Co Ltd. for the year ended 30 June 2021, I declare that, to the best of my knowledge and belief, there have been:

1. No contraventions of the auditor independence requirements of section 60-40 of the *Australian Charities and Not-for-profit Commission Act 2012* in relation to the audit; and
2. No contraventions of any applicable code of professional conduct in relation to the audit.

DAVID E PALMER
Partner

BDO Audit (TAS)

Hobart, 27 October 2021



Statement of Profit or Loss

Blue Economy CRC-Co Ltd

For the year ended 30 June 2021

	NOTES	2021	2020
Funding & Program Revenue			
Funding & Program Revenue	13	6,907,607	2,877,949
Total Funding & Program Revenue		6,907,607	2,877,949
Other Revenue			
Interest Income		7,214	-
Government Cash Flow Boost Subsidy		100,000	-
Total Other Revenue		107,214	-
Total Revenue		7,014,821	2,877,949
Expenditure			
Consulting & Legal Fees		153,421	388,589
Depreciation & Amortisation Expense		11,046	160
Directors Fees		157,534	155,251
Employee Benefit Expense		673,319	256,170
Finance Fees		18,648	1,840
General Administration		164,663	153,098
Marketing & Communications		63,255	25,788
Research & Development Expenditure		5,619,281	1,864,423
Travel		46,440	32,630
Total Expenditure		6,907,607	2,877,949
Net Surplus / (Deficit) for the year		107,214	-



Statement of Financial Position

Blue Economy CRC-Co Ltd

As at 30 June 2021

	NOTES	30 JUN 2021	30 JUN 2020
Assets			
Current Assets			
Cash and Cash Equivalents	3	4,126,654	1,356,495
Financial Assets	5	2,000,000	2,000,000
Other Current Assets	7	1,259,131	1,269,091
Trade and Other Receivables	4	633,150	614,000
Total Current Assets		8,018,935	5,239,586
Non-Current Assets			
Property, Plant & Equipment	6	1,989,351	13,767
Total Non-Current Assets		1,989,351	13,767
Total Assets		10,008,286	5,253,353
Liabilities			
Current Liabilities			
Deferred Revenue	12	7,302,338	4,350,998
GST Payable		98,970	255,506
Lease Liability	11	45,221	-
Other Current Liabilities	10	-	5,834
Provisions	8	35,504	32,603
Trade and Other Payables	9	491,034	608,412
Total Current Liabilities		7,973,067	5,253,353
Non-Current Liabilities			
Lease Liability	11	1,928,004	-
Total Non-Current Liabilities		1,928,004	-
Total Liabilities		9,901,071	5,253,353
Net Assets		107,214	-
Accumulated Funds			
Surplus / (Deficit) for the year		107,214	-
Balance at end of year		107,214	-



Statement of Cash Flows

Blue Economy CRC-Co Ltd

For the year ended 30 June 2021

	NOTES	2021	2020
Operating Activities			
Receipts From Grants & Participants		10,779,758	7,292,627
Payments to Suppliers & Employees		(8,003,409)	(3,922,205)
Interest received		7,214	-
Net Cash Flows from Operating Activities		2,783,564	3,370,422
Investing Activities			
Payment for Property, Plant & Equipment	6	(13,405)	(13,927)
Payment for Investments	5	-	(2,000,000)
Net Cash Flows from Investing Activities		(13,405)	(2,013,927)
Net Cash Flows		2,770,159	1,356,495
Cash and Cash Equivalents			
Cash and cash equivalents at beginning of period		1,356,495	-
Net change in cash for period		2,770,159	1,356,495
Cash and cash equivalents at end of period		4,126,654	1,356,495



Statement of Movements in Equity

Blue Economy CRC-Co Ltd

For the year ended 30 June 2021

	2021	2020
Equity		
Opening Balance - Accumulated Funds	-	-
Increases		
Surplus for the Period	107,214	-
Total Increases	107,214	-
Closing Balance - Accumulated Funds	107,214	-
Total Equity	107,214	-



Notes to the Financial Statements

Blue Economy CRC-Co Ltd

For the year ended 30 June 2021

1. General Information

(i) Basis of Preparation

These general purpose financial statements have been prepared in accordance with the Corporations Act 2001, Australian Accounting Standards and other authoritative pronouncements issued by the Australian Accounting Standards Board (AASB), and comply with other requirements of the law.

The presentation currency used in these financial statements is Australian dollars (\$). Amounts in these financial statements are stated in Australian dollars unless otherwise noted.

(ii) Overview of requirements on transition to AASB 1060 – Early Adoption

The directors have elected to Apply AASB 1060 General Purpose Financial Statements – *Simplified Disclosures for For-Profit and Not-for-Profit Tier 2 Entities* prior to its mandatory effective date (annual reporting periods beginning on or after 1 July 2021). As a result of the early application of AASB 1060, these financial statements have been prepared in accordance with Australian Accounting Standards – Simplified Disclosures.

The entity previously prepared general purpose financial statements under Tier 2 – Reduced Disclosure Requirements. There were no transition adjustments other than a few disclosure changes on the adoption of Australian Accounting Standards – Simplified Disclosures (however there are some unrelated prior year adjustments outlined in note 14). As the entity is a not-for-profit entity, there are no reliefs available upon early adoption.

2. Summary of Significant Accounting Policies

(a) Cash and Cash Equivalents

Cash and Cash Equivalents in the Statement of Financial Position comprise cash at bank and in hand and short-term deposits with an original maturity of three months or less. For the purposes of the statement of Cash Flows, cash and cash equivalents consist of cash and cash equivalents as defined above, net of outstanding bank overdrafts.

(b) Receivables

Trade receivables are initially recognised at fair value and subsequently measured at amortised cost using the effective interest method, less any allowance for expected credit losses. Trade receivables are generally due for settlement within 30 days.

The company has applied the simplified approach to measuring expected credit losses, which uses a lifetime expected loss allowance. To measure the expected credit losses, trade receivables have been grouped based on days overdue.

Other receivables are recognised at amortised cost, less any allowance for expected credit losses.

(c) Property, Plant & Equipment

All classes of property, plant and equipment are measured on the cost basis and are therefore carried at cost less accumulated depreciation and any accumulated impairment losses. Cost includes expenditure that is directly attributable to the acquisition of the item.

The method of depreciation and the depreciation rate is used as follows:

Furniture and Computer Equipment – Straight Line Method at 30% - 50%

Computer Software –Diminishing Value 67%



Fitout – Straight Line Method over the remaining life of the lease

Gains and losses on disposals are determined by comparing proceeds with the carrying amount. These gains or losses are recognised in profit or loss in the period in which they arise.

(d) Revenue Recognition

Revenue comprises revenue from government grants, cash and in-kind contributions from Participants. Revenue from major products and services is shown in Note 13.

Revenue is measured by reference to the fair value of consideration received or receivable by the Company for goods supplied and services provided, excluding sales taxes, rebates, and trade discounts.

Revenue is recognised when the amount of revenue can be measured reliably, collection is probable, the costs incurred or to be incurred can be measured reliably, and when the criteria for each for the Company's different activities have been met. Details of the activity-specific recognition criteria are described below.

(i) Government Grants

The Company's operations are supported by federal government grant funding.

If sufficiently specific conditions are attached to a grant which must be satisfied before the Company is eligible to receive the contribution, recognition of the grant as revenue is deferred until those conditions are satisfied.

Where a grant is received on the condition that specific services are performed, revenue is recognised as services are performed and at period end a liability is recognised until the service is delivered.

Revenue that is not subject to conditions is recognised when the Company obtains control of the funds, economic benefits are probable and the amount can be measured reliably. The revenue is recognised on cash receipts basis. Where a grant may be required to be repaid if certain conditions are not satisfied, a liability is recognised at period end to the extent that conditions remain unsatisfied.

Where the Company receives a contribution of an asset from a government or other party for no or nominal consideration, the asset is recognised at fair value and a corresponding amount of revenue is recognised.

(ii) Cash Contributions Received from Participants

Income arising from participant cash contributions received is recognised as deferred revenue on receipt and revenue is recognised as services are performed in accordance with the project agreements. At period end a liability is recognised to the extent that conditions remain unsatisfied.

(iii) In-Kind Contributions

The Company has not elected to bring in-kind contributions to account in the financial statements, which is allowed as a policy choice under AASB 1058. Additional disclosures in relation to in-kind contributions received during the financial year are included at note 19.

(iv) Gifts and Donations

Gifts and donations received that do not create enforceable rights and performance obligations are recognised as revenue on receipt.

(v) Interest Revenue

Interest revenue is recognised using the effective interest rate method. It includes the amortisation of any discount or premium.



(e) Trade and Other Payables

Trade and other payables are recognised when the company becomes obliged to make future payments resulting from the purchase of goods and services. The amounts are unsecured and paid within 30 days of recognition

(f) Impairment

At each reporting date the company reviews the carrying amounts of assets to determine whether there is any indication that those assets have suffered an impairment loss. If any such indication exists, the recoverable amount of the asset is estimated in order to determine the extent of the impairment loss if any. The recoverable amount is assessed as the higher of fair value less costs to sell or the assets value in use being the depreciated replacement cost.

(g) Goods and Services Tax

Revenue, expenses and assets are recognised net of the amount of goods and services tax (GST) except:

1. Where the amount of GST incurred is not recoverable from the taxation authority, it is recognised as part of the cost of acquisition of an asset or as part of an item of expense, or
2. For receivables and payables which are recognised inclusive of GST, the net amount of GST recoverable from, or payable to the taxation authority is included as part of receivables or payables in the Statement of Financial Position. Receivables and payables are stated with the amount of GST included.

(h) Provisions

Provisions are recognised when the company has a present obligation (legal, equitable or constructive) as a result of a present or past event, it is probable that an outflow of resources embodying economic benefits will be required to settle the obligation and a reliable estimate can be made of the amount of the obligation.

The amount recognised as a provision is the best estimate of the consideration required to settle the present obligation at reporting date.

(i) Leases

The company recognises a right-of-use asset and a lease liability at the lease commencement date. The right-of-use asset is initially measured at cost, which comprises the initial amount of the lease liability adjusted for any lease payments made at or before the commencement date, plus any initial direct costs incurred and an estimate of costs to dismantle and remove the underlying asset or to restore the underlying asset or the site on which it is located, less any lease incentives received.

The right-of-use asset is subsequently depreciated using the straight-line method from the date the asset becomes available for use to the earlier of the end of the useful life of the right-of-use asset or the end of the lease term. The estimated useful lives of right-of-use assets are determined on the same basis as those of property and equipment. In addition, the right-of-use asset is periodically reduced by impairment losses, if any, and adjusted for certain re-measurements of the lease liability.

The lease liability is initially measured at the present value of the lease payments that are not paid at the commencement date, discounted using the interest rate implicit in the lease or if that rate cannot be readily determined, the company's incremental borrowing rate. Generally, the company uses its incremental borrowing rate as the discount rate.

Lease payments included in the measurement of the lease liability comprise of the following:

- Fixed payments; including in-substance fixed payments;
- Variable lease payments that depend on an index or a rate, initially measured using the index or rate as at the commencement date;
- Amounts expected to be payable under a residual value guarantee; and
- The exercise price under a purchase option that the company is reasonably certain to exercise and extension option, and penalties for early termination of a lease unless the company is reasonably certain not to terminate early.



The lease liability is measured at amortised cost using the effective interest method. It is remeasured when there is a change in future lease payments arising from a change in an index or rate, if there is a change in the company's estimate of the amount expected to be payable under a residual value guarantee, or if the company changes its assessment of whether it will exercise a purchase, extension or termination option.

When the lease liability is remeasured this way, a corresponding adjustment is made to the carrying amount of the right-of-use asset or is recorded in profit or loss if the carrying amount of the right-of-use asset has been reduced to zero.

(j) Income Taxes

The company is charitable organisation under Subdivision 50-B of the Income Tax Assessment Act 1997, Division 176 of a New Tax System (Goods and Services Tax) Act 1999 and section 123E of the Fringe Benefits Tax Assessment Act 1986.

The company is exempt from income tax and therefore no provision for income tax is made in these financial statements.

(k) Financial Assets and Financial Liabilities

Financial assets and financial liabilities are recognised in the Statement of Financial Position when the company becomes party to the contractual provisions of the financial instrument.

Financial instruments are subsequently measured at fair value, amortised cost using the effective interest method, or cost.

A financial asset is derecognised when the contractual rights to the cash flows from the financial assets expire or are transferred and no longer controlled by the company.

A financial liability is removed from the Statement of Financial Position when the obligation specified in the contract is discharged or cancelled or expires.

Financial assets and financial liabilities classified as held for trading are measured at fair value through profit or loss.

Financial assets not measured at fair value comprise, held-to-maturity investments being non-derivative financial assets with fixed or determinable payments and fixed maturity that will be held to maturity. These are measured at amortised cost using the effective interest method.

(l) Research and Development Expenditure

Research and development expenditure is recognised as an expense in the period incurred.

Intangible assets arising from development activities are recognised when resources are available to complete the assets and future economic benefits from use or sale of assets is probable.

(m) Contingent Liabilities

A contingent loss is recognised as an expense and a liability if it is probable that future events will confirm that, after taking into account any related probable recovery, an asset has been impaired, or a liability incurred and, a reasonable estimate of the amount of the resulting loss can be made.



(n) Employee Benefits

Short term employee benefits are employee benefits (other than termination benefits and equity compensation benefits) which fall due wholly within 12 months after the end of the period in which employee services are rendered. They comprise wages, salaries, social security obligations, short-term compensation absences, profit sharing and bonuses payable within 12 months and non-mandatory benefits such as medical care, housing and car and service goods.

Short term employee benefits are measured at the (undiscounted) amounts expected to be paid when the obligation is settled.

Other long-term employee benefits include long-service leave, long-term disability benefits, deferred compensation and profit sharing and bonuses payable 12 months or more after the end of the period in which employee service are rendered.

Other long-term employee benefits are measured at the present value of the expected future payments to be made to employees.

All employees of the company receive defined contribution superannuation entitlements, for which the company pays the fixed superannuation guarantee contribution (currently 10% of the employee's average ordinary salary) to the employee's superannuation fund of choice. All contributions are recognised as an expense when they become payable.

(o) Intangible Assets

Intangible Assets are accounted for using the cost model whereby capitalised costs are amortised on a straight-line basis over their estimated useful lives, as these assets are considered finite. Residual values and useful lives are reviewed at each reporting date and they are subject to impairment testing.

	2021	2020
3. Cash and Cash Equivalents		
Blue Economy CRC-Co Ltd	4,126,654	1,356,495
Total Cash and Cash Equivalents	4,126,654	1,356,495

	2021	2020
4. Trade and Other Receivables		
Current		
Accounts Receivable	633,150	614,000
Total Trade and Other Receivables	633,150	614,000

	2021	2020
5. Financial Assets		
Current		
CBA Term Deposit	2,000,000	2,000,000
Total Financial Assets	2,000,000	2,000,000



	2021	2020
6. Plant and Equipment, Motor Vehicles		
Plant and Equipment		
Plant and Equipment at Cost	27,332	13,927
Accumulated Depreciation of Plant and Equipment	(11,206)	(160)
Total Plant and Equipment	16,126	13,767
Right of Use Asset		
Right of Use Asset - Hydrogen Equipment	1,973,225	-
Total Right of Use Asset	1,973,225	-
Total Plant and Equipment, Motor Vehicles	1,989,351	13,767
	2021	2020
7. Other Assets		
Current		
Prepayments	1,259,131	1,269,091
Total Other Assets	1,259,131	1,269,091
	2021	2020
8. Provisions		
Accrued Wage	3,634	6,692
Annual Leave Liability	31,870	15,067
Long Service Leave Liability	-	3,310
Sick Leave Liability	-	7,534
Total Provisions	35,504	32,603
	2021	2020
9. Trade and Other Payables		
Current		
Accrued Expenses	265,765	348,286
Accounts Payable	187,305	141,075
Credit Cards	4,233	-
FBT Payable	(446)	217
PAYG Withholdings Payable	33,131	102,523
Superannuation Payable	1,046	8,576
Wages Payable - Payroll	-	7,735
Total Trade and Other Payables	491,034	608,412



	2021	2020
10. Other Liabilities		
Current		
Insurance Funding	-	6,379
Interest on Funding	-	(545)
Total Current	-	5,834
Total Other Liabilities	-	5,834
	2021	2020

11. Lease Liability

Current		
Hydrogen Equipment Lease Liability - Current	45,221	-
Total Current	45,221	-
Non-Current		
Hydrogen Equipment Lease Liability - Non-current	1,928,004	-
Total Non-Current	1,928,004	-
Total Lease Liability	1,973,225	-
	2021	2020

12. Deferred Revenue

Government Contributions		
CRC Program Grant Received in Advance	4,942,741	1,336,373
Total Government Contributions	4,942,741	1,336,373
Participant Contributions		
Participant Contributions Received in Advance	2,359,597	3,014,625
Total Participant Contributions	2,359,597	3,014,625
Total Deferred Revenue	7,302,338	4,350,998

As per the accounting policy in note 2, contributions from the Commonwealth of Australia and Participants are treated as deferred revenue until matched against expenditure in the course of the Company's activities.

Deferred revenue arising from obligations to make contributions to the Company and not allocated to program expenses at balance date has been included as a current liability as it is anticipated that the relevant sum will be matched against expenditure during the next financial year.



	2021	2020
13. Results from Operating Activities		
Funding & Program Revenue		
CRC Program Grant	2,610,495	1,619,180
Participant Cash Contributions	4,099,153	1,258,769
Project Cash Contribution	197,959	-
Total Funding & Program Revenue	6,907,607	2,877,949
Other Revenue		
Cash Flow Boost	100,000	-
Interest Income	7,214	-
Total Other Revenue	107,214	-
Net Realised Revenue	7,014,821	2,877,949
Reconciliation of Net Result		
Government Contributions Expended	2,610,495	1,619,180
Participant Contributions Expended	4,297,112	1,258,769
Net Result	107,214	-

14. Changes of Accounting Policies & Correction of Prior Year Errors

In the course of preparing financial statements for the current year, it was identified that there were a number of accounting interpretations applied in the previous year which have subsequently been found to be incorrect. The comparative figures in these financial statements have been restated to be consistent with the accounting policies adopted in the current financial year.

	NOTES	2020 - PREVIOUSLY REPORTED	ADJUSTMENT	2020 - RESTATED
Reconciliation of Comparatives				
Balance Sheet (Extract)				
Current Asstes				
Trade & Other Receivables	(a)	1,239,000	(625,000)	614,000
Total Assets		5,878,353	(625,000)	5,253,353
Current Liabilities				
Deferred Revenue	(a)	-	4,350,998	4,350,998
Total Liabilities		902,355	4,350,998	5,253,353
Net Assets		4,975,998	(4,975,998)	-
Income Statement (Extract)				
Revenue				
Funding & Program Revenue	(a)	7,853,947	(4,975,998)	2,877,949
Net Surplus/(Deficit)		4,975,998	(4,975,998)	-



(a) Funding & Program Revenue

Funding and Program revenue was previously recognised as income on invoicing of the amount. It was subsequently identified that there were specific performance obligations under the funding and project agreements which had not been fully met at the end of the financial year. As per the accounting policy in note 2(d), where amounts have been received with related conditions yet to be satisfied, the amount representing the unmet conditions should be recognised as a deferred revenue liability. Management have determined that the most robust proxy for meeting conditions under the funding and project agreements is the expenditure that has been incurred, and accordingly program and funding revenue has been restated to match eligible expenditure.

It was also identified that a component of this deferred revenue liability balance related to participant contributions not considered receivable and that this component is more correctly adjusted as a decrease to trade and other receivables rather than as an increase to deferred revenue.

15. Share Capital

Blue Economy CRC-Co Ltd is a company limited by guarantee; thereby the company has been formed on the principle of having the liability of its members limited by the Constitution to the respective amount that the members undertake to contribute to the property of the company in the event of it being wound up.

16. Financial Risk Management Objectives and Policies

The company's principal financial instruments comprise receivables, payables, cash and short-term deposits. These activities expose the company to a variety of financial risks: market risk (including interest rate risk), credit risk and liquidity risk.

Surplus funds are invested in short and long-term deposits with one of the four major Australian banks at the best negotiated rate with maturities selected to match future expenditure needs.

Ageing analyses and monitoring of specific credit allowances are undertaken to manage credit risk, liquidity risk is monitored through regular analysis of cash flows over a variety of periods that draw on the business budgets and forecasts.

The company has implemented a risk management process and a number of operational Key Performance Indicators and provides the Board and Management with an assessment of performance against agreed objectives.

Risk Exposure and Responses

Interest Rate Risk

The company's exposure to market interest rates related primarily to the short and long-term deposits it held.

The company's exposure to interest rate risk is not material as the majority of its interest-bearing financial assets are in the form of fixed rate term deposits.

Liquidity Risk

The company manages liquidity risk by monitoring cash flow and maturity profiles of financial assets and liabilities.



17. Related Party Transactions

The names of all Directors who have held office during the financial period are:

Mr Greg Johannes (Chair), Appointed 05/07/2019

Mr Greg Vickery, Appointed 05/07/2019

Ms Gunilla Burrowes, Appointed 05/07/2019

Mr Nicholas Elliott, Appointed 05/07/2019

Mr Rhys Edwards, Appointed 05/07/2019

All the directors of the company are non-executive directors.

The results from operations include the following expenses that resulted from transactions with directors or their related parties:

Greg Johannes - \$54,795

Greg Vickery - \$22,831

Gunilla Burrowes - \$25,114

Nicholas Elliott - \$27,397

Rhys Edwards - \$27,397

18. Key Management Personnel

Key management personnel comprise executive directors and other persons having authority and responsibility for planning, directing and controlling the activities of Blue Economy CRC-Co Ltd

Name of Each Key management personnel:	Position:
Dr John Whittington	Chief Executive Officer
Prof Irene Penesis	Research Director
Mr Jonathon Brown	Business Manager

	2021	2020
Amounts paid or payable to key management personnel are as follows:		
Short-term employee benefits	684,505	317,120
Post Employment benefits	-	38,202



19. In-Kind Contributions

Participants and third parties make contributions to the various CRC projects in accordance with the project agreements through a mix of cash and in-kind contributions. In-kind contributions can comprise both staff in-kind contributions as well as other in-kind contributions. Staff in-kind contributions include the allocation of staff time to the CRC and projects, whereas other in-kind contributions include the allocation of non-staff resources such as access to the use of equipment, property or office space.

As noted in note 1 (d) (iii) the Company has not elected to bring in-kind contributions to account in the financial statements. However, the agreed value of in-kind participant contributions made to the CRC and its projects are as follows:

	2021	2020
In-kind Contributions		
Staff in-kind contributions	3,765,650	2,192,500
Other in-kind contributions	2,003,977	84,900

20. Unrecognised Contractual Commitments

At balance date the entity had obligations to make payments under a site access agreement with a participant. The sum of the cash obligations at the 30th June 2021 under this agreement is \$4,500,000.

	2021	2020
Unrecognised Contractual Commitments		
Payable within 1 year	1,500,000	1,500,000
Payable outside 1 year	3,000,000	4,500,000
	2021	2020

21. Remuneration of Auditors for:

Auditing or reviewing the financial statements	3,500	-
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22. Subsequent Events

No matter or circumstance has occurred subsequent to year end that has significantly affected, or may significantly affect, the operations of the Company, the results of those operations or the state of affairs of the Company or economic entity in subsequent financial years.

23. Economic Dependency & Continuance of Operations

The Company depends upon continued support from Participants and the Commonwealth of Australia for its ongoing operations. During the period ending 30 June 2021 approximately 37% (2020: 59%) of the Company's cash contributions of \$9,858,947 (2020: \$7,228,947) was sourced from Participants and Third Parties and 63% (2020: 41%) from the Commonwealth of Australia.



24. Cash Flow Information

Reconciliation of net cash flows from operating activities to operating profit.

	2021	2020
Cash Flow Reconciliation		
Profit for the year	107,214	-
Depreciation	11,046	160
Changes in Assets & Liabilities		
(Increase)/Decrease in Trade & Other Receivables	(19,150)	(614,000)
(Increase)/Decrease in Other Current Assets	9,960	(1,269,091)
Increase/(Decrease) in GST Payable	(156,536)	255,506
Increase/(Decrease) in Trade & Other Payables	(117,378)	608,412
Increase/(Decrease) in Provisions	2,901	32,603
Increase/(Decrease) in Other Current Liabilities	(5,834)	5,834
Increase/(Decrease) in Deferred Revenue	2,951,340	4,350,998
Cashflows from Operations	2,783,564	3,370,422

25. Entity Details

The registered office and the principal place of business of the company is:

Building "V"

Maritime Way

Newham, TAS 7248



Directors Declaration

Blue Economy CRC-Co Ltd

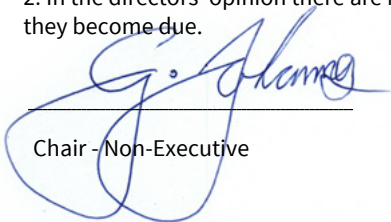
For the year ended 30 June 2021

In accordance with the resolution of the directors of Blue Economy CRC-Co Ltd, the directors declare that:

1. The financial statements and notes are in accordance with the Corporations Act 2001 and the Australian Not-for-Profit and Charities Commission Act 2012 and:

- a) Comply with Australian Accounting Standards applicable to the Company and Division 60 of the Australian Charities & Not-For-Profits Commission Regulations 2013; and
- b) Give a true and fair view of the financial position of the Company as at 30 June 2021 and of its performance for the year ended on that date in accordance with the accounting policies described in Note 1 to the financial statements.

2. In the directors' opinion there are reasonable grounds to believe that the Company will be able to pay its debts as and when they become due.



Chair - Non-Executive

25th October 2021

Date



Director - Non-Executive

25th October 2021

Date



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INDEPENDENT AUDITOR'S REPORT

To the members of Blue Economy CRC-Co Ltd.

Report on the Audit of the Financial Report

Opinion

We have audited the financial report of Blue Economy CRC-Co Ltd. (the registered entity), which comprises the statement of financial position as at 30 June 2021, the income statement, the statement of movements in equity and the statement of cash flows for the year then ended, and notes to the financial report, including a summary of significant accounting policies, and the responsible entities' declaration.

In our opinion the accompanying financial report of Blue Economy CRC-Co Ltd., is in accordance with Division 60 of the *Australian Charities and Not-for-profits Commission Act 2012*, including:

- (i) Giving a true and fair view of the registered entity's financial position as at 30 June 2021 and of its financial performance for the year then ended; and
- (ii) Complying with Australian Accounting Standards to the extent described in Note 1 and Division 60 of the *Australian Charities and Not-for-profits Commission Regulation 2013*.

Basis for opinion

We conducted our audit in accordance with Australian Auditing Standards. Our responsibilities under those standards are further described in the *Auditor's responsibilities for the audit of the Financial Report* section of our report. We are independent of the registered entity in accordance with the auditor independence requirements of the *Australian Charities and Not-for-profits Commission Act 2012* (ACNC Act) and the ethical requirements of the Accounting Professional and Ethical Standards Board's *APES 110 Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) that are relevant to our audit of the financial report in Australia. We have also fulfilled our other ethical responsibilities in accordance with the Code.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Emphasis of matter - Basis of accounting

We draw attention to Note 1 to the financial report, which describes the basis of accounting. The financial report has been prepared for the purpose of fulfilling the registered entity's financial reporting responsibilities under the ACNC Act. As a result, the financial report may not be suitable for another purpose. Our opinion is not modified in respect of this matter.

Other information

Those charged with governance are responsible for the other information. The other information obtained at the date of this auditor's report is information included in the registered entity's annual report, but does not include the financial report and our auditor's report thereon.

Our opinion on the financial report does not cover the other information and accordingly we do not express any form of assurance conclusion thereon.



In connection with our audit of the financial report, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial report or our knowledge obtained in the audit or otherwise appears to be materially misstated.

If, based on the work we have performed on the other information obtained prior to the date of this auditor's report, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

Responsibilities of responsible entities for the Financial Report

The responsible entities of the registered entity are responsible for the preparation of the financial report that gives a true and fair view and have determined that the basis of preparation described in Note 1 to the financial report is appropriate to meet the requirements of the ACNC Act and the needs of the members. The responsible entities' responsibility also includes such internal control as the responsible entities determine is necessary to enable the preparation of a financial report that gives a true and fair view and is free from material misstatement, whether due to fraud or error.

In preparing the financial report, the responsible entities are responsible for assessing the registered entity's ability to continue as a going concern, disclosing, as applicable, matters relating to going concern and using the going concern basis of accounting unless the responsible entities either intend to liquidate the registered entity or to cease operations, or have no realistic alternative but to do so.

Auditor's responsibilities for the audit of the Financial Report

Our objectives are to obtain reasonable assurance about whether the financial report as a whole is free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of this financial report.

A further description of our responsibilities for the audit of the financial report is located at the Auditing and Assurance Standards Board website (<http://www.auasb.gov.au/Home.aspx>) at:

http://www.auasb.gov.au/auditors_responsibilities/ar4.pdf

This description forms part of our auditor's report.

BDO Audit (TAS)

BDO Audit (TAS)

DAVID E PALMER
Partner

Hobart, 27 October 2021

Blue Economy CRC

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Australian Government
Department of Industry, Science,
Energy and Resources

AusIndustry
Cooperative Research
Centres Program

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