BLUE ECONOMY

COOPERATIVE RESEARCH CENTRE

2021-22 ANNUAL REPORT

Australian Government
Department of Industry, Science and Resources

AusIndustry
Cooperative Research Centres Program

CONTENTS

BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

FOREWORD

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, the Blue Economy CRC brings together 43 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.

A year in review

10YR LIFESPAN

43 PARTNERS

10 COUNTRIES

43 PARTICIPANTS

10 COUNTRIES

19 PROJECTS UNDERWAY

7 STAFF EMPLOYED

5 RESEARCH PROGRAMS

5 PROJECTS COMPLETED

FUNDING SECURED UNTIL 2029

7 PROPOSALS UNDER DEVELOPMENT

31 PHD SCHOLARSHIPS AWARDED

17 MILESTONES ACHIEVED

16 PHD SCHOLARS & 1 MPHIL SCHOLAR UNDERWAY

Our Participants

tassal TASSAL GROUP a better tomorrow

UNIVERSITY of TASMANIA

CSIRO

saitec offshore technologies

Griffith UNIVERSITY

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

New Zealand King Salmon

OceanPixel fluid . energy . intelligence

CSFRI CAFS

AUT NEW ZEALAND

THE UNIVERSITY OF WESTERN AUSTRALIA

sabella ride the tide

MACQUARIE University SYDNEY·AUSTRALIA

Tasmanian Government

SINTEF

Carnegie CLEAN ENERGY

Plant & Food Research Rangahau Ahumāra Kai

HUON AQUACULTURE

OPTIMAL

NUS National University of Singapore

xylem Let's Solve Water

SKRETTING a Nutreco company

TCOMS

oysters TASMANIA

ACS AUSTRALIA TRANSFORMING POSSIBILITIES INTO REALITY

DEME Dredging, Environmental & Marine Engineering

BMT

MERIC by ENERGIAMARINA SpA®

pitt&sherry

FIAL

Petuna BY PETER & UNA ROCKLIFF

CLIMATE KIC AUSTRALIA KNOWLEDGE INNOVATION COMMUNITY

Southern Blue Reef /// Enhancing the environment

GHENT UNIVERSITY

DNV·GL

UCC University College Cork, Ireland Coláiste na hOllscoile Corcaigh

CAWTHRON The power of science®

THE UNIVERSITY OF AUCKLAND NEW ZEALAND Te Whare Wānanga o Tāmaki Makaurau

HENSOLDT Detect and Protect.

SOUTHERN OCEAN CARBON COMPANY

CLIMATE FOUNDATION

Image courtesy of Marta Ribo (AUT) | Voyage #3 – Blue Endeavour Voyage in the Cook Strait

Chair & CEO Report

We cannot overstate the importance of oceans in the global climate change equation and for food production.

Earlier this year during the World Ocean Conference, we heard the Secretary-General of the United Nations say that "sustainable ocean management could help the ocean produce as much as six times more food and generate 40 times more renewable energy than it currently does". Delivering on this ambition requires industries and governments to better understand what they have now while looking further offshore to establish new sustainable business models.

The Blue Economy CRC was established to undertake industry focussed research and training to support the growth of the Blue Economy with a focus on two new, emerging, and transitioning ocean industries for Australia: offshore aquaculture and renewable energy production.

These are new industries, often operating in new ocean areas, using new technologies and production systems. This means that realising the exciting opportunities they have will also expose them to significant risk. With our Participants, we are implementing an ambitious portfolio of activity to understand and capture these opportunities while reducing that risk. After three years of operation, it is a timely to reflect on our direction and approach.

Blue leadership

The oceans are a publicly owned and shared space with important values, and we must respect the rights and aspirations of existing users. There are significant challenges and risk for new industries moving into the oceans including gaining acceptance from the public, regulators and existing users. The Blue Economy CRC is developing the tools and approaches to help integrate aquaculture and renewable energy into the ocean economy.

Dr John Whittington | CEO

Greg Johannes | Chair

We are undertaking projects to better understand the values of the oceans and how to measure them through environmental management accounting, ocean accounting and integrated reporting across economy, society, and environment. And we are working to understand the ethical values that are at stake in the Blue Economy, including those of First Nations Peoples, and supporting industries to secure social licence to operate in these new environments.

The CRC is also developing contemporary marine spatial planning frameworks that support equity and can provide industry with certainty of tenure while managing risks and undertaking foundational research to understand the environmental footprint of operating in deeper, high-energy sites.

Blue frontiers - regulation

Planning and regulatory frameworks are generally designed to meet the needs of the community and industry at a point in time. For new, emerging, and transitioning industries the regulatory environment often hasn't contemplated their activities and either doesn't allow for or restricts the opportunity for transition and innovation. This was the case for both offshore renewable and offshore aquaculture industries when the CRC commenced, where there wasn't a regulatory environment for them to operate in Commonwealth waters.

Our research to support planning and regulatory reform has included projects to understand and map the current systems in place for offshore wind and aquaculture, develop the information and tools to support the case for reform, and provide formal policy advice to governments. We have actively pursued regulatory change at the state and Federal level to allow aquaculture research in Commonwealth waters, as well as to improve the planning and regulatory systems in state waters. This has culminated in a changed planning and regulatory environment and the development of an MoU for the Blue Economy CRC to develop a research program in Bass Strait.

Our work has also influenced the Australian Government's decision to introduce a new planning and regulatory framework for offshore renewable developments.

Blue frontiers – offshore operations

There are many technical challenges to moving offshore. We are addressing these through focussed research on improving technologies and systems of work. This includes the development of more robust infrastructure with new materials and designs, the development of autonomous technologies for working in challenging environments and using advanced monitoring systems and computer learning systems to manage fish health. Some of our work is sector specific, which is why we are developing more efficient and cost-effective ways of converting wave energy into electrical energy, enhancing the competitiveness of Wave Energy Convertors, and we're addressing, the regulatory, technical, and logistical challenges of growing seaweeds offshore.

Some of our work applies across the blue economy. We know that moving further offshore will require new systems of work and we are developing a Code of Practice specific to offshore aquaculture vessels.

Blue energy

Meeting the global challenge to decarbonise ocean-based industries requires new ways of thinking, and new technologies. The Blue Economy CRC's research program is helping industry understand and quantify the challenge and share the risks associated with developing these technologies.

Our work has helped industry to understand the size and scope of the decarbonisation challenge for offshore aquaculture and we are working across sectors to develop the renewable energy solutions. This includes developing new wave energy converter devices that are suited to offshore aquaculture operations and a marinised hydrogen microgrid which will be integrated with offshore renewable energy systems to provide a fully off-grid green energy solutions for industry. These technologies will have wide application, well beyond the aquaculture industry.

By building and showcasing these emerging technologies we are showing what is possible as well as re-risking future adoption by industry. The scope and complexity of this work has attracted a new Participant to the CRC as well as deep connections to new third-party Participants.

FOREWORD | HIGHLIGHTS & ACHIEVEMENTS | CASE STUDIES | RESEARCH PROGRAMS | RESEARCH PROJECTS | EDUCATION & TRAINING | GOVERNANCE | FINANCIALS

Blue knowledge

The future of the new and emerging blue economy industries will rely on an informed, highly trained, and skilled workforce. Our PhD program has doubled in size over the last year and our students and their research are deeply connected to industry.

Through our extensive webinar program and in-person and virtual symposiums we are providing an opportunity for continuous learning as we raise the awareness of our participants, the broader industry, and governments to new and emerging approaches, thinking and technologies from around the world.

FY21-22 represented a pivotal third year of operation for the Blue Economy CRC, and for driving the sustainable utilisation of the oceans globally. As the COVID travel barriers were reduced, we were able to come together physically for the first time in many years to advance our shared goals.

Together, we have developed into a strong organisation that is having real impact by addressing the challenges and opportunities for industry, government, and society as we move offshore to develop renewable energy and sustainably produced aquaculture. This would not be possible without the contributions of our Participants, the Australian Government, our Board, management team and the talented team of researchers from industry, research institutions and government.

HIGHLIGHTS & ACHIEVEMENTS

Green Hydrogen Microgrid Project

The Blue Economy CRC is developing Tasmania's first fully operational commercial scale green hydrogen facility to support the decarbonisation of offshore industries including shipping and aquaculture, that will come online in Tasmania in the first half of 2023.

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, with partners, the Tasmanian Government, Optimal Group, Pitt&Sherry and Griffith University.

The onshore phase of the demonstration project is well underway in Hobart. Green hydrogen will be generated by an ITM Power HGAS1SP PEM electrolyser with maximum power input of 700 kW, corresponding to hydrogen production of 265 kg/day.

The electrolyser will be connected to a DC microgrid that will include a Capstone C65 pure-hydrogen turbine for generating electricity (65 kW maximum). The electrolyser and turbine are supplied by Optimal Group, who will also build the microgrid in a configuration adopted through consultation between the Blue Economy CRC, Optimal and Pitt&Sherry, who have been engaged as engineering consultants to the project.

The ITM Power electrolyser power supply has arrived in Australia and the electrolyser stack is scheduled for delivery by December 2022. The Capstone turbine has been commissioned on 100% hydrogen fuel. The programmable load has been delivered and the hydrogen compressor has been ordered. The specification of the hydrogen storage (buffer tank and tube trailer) is being undertaken collaboratively with the project partners.

In combination with a sophisticated system controller, the programmable load will allow the microgrid to emulate actual and potential applications for research purposes and offshore deployments, such as aquaculture installations (lights, feed delivery systems, general power), hydrogen vessels, an island community (a renewable energy microgrid), Antartic station, etc.

700 kW

MAX POWER INPUT

265 KG/DAY

HYDROGEN PRODUCTION

Tasmanian Government

OPTIMAL

pitt&sherry

Griffith UNIVERSITY

During the onshore project phase, the Blue Economy CRC will, through its research:

- Build and test a simplified version of the ultimate offshore hydrogen microgrid.
- Enhance the BE CRC's capability in hydrogen microgrids ahead of designing the offshore microgrid.
- Support research into the provision of electricity and hydrogen to relevant industries, particularly aquaculture, through emulations of real-world scenarios.
- Support training in advanced microgrid- and hydrogen- related skills.
- Support engagement with BE CRC partners and third parties through the supply of hydrogen for offtake and use in mobility.
- Provide a foundation for hydrogen related projects addressing social licence and community acceptance, markets and supply chain, safety and risk, and certification of origin.

The Tasmanian Government (September 2021) announced that they are working with the Blue Economy CRC to supply green hydrogen produced through the hydrogen facility (as an 'off-take') to fuel Metro Tasmania's bus trial, in support of the Tasmanian Government's Industry Activation Study.

On 10 December 2021, the Australian Government announced the commencement of trials for a Hydrogen Guarantee of Origin (GO) Scheme. A GO scheme will underpin Australia's clean hydrogen future and enable Australian businesses to sell verified low emissions hydrogen from renewable sources and fossil fuels with substantial carbon capture and storage, domestically and to the world.

The purpose of the trials is to design and test GO processes and the accounting framework in collaboration with industry and supply-chain partners on real-world projects. The Blue Economy CRC's green hydrogen microgrid project is participating in this trial and codesign process run by the Clean Energy Regulator and the Department of Industry, Science, Energy and Resources (DISER).

The Tasmanian government and the Flanders government recently signed a Memorandum of Understanding (MOU) on green hydrogen cooperation. The MOU provides a framework for partnerships and joint projects across the green hydrogen value chain, covering a range of sectors in both the industry and research domains.

The potential for the use of green hydrogen in marine, shipping and offshore energy applications has been identified as a priority area of cooperation under the MOU. The Blue Economy CRC held cross-continent events to bring together stakeholders from both Flanders and Tasmania to give an overview of why the MOU was agreed to and how green hydrogen can play a valuable role in the future. The Blue Economy CRC worked with industry stakeholders to determine how the cooperation could best support them in areas of hydrogen research and development, pilot projects and demonstrations in the marine, shipping and offshore energy sectors.

The Blue Economy CRC has given invited presentations on its research program and green hydrogen project at several important energy forums including the H2 Expo (April 2022), Tasmanian Energy Development Conference (June 2022), and upcoming events: Tasmanian Government Hydrogen Vessels Roundtable (July 2022) and Macquarie University Sustainable Energy Research Centre seminar series (July 2022).

6
COMPLETED PROJECTS

19
PROJECTS UNDERWAY

$31.7m
LIFETIME VALUE

$13m
CASH CONTRIBUTION

2
PROJECTS APPROVED

Research Projects

The Blue Economy CRC has made significant progress in 2021-2022 towards meeting its objectives as outlined in its Strategic Plan and its agreed milestones.

The Blue Economy CRC completed 6 projects in 2021-22 and engaged strongly with our industry, research and government participants to understand their objectives and priorities, and the current state-of-play for the industry. Edited versions (to protect IP and Commercial in Confidence material) of the final reports were made available via the Blue Economy CRC Connect community platform and the website, (see past projects page).

Nineteen projects are underway spanning research across the five research programs (see current research projects page). The research is focused on our participant's needs, is environmentally and socially responsible and will have a demonstrable commercial impact. It delivers on national and international agendas focused on a sustainable blue economy including Australia's commitment to cut emissions and initiatives to protect our oceans, Australia's commitment to the High-Level Panel for a Sustainable Ocean Economy, Ocean Decade Australia, and United Nations (UN) 2030 Agenda for Sustainable Development SDG 14. These projects have a lifetime value of $31.7M with the Blue Economy CRC cash contribution of $13M.

The Blue Economy CRC has approved two additional projects on offshore salmon and oyster production during this reporting period, with a Blue Economy CRC cash contribution of $1.24M and total project value of $3.55M. These projects are set to start in Q1 2022-23. Several others are in the commissioning phase.

Education & Training

The Blue Economy CRC granted eight new scholarships for stand-alone PhD and Masters projects, with six of these students commencing studies in 2021-22.

In addition, ten PhD scholarships (including two top-ups) were awarded within new general projects during this year, with three of the successful students commencing before 30 June 2022. The eight PhD scholarship recipients that commenced prior to 2021-22 continued their research successfully throughout this year.

By mutual agreement, one of these Scholars had a temporary scholarship suspension while they undertook a 10-month job placement with the Organisation for Economic Co-operation and Development (OECD), in a role deemed to be beneficial for their Blue Economy CRC scholarship.

The 2022 participants workshop included a showcasing of the BE CRC's PhD program, with most of the PhD Scholars presenting a poster describing their research.

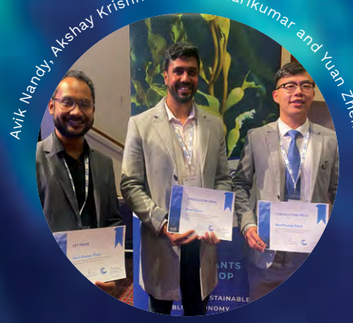
Workshop attendees had several opportunities to talk directly with the Scholars about their research, and then lodge votes for the awarding of prizes for: (1) best poster; (2) best presenter, with the winner (in both cases, Mr Avik Nandy) then making a short presentation before all workshop attendees.

A number of the PhD Scholars were sponsored by the Blue Economy CRC to attend the 2021-22 Collaborate-Innovate Conference held by Cooperative Research Australia.

The Blue Economy CRC has also been providing opportunities to honours and masters by coursework activities, to develop expertise and interest in emerging blue economy activities through support for university-based work integrated learning placements.

Notable mentions are from the University of Tasmania, Australian Maritime College Ocean Engineering honours student Curtis Graham, supervised by Dr Nagi Abdussamie (Research Program 1 Deputy Program leader and UTAS Senior Lecturer) receiving the Best Presentation award and OMC International (Most Innovative Project) industry award for his research titled 'Numerical Analysis of Tsunami Wave Actions on Vertical Cylinders'.

8 | **SCHOLARSHIPS AWARDED OUTSIDE OF PROJECTS**



6 | **COMMENCING STUDY IN 2021-22**

Milestones Progress

The Blue Economy CRC continues to make progress against its research output obligations, with five additional Milestones completed during 2021-22.

17
CONTRACTED MILESTONES

68
MILESTONES IN PROGRESS

The Blue Economy CRC has now completed 17 of its contracted milestones with 68 milestones in progress and 18 not yet scheduled to start.

Drawing on the outcomes of its R&D activity over the last three years, the Blue Economy CRC will be undertaking a review of its milestones in the first half of 2022-23.

Blue Economy CRC welcomes three new participants

Three companies, Southern Ocean Carbon Company Pty Ltd, Climate Foundation Australia Ltd and HENSOLDT Australia Pty Ltd became Participants in the Blue Economy CRC this year.

Southern Ocean Carbon Company Pty Ltd (SOCC) is a seaweed start-up company that aims to sequester carbon dioxide through seaweed production. SOCC has extensive marine engineering expertise. Their new 'Quadrat' long line culture system will be used for the seaweed cultivation and the long-term sequestration will be achieved via three innovative strategies: rehabilitation or creation of new habitats, seaweed biochar production and deep burial of seaweed.

Climate Foundation Australia Ltd (CF) is a non-profit organisation dedicated to reversing global warming. By developing marine permaculture initiatives and using deep-water irrigation, nutrient value-chain gaps can be filled, extending cultivable ocean area across [sub]tropical and temperate oceans. Climate Foundation aims to develop a distributed network of multiple autonomous, self-guided Marine Permaculture arrays from 1-100 Ha in size. These arrays combined with automated kelp cutters and floating marine biorefineries will process seaweed into high-value seaweed food and fertiliser products.

HENSOLDT Australia Pty Ltd is a technology solutions company providing multi-domain solutions, analytics, and services across Defence, Space, Clean Energy, and Maritime sectors. In the Clean Energy sector, HENSOLDT specialises in hydrogen storage and integrated microgrid solutions. HENSOLD brings four major capability components to the Blue Economy CRC: hydrogen storage solutions and control systems, pressurised canisters for storage, saltwater filtration systems and hydrogen vessels.

SOUTHERN OCEAN CARBON COMPANY

CLIMATE FOUNDATION

HENSOLDT Detect and Protect.

Welcoming new Team Members

Dr Tania Lado Insua
Manager, Research and Partnerships

In October 2021, we welcomed **Dr Tania Lado Insua** as the Blue Economy CRC Manager, Research and Partnerships. In her role she brings her ocean sciences and engineering expertise to support collaborations between academia, industry and governmental organisations at a national and international level.

Angela Williamson
Director of Blue Policy and Planning

Angela Williamson was welcomed to the Blue Economy CRC team in May 2022 as the Director of Blue Policy and Planning. She brings a passion for sustainable oceans development and a wealth of experiences in government, political and private sector gained over the past two decades.

In December 2021, we welcomed **Dr Jana Orszaghova** as the Deputy Program Leader for the Offshore Renewable Energy Systems. Jana's primary affiliation is the University of Western Australia, where she is a Research Fellow focused on ocean renewable energy; applying analytical, numerical and experimental skills to solve challenging problems in the field of hydrodynamics.

Dr Jana Orszaghova
Deputy Program Leader,
Offshore Renewable Energy Systems

Changes to the Research Executive

In August/September 2021, we farewelled three of our Blue Economy CRC leaders. Whilst they stepped down from their program leader roles, they are still involved in projects and collaborations with the Blue Economy CRC.

Dr Mark Hemer (CSIRO), former program leader of the Offshore Renewable Energy Systems Research Program 3 (RP3) was a major contributor in the development of the 10-year roadmap for the Blue Economy CRC and oversaw the evolution of RP3 vision to encompass broad opportunities for offshore renewable energy systems; to meet needs of offshore industry, enable growth of new offshore industries and to contribute towards Australia's necessary energy transition.

Dr Beth Fulton (CSIRO), former program leader of the Environment and Ecosystems Research Program 4 (RP4), was a contributor to the Blue Economy CRC roadmap and the leader of the RP4 development on its first years. Beth's engagement continued through the *Risks and Opportunities for the Blue Economy (4.20.006)* project that has just finalised and we anticipate her engagement as the program continues.

Dr Leo Dutra (CSIRO), former deputy program leader of the Sustainable Offshore Developments Research Program 5 (RP5) was a contributor to the roadmap and development of RP5 research agenda.

Mark, Beth and Leo were instrumental on the establishment and development of the Blue Economy CRC and the management of the CRC during the first two years of the pandemic. We thank them for their significant and valuable contribution to the Blue Economy CRC and look forward to their continued engagement via their organisations.

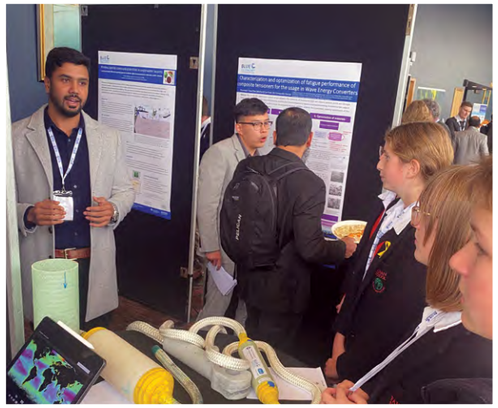
In September 2021, our Executive team welcomed Prof Evan Gray (Griffith University) and Prof Chris Frid (Griffith University) as the new Program Leader's for RP3 and RP4 respectively.

Prof Evan Gray research interests focus on the physics of energy-related materials, including hydrogen storage materials and superconductors, and modelling energy systems.

Prof Chris Frid is committed to transdisciplinary research with a focus on the application of holistic, ecosystem perspectives and management of multiple sectors.

Professor Evan Gray
Program Leader,
Offshore Renewable Energy Systems

Professor Chris Frid
Program Leader,
Environment and Ecosystems



Participants Workshop and Symposiums

This year has been a very active engagement year. The Blue Economy CRC ran three successful hybrid events in May 2022 in Hobart that attracted more than 400 attendees in person and virtually. The full program was streamed live on a dedicated virtual platform, allowing attendees to join and contribute to sessions in real-time from across the globe.

3
SUCCESSFUL EVENTS

400+
ATTENDEES (IN PERSON + VIRTUAL)

STREAMED LIVE
ACROSS THE GLOBE

2022 Tasmanian Salmon Symposium

This symposium examined and discussed issues in international best practice, research and developments in contemporary offshore and associated land-based aquaculture systems. The Salmon Symposium was attended by over 350 attendees, 160 virtual and 191 in person.

The symposium considered ethics, values and social licence of aquaculture in offshore environments. The risks and opportunities of moving into offshore environments were discussed, including innovative ocean accounting, opportunities for multispecies and integrated multitrophic aquaculture, offshore engineering and innovative technologies, responsible feed production and low carbon farming technologies. The 2022 Salmon Symposium was supported by the Tasmanian Government.

The workshop had strong international panels with invited speakers from Australia, New Zealand, Chile, Norway, Belgium, Greece, USA and attendees from several other countries online. The event concentrated on the technical aspects of salmon aquaculture from an industry perspective with a strong focus on sustainability. The topics covered expanded from sustainable aquaculture visions for the future to technology, fish production and supply chain, fish health and welfare, ocean aquaculture, connections to society and international views.

Supported by

Tasmanian Government | BLUE ECONOMY COOPERATIVE RESEARCH CENTRE | Australian Government Department of Industry, Science and Resources | AusIndustry Cooperative Research Centres Program

2022 Australian Ocean Energy Market Summit

The 2022 Australian Ocean Energy Market Summit was organised in collaboration with our participant Australian Ocean Energy Group (AOEG) and facilitated by UK-based Aquatera.

The Market Summit was designed to create meaningful, information-based connections between Australian market representatives and industry leaders, such as project developers, technology providers, supply chain, investors, funders, researchers, stakeholders, policy makers and communities. The Summit was a highly interactive event open to anyone with an interest in the ‘blue economy’ that congregated more than 150 attendees, 90 virtual and 69 in person.

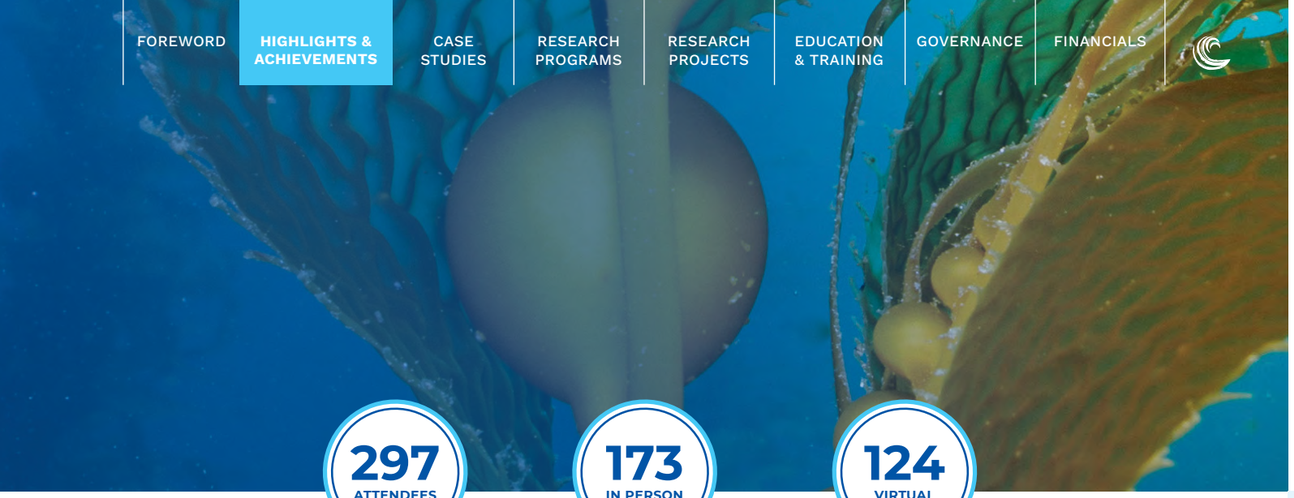
The Ocean Energy Market Summit identified priority markets for wave and tidal technologies and integrated ocean energy systems in Australia, examined opportunities and challenges faced in relation to energy transition and decarbonisation and identified key research to support the market’s adoption of ocean energy and the sustainable development of Australia’s ocean energy industry. The sessions from this Summit covered technical, financial, regulatory and stakeholder engagement topics, showcased energy developers and informed the strategic objectives and detailed design of the AOEG Ocean Energy Marketplace.

Facilitated by

aquatera environmental services and products

Supported by

BLUE ECONOMY COOPERATIVE RESEARCH CENTRE | Australian Government Department of Industry, Science and Resources | AusIndustry Cooperative Research Centres Program



2022 Participants Workshop

The Blue Economy CRC's 3rd Annual Participants Workshop was themed 'Towards a Sustainable Blue Economy'.

The event coincided with the 2022 Tasmanian Salmon Symposium and the Australian Ocean Energy Market Summit earlier in the week, followed by the two-day Workshop and on-site tours of participants Tassal and Huon Aquaculture's operational feed centres, hatcheries, and feed barges. A total of nearly 300 attendees from our participant organisations attended the workshop, 124 virtual and 173 in person.

The Annual Participants Meeting and Annual General Meeting were held as part of the Participants Workshop. PhD Scholar poster presentations and discussions with Program Leaders and participants were held to facilitate better integration of the students with the CRC program and industry participants.

Webinars

We have continued with our well-recognised webinar series to support engagement and collaboration across the blue economy sectors and community.

Participants and external organisations from industry, research and government are invited to share their blue economy R&D activities and knowledge of the sector. Several of the webinars are built around key Blue Economy CRC themes and highlight our engagement activities and research outcomes.

There have been thirteen webinars held during this annual report period, covering the following topics:

- Unlocking the Blue Economy: is seaweed one of the keys? (July 21, 2021)
- New research on offshore wind energy in Australia (July 22, 2021)
- Mapping and analysis of Blue Economy policy and legislative arrangements (Participants only) (July 26, 2021)
- What are the key ethical values relevant to the Blue Economy, the opportunities, challenges and dilemmas they present? (Participants only) (July 28, 2021)
- Offshore wind industry panel discussion (August 10, 2021)
- Decarbonising the Blue Economy through accelerated adoption of ocean energy (September 22, 2021)
- Offshore Aquaculture – Matching technology to challenges of exposed fish farming (October 13, 2021)
- Decarbonising offshore aquaculture with Carnegie Clean Energy's 'MoorPower™' (October 22, 2021)
- Riding the wave to zero emission energy (December 8, 2021)
- Floating structures for the next generation of ocean industries (February 15, 2022)
- Ocean-based carbon markets Australia and New Zealand (March 28, 2022)
- Offshore aquaculture as a market for ocean renewable energy (April 27, 2022)
- Tasmania and Flanders green hydrogen in marine and shipping (May 17, 2022)

3263 | **REGISTERED ATTENDEES**

744 | **HIGHEST NO. OF ATTENDEES FOR SINGLE WEBINAR**

Overall, there have been 3263 registered attendees who were logged on across all of the above webinars, with 744 attendees being the highest number of registrations for a single webinar for 'New research on offshore wind energy in Australia'.

The recordings of these webinars can be found on the Blue Economy CRC's events page.

Communications

We continue to grow the awareness of the Blue Economy CRC's work through our website and social media channels.

The website continues to see a steady uptake in traffic with 34,000 website visitors over the past 12 months (an increase of 31% from the 2020-21 year), with 34% of these new visitors to the site. Visitors view on average 11 pages across the site per session which shows engagement with the various forms of content across the site. The website has undergone a Phase 3 upgrade with a more comprehensive project page design detailing project Participants, milestones and outcomes.

Our social media channels continue to grow with the scheduling of consistent, branded content on commencing and completed project outcomes, events, media mentions, PhDs and current research. LinkedIn continues to be the predominant channel with 3,500 followers. The mailing database connects to 5,700 contacts on a regular basis with quarterly newsletters and webinar invitations.

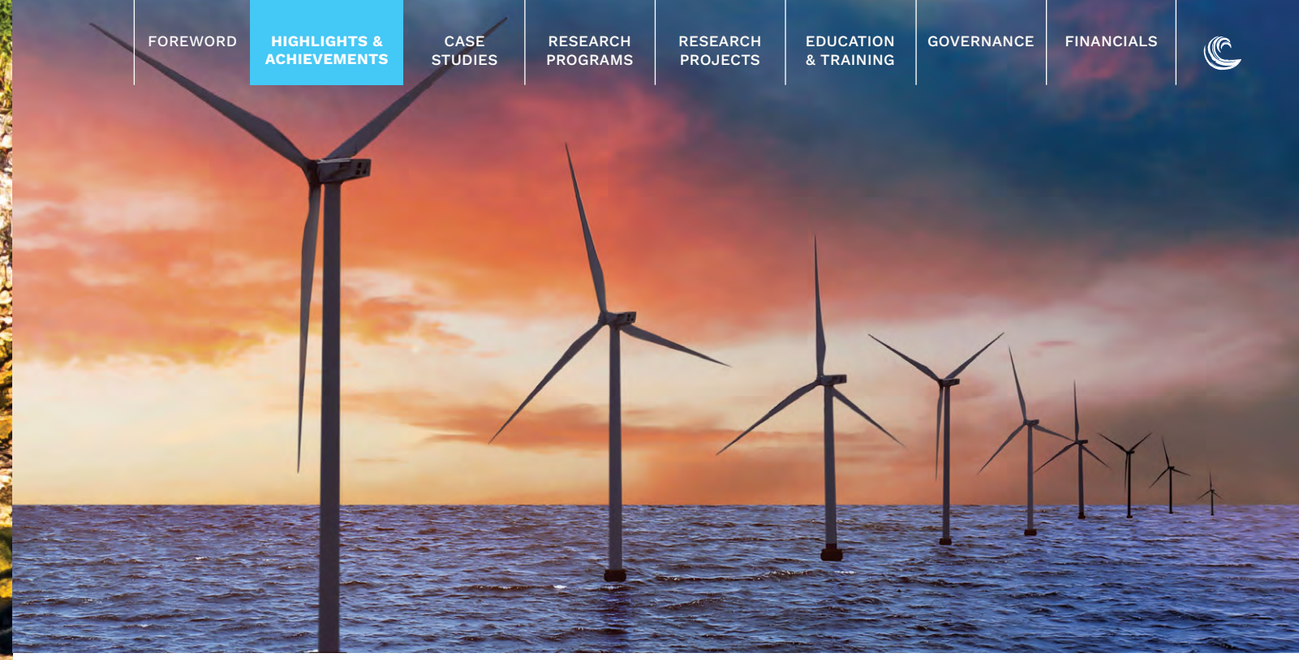
31% ↑ IN WEBSITE TRAFFIC FROM 2020-21

PREDOMINANT SOCIAL CHANNEL

5,700 MAILING DATABASE

3,500 LINKEDIN FOLLOWERS

34K WEBSITE VISITORS



Formal Submissions and Hearings

Offshore Renewable Energy Infrastructure Act

The Australian Government passed the Offshore Electricity Infrastructure Bill in November 2021. This Bill facilitates and regulates the development of electricity infrastructure in Commonwealth waters.

The Blue Economy CRC's Offshore Wind Energy for Australia (3.20.007) report provided valuable factual information to support the passage of this bill. In addition, the Blue Economy CRC provided submissions into the drafting of the Bill and to the Senate's Environment and Communications Legislation Committee's inquiry into the Bill.

The Offshore Electricity Infrastructure Bill 2021 is a key element in developing a regulatory regime and provides legislative certainty in relation to construction, operation, maintenance and decommissioning of offshore electricity projects.

In April 2022, the Blue Economy CRC provided a response to the Department of Industry Science, Energy and Resources (DISER) on the Offshore Electricity Regulations and Cost Recovery Framework (March 2022).

The regulations assist in operationalising the legal framework established by the Offshore Electricity Infrastructure Act 2021 (Cth) and propose cost recovery implementation models. The focus of the comments for the Blue Economy CRC addressed the licensing scheme and arrangements for pre-existing infrastructure.

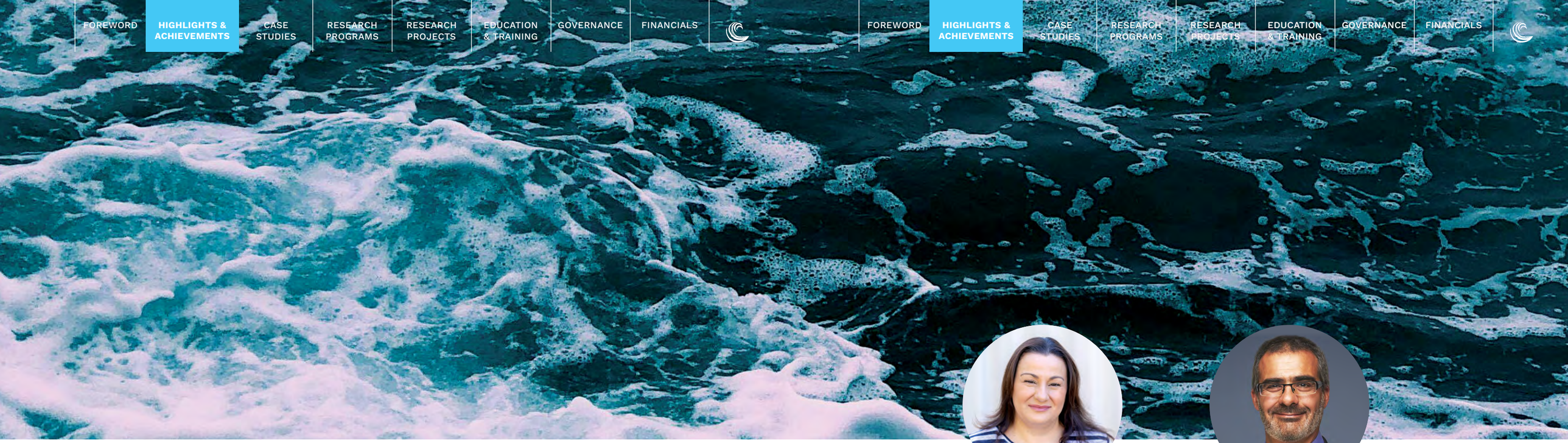
This Bill facilitates the development of the offshore renewable energy sector in Australia providing certainty and a framework for companies at a national and international level to exploit this untapped resource in Australia.

Offshore Aquaculture

In May 2021, the Blue Economy CRC provided a submission to the House of Representatives Standing Committee on Agriculture and Water Resources: Australian Aquaculture Sector, highlighting the work by our participants and organisation, and the potential and benefits of offshore aquaculture for Australia.

This included the importance of marine spatial planning and site selection, fit for purpose regulation and the need for research focused on multiple approaches to monitor the health and welfare of species and to combine these to provide mitigation responses and strategies. This submission was followed by attendance of the Blue Economy CRC before the Standing Committee.

In early March 2022, the Tasmanian Government's Living Marine Resources Management Amendment (Aquaculture Research) Bill 2021 was passed by Parliament. The purpose of this Bill is to facilitate future research into offshore aquaculture in Commonwealth waters adjacent to Tasmania. Again, the Blue Economy CRC played a significant role in supporting the development and debate of the Bill. The outcome of this Bill is the ability to develop a Blue Economy Zone research trial in Bass Strait (see case study section).



Professor Irene Penesis
Blue Economy CRC

Professor Christophe Gaudin
University of Western Australia

Blue Economy CRC announced as Australian Delegation to the IEA OES

The Blue Economy CRC confirms its role as the lead Australian Delegation to the International Energy Agency Ocean Energy Systems (IEA OES) with the Blue Economy CRC's Research Director, Professor Irene Penesis Australia's Executive Committee Delegate, together with Professor Christophe Gaudin from the University of Western Australia as Alternate Representative.

The IEA OES brings together countries to advance research, development and demonstration of conversion technologies to harness energy from all forms of ocean renewable resources, such as tides, waves, currents, temperature gradient and salinity gradient for electricity generation, as well as for other uses, such as desalination, through international cooperation and information exchange.

Several of the Blue Economy CRC's participants (AOEG, Carnegie Clean Energy, SABELLA, AMC-UTAS, UWA) are active participants in the IEA's OES Technology Collaboration Program.

In March 2022, together with the US Department of Energy Pacific Northwest National Laboratory, the Blue Economy CRC delivered an international assessment and report on the global energy requirements of offshore aquaculture as a market for ocean energy, commissioned by the IEA OES.

IEA OES Technology Collaboration Program

sabella ride the tide

AUSTRALIAN OCEAN ENERGY GROUP

UNIVERSITY of TASMANIA

AMC Australian Maritime College

THE UNIVERSITY OF WESTERN AUSTRALIA

Carnegie CLEAN ENERGY

OES OCEAN ENERGY SYSTEMS

This leading international forum offers the Blue Economy CRC an opportunity to showcase industry, research and government engagement in ocean energy and its associated markets and provide significant international outreach.

Governance

The Board of the Blue Economy CRC is governed by 5 independent non-executive Directors. During the financial year, two retiring Directors were reappointed as Directors of the Company to fill the vacancies left at the end of their respective further terms until the next AGM.

The Board has re-elected Greg Johannes to continue as Chair for a further 2-year term subject to his reappointment at the next AGM. All Partners are eligible to be a member of the company and as of 30 June 2022 six participants have elected to become members of the Company. The Blue Economy CRC held its first AGM in conjunction with its Annual Participants Meeting in May 2022.

The Board commissioned an Independent Review by Professor Tony Peacock. The review will consider governance and administration, engagement with our Participants and students, and our research and training portfolios. The review is scheduled to complete early in FY 22-23.

The Board has continued to provide strategic leadership and good corporate governance with the review of the 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.

Greg Johannes
Chairperson

Dr Nick Elliott
Board Member

Greg Vickery
Board Member

Rhys Edwards
Board Member

Dr Gunilla Burrowes
Board Member

Image courtesy of Saitec Offshore

CASE STUDIES

Development of MoorPower™ concept

Provision of clean and reliable energy for the offshore aquaculture industry is a key interest of the Blue Economy CRC. Following several conversations between Carnegie Clean Energy and aquaculture companies, a group of participants identified an opportunity to utilise know-how and unique aspects of Carnegie's CETO wave energy technology to come up with a solution to this challenge.

These conversations led Carnegie to develop MoorPower™, a CETO derived wave energy product designed for moored vessels. MoorPower™ offers a solution to the challenge of securing clean and reliable energy for offshore activities, reducing reliance on diesel generation.

The versatility of MoorPower™ allows for its use in offshore vessels such as feeding barges for the aquaculture sector and will expand into other markets in the future for offshore floating structures with an energy need.

In 2021, the Blue Economy CRC and Carnegie launched the MoorPower™ Scaled Demonstrator project. The 2-year project includes the design, installation and operation of a scaled demonstrator of the MoorPower™ technology just offshore from Carnegie's headquarters and research facility in North Fremantle, Western Australia. The demonstrator will be deployed in early 2023.

This *$3.4M MoorPower™ Scaled Demonstrator (1.21.001)* project is being delivered with funding support from the Blue Economy CRC and in close collaboration with a consortium of partners including two of Australia's largest aquaculture companies, Huon Aquaculture and Tassal Group. Academic and industry partners include DNV GL Australia, Advanced Composite Structures Australia, University of Tasmania, Climate KIC/ Australian Ocean Energy Group, and University of Queensland.

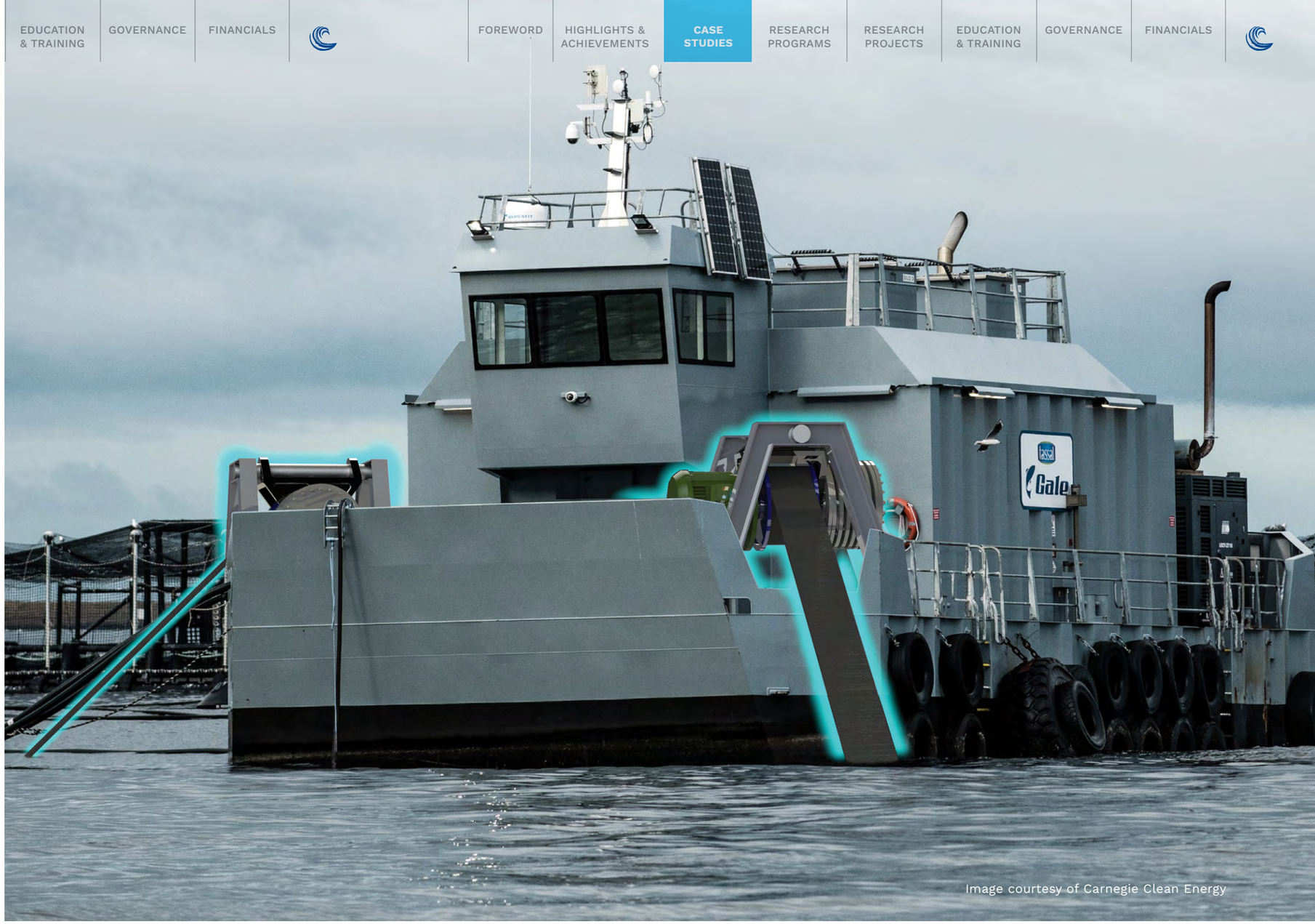
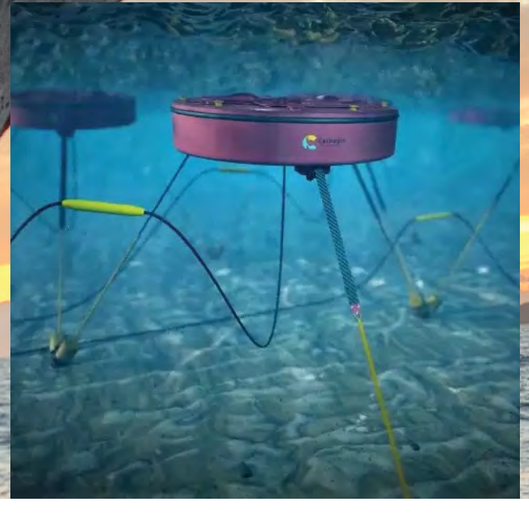


Image courtesy of Carnegie Clean Energy

Impression of the MoorPower™ system aboard a feeding barge
Image courtesy of Carnegie Clean Energy



Carnegie's CETO technology
Image courtesy of Carnegie Clean Energy

As the aquaculture sector moves operations further offshore, infrastructure such as feeding barges will no longer have access to shore-based power and the reliance on diesel generators comes with many associated costs, carbon emissions and environmental risks, including fuel storage and spillage risks while refuelling offshore.

This challenge presents an opportunity to utilise wave energy, an untapped energy source constantly flowing around offshore facilities.

Theoretically, MoorPower™ can be deployed for any type of moored vessel and is not limited to aquaculture. The project team continues to collaborate with key aquaculture companies to understand their requirements, constraints and challenges. The MoorPower™ technology will be an integrated solution with other offshore renewable energy systems including hydrogen and batteries. Through this project, a PhD student at University of Tasmania is also investigating alternative energy storage opportunities to meet the needs of the aquaculture industry.

Carnegie has incorporated aspects of its proprietary core CETO wave energy technology into MoorPower™. The core CETO technology has a submerged buoy that sits a few metres below the surface of the ocean, moving with the waves. This orbital motion drives a Power Take-Off (PTO) system that converts the wave motion into electricity energy. MoorPower™ is a spin-off from CETO that takes key CETO components such as the PTO and offers an alternative configuration for a new market application.

> As population increases, wild harvest stocks decrease, and farming land and freshwater is restricted, aquaculture is providing a source of renewable protein farmed through sustainable practices. Partnerships like this ensure our industry continues to deliver the benefits of high-performance sustainable innovation, research and development (R&D) and change practices. Through the introduction of novel oceanic renewable energy sources, aquaculture will continue to offer healthy seafood produced with a low carbon footprint.

Mr Mark Asman
Head of Aquaculture, Tassal Group

> Improving the robustness of feed delivery systems will help reduce costs and allow operation of fish farms in more energetic environments.

Mr Rowan Paton
Principal Engineer
Advanced Composite Systems Australia

This collaborative project is de-risking this new technology for a future commercial roll out of this technology in Australia and internationally. The project provides an innovative solution for the aquaculture sector and continues the development and commercialisation of technologies to efficiently and cost-effectively convert wave energy into electrical energy.

Wave energy technologies have the potential to revolutionise marine renewable power, deliver innovative solutions to ocean industries and support global efforts towards decarbonisation and a more sustainable environment.

Patent Filed for a novel Mooring Tensioner

In 2020, Blue Economy CRC funded the Mooring Tensioner for Wave Energy Converters (MoTWEC) project, a $1.6M project led by Carnegie with partners Advanced Composite Structures Australia (ACS-A), University of Queensland (UQ) and ClimateKIC representing the Australian Ocean Energy Group (AOEG).

This project has developed the novel Mooring Tensioner, a key component that will support the use of rotary power take-off systems and associated cost reductions for wave energy converters. A prototype is currently undergoing testing at Carnegie's private wave energy research facility in Western Australia.

The Mooring Tensioner is a subsystem that will support cost-effective wave energy converters. The wave energy industry has fundamentally demonstrated that it is possible to capture wave energy and convert it to electricity. The key task now is to reduce cost and improve performance.

Wave energy converters (WECs) are targeting a significant portion of the energy market while continuing to leverage the unique properties of predictability and consistency provided by waves.

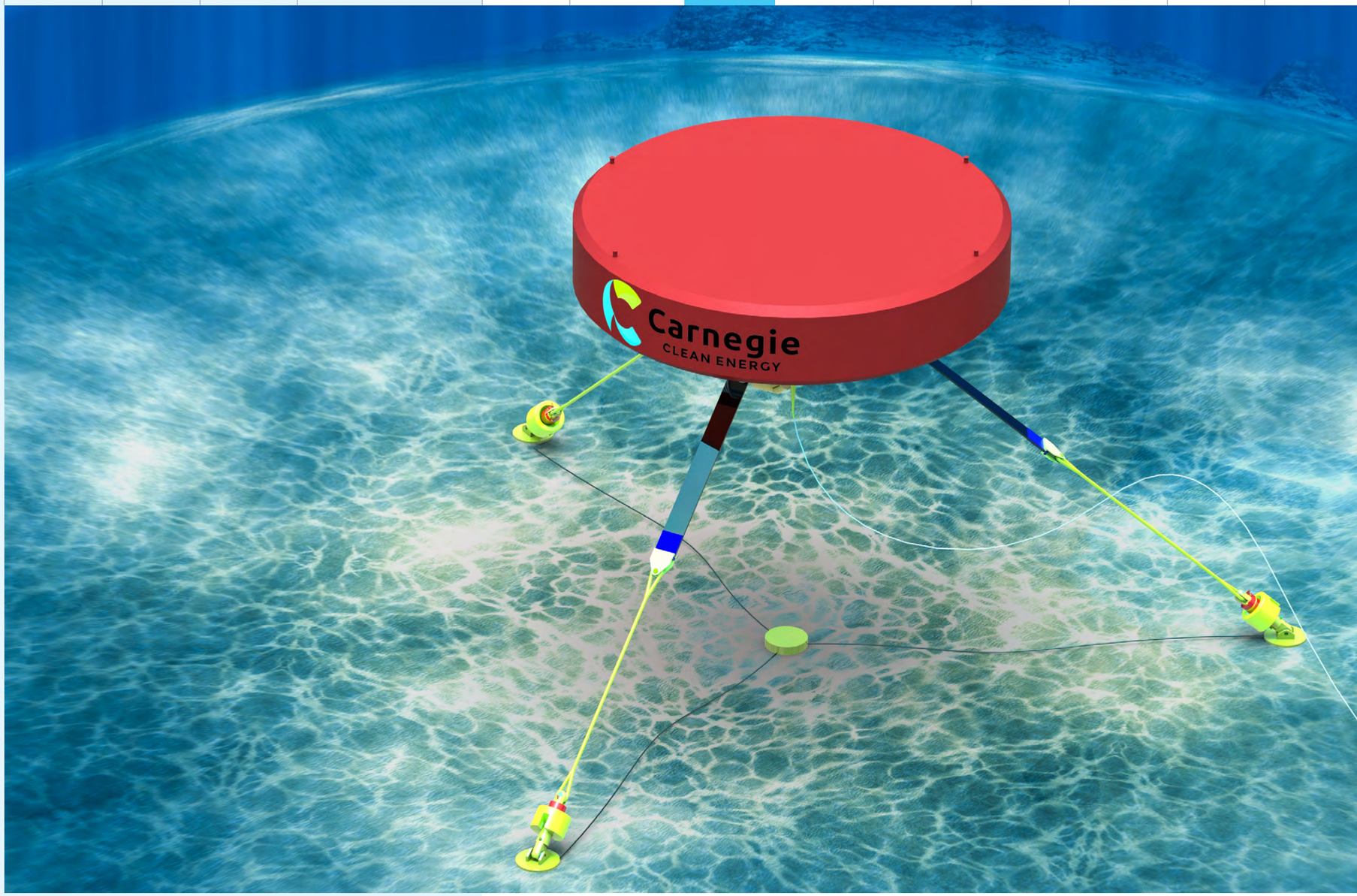


Image courtesy of Carnegie Clean Energy

The wave energy industry is an untapped renewable energy resource with significant market potential around the world. Ocean Energy Europe (OEE) has forecast a €653 billion market potential by 2050.

A wave energy converter's Power Take-Off (PTO) system converts the kinetic energy captured from the waves into electrical energy. The PTO represents a significant portion of the overall cost of a wave energy converter making it a prime target for system cost reductions. Many wave energy converters are converging towards rotary electric PTOs which can leverage emerging innovations from wind power and the worldwide trend towards electric vehicles. Wave energy converters can redeploy these innovations to reduce the cost and increase the performance of the PTO. To unlock cost reductions associated with the use of a rotary electric PTO, wave energy converters need a way to balance the rotary mechanical energy storage and mooring line pretension. This project is developing a Mooring Tensioner to address this technical gap and unlock cost reductions for Carnegie and other wave energy developers.

A provisional patent has been filed by the Blue Economy CRC for the Mooring Tensioner Design invented during this project.

ACS-A manufacturing a Mooring Tensioner element to undergo material characterisation tests by University of Queensland
Image courtesy of ACS-A

Carnegie had already completed initial work to develop the concept and explore the benefits provided by an advanced composite material Mooring Tensioner. This project brought together the right collaborative team to deliver this exciting new technology and a new design for the mooring tensioner was developed by ACS-A. Following work to select the material, University of Queensland undertook a series of material testing campaigns to better define the characteristics of the material for use in sea water for this application. The project is also funding a PhD student at University of Queensland who is involved in testing the composite material for the mooring tensioner and is doing relevant research on reaction induced phase separation of Fibre Reinforced Polymers (FRPs) to optimize fatigue performance and sea water durability.

Following completion of the design by ACS-A and Carnegie, ACS-A constructed a Mooring Tensioner prototype using high performance, light weight and durable fibre reinforced composites, allowing easier integration to the space constrained WEC environment. Carnegie constructed and commissioned a test rig for the prototype at its research facility and a fatigue testing campaign is currently underway.

In addition to supporting novel rotary power take-off systems for wave energy converters, the Mooring Tensioner could offer an attractive alternative to current mooring systems for various marine applications, for example to anchor fish cages and service vessels employed in the offshore aquaculture industry.

This innovation has the potential to offer improved station keeping of the moored systems in energetic wave environments where long mooring chains that hold the vessel in place typically allow large excursions from the desired location.

Successful deployment of the proposed Mooring Tensioner could also reduce the environmental impact of the mooring systems by limiting contact with the seabed.

The project will continue exploring these other market opportunities for the Mooring Tensioner in order to identify additional commercial applications.

Brighid Jay
Chief Commercial Officer
Carnegie Clean Energy

"Carnegie is excited to be seeing the value unlocked through the MoTWEC project and the collaboration with our project partners through the Blue Economy CRC. The support from the Blue Economy CRC has allowed the team to complete an impressive testing effort, an important step in de-risking the design of the Mooring Tensioner and characterising a new composite material for future ocean applications."

Towards open ocean aquaculture | Bass Strait Blue Economy Zone

In the ocean economy, emerging and transitioning industries face challenges associated with the 'shared' nature of the ocean. Approaches like ecosystem-based management, multiple use management along with tools like marine spatial planning provide a contemporary and equitable basis for entering new ocean space. However, the success of these emerging ocean industries will ultimately come down to contemporary leadership.

Globally, the drive to develop open ocean aquaculture acreage and capability is no exception. While aquaculture is recognised to have a critical role in future food production, its growth is 'framed' by other ocean users and community values and sentiment as much as market and demand trends.

Today, aquaculture's importance to the ocean economy is also shifting beyond just food production. It has an emerging role in restoration of coastal and marine ecosystems. While markets and innovation are further driving new sectors, like seaweed as a standalone and as a co-located venture. Investor and retailer benchmarking is demanding circular economy solutions and decarbonisation efforts.

These trends are driving diversification, innovation, productivity, and growth of the industry in Australia, and some states are opening waters and coastal areas through dedicated aquaculture planning regimes. However, new ocean space for acreage is patchwork, and the likelihood of operating in these new waters remains untested due to a suite of risks that must be overcome.

Considering the risks and costs associated with these acreage and capability challenges and the critical need to balance growth with existing users and natural ocean values, the Blue Economy CRC took the first step to introduce a new era of aquaculture into Commonwealth waters.

WHAT IS A BLUE ECONOMY ZONE?

- An identified open ocean acreage for research focused aquaculture and renewable energy activities with a 'gate' before any commercial operations are considered.
- Characterised by open ocean, higher energy, deeper waters, and stronger currents.
- Can contain single-species or multi-species offshore farm/s.
- Operations are characterised by advanced innovation, safety, scale and the integration of sustainability outcomes, including the use and or generation of renewable energy.

The challenge

There is no regulatory and planning basis for establishing aquaculture operations in Australian Commonwealth Waters. Operating in Commonwealth waters which is naturally a high energy profile at great distance from land, comes with risks, including needing to test current range of capabilities of infrastructure and operational approaches and to identify innovation that sits beyond current capabilities or available capital expenditure spend.

The opportunity

The development and road testing of a blueprint for open ocean aquaculture acreage and capability that reduces the current risks by defining and delivering best practice: policy, regulatory, planning, engagement, operational, innovation, infrastructure, sustainability, environmental monitoring and management, collaboration and aquaculture literacy.

The Achievements (to now)

Opportunity identified (2019)

Blue Economy CRC and participants identified that offshore expansion of aquaculture in Australia is limited by the regulatory environment

Broad area of interest identified (Mid 2020)

An area of research interest in Bass Strait identified using marine spatial planning data and commercial participant input.

Commenced baseline monitoring (Late 2020)

BEZ Baseline Phase I research project kicked off to collect physical data and run a seabed and mobile fauna survey within area of interest. Continued with BEZ Baseline Phase I research project.

Proposed research trial site identified (2021)

Project team identified a proposed research trial site within the board area of interest using baseline monitoring data, input from participants and other ocean users.

MOU Signed (September 2021)

The Australian and Tasmanian Government entered into a Memorandum of Understanding to support and deliver sustainable aquaculture research in Commonwealth waters adjacent to Tasmania, signing off on Australia's first Blue Economy Zone.

Public consultation on proposed research trial site (February 2022)

The Australian Government undertook community consultation on the proposed research trial site. This received 1352 responses and resulted in a reduction of the final fisheries arrangement area announced in April 2022.

Aquaculture Research Bill (March 2022)

The Tasmanian Government's Living Marine Resources Management Amendment (Aquaculture Research) Bill 2021 was passed by Parliament. This facilitates future research into offshore aquaculture in Commonwealth waters adjacent to Tasmania.

BEZ Research Series (June 2022)

The BE CRC commissioned a series of expert data analyses and reports including commercial fishing and seaweed.

Research Trial Site

A three-year research trial will take place within the designated research trial site in Commonwealth waters north of Burnie.

Through this research, the Blue Economy CRC is looking to work with industry, commercial, university and government Participants to test the capability of existing and new sustainable offshore aquaculture systems for finfish, while exploring opportunities for seaweed and shellfish.

The trial needs to consider: the examination of environmental conditions; environmental impacts are monitored and mitigated; wildlife impacts are monitored and mitigated effectively; assessment of economic viability of sustainable aquaculture in Commonwealth waters and potential benefits for the Tasmanian and local economies; further assessment of any impacts on other marine users; and assessment of the operational feasibility and suitability of open ocean aquaculture.

Research proposals approved for the trial are required to comply with all relevant Tasmanian and Commonwealth legislation, including the Commonwealth Environment Protection and Biodiversity Conservation Act 1999.

No research proposal has been put to the Government for approval yet. This is forecast to follow the release of the Tasmanian Government's Aquaculture Research policy guidance.

Source: haveyoursay.agriculture.gov.au/aquaculture-trial-site

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The conversation

Our purpose is to undertake research in promotion of growing Australia's blue economy led by sustainable aquaculture practices incorporating seaweeds, shellfish and finfish. We have been surveying baseline information off the north coast of Tasmania for over a year and have a good understanding of the physical, chemical and ecological characteristics of the area.

John Whittington
CEO, Blue Economy CRC

Enabling this research will allow us to fully examine the economic, environmental, and operational feasibility for aquaculture in these waters, and help inform the development of contemporary legislative frameworks to support future sustainable aquaculture in our oceans.

Jo Palmer
Tasmanian Minister for Fisheries

Focused research will provide the information we need to better understand the possibilities and potential benefits of aquaculture in deeper waters further offshore, and this approach may provide a template for a future national development of aquaculture in Commonwealth waters.

Jonathon Duniam
Former Federal Assistant Minister for Fisheries

RESEARCH PROGRAMS

The Blue Economy CRC has made significant progress in 2021-2022 towards meeting its objectives as outlined in its Strategic Plan and its agreed milestones. We have worked closely with our 43 industry, research and government participants to understand their objectives and priorities, and the current state-of-play for the industry.

The Blue Economy CRC completed five projects in 2021-22. Final reports were made available via the Blue Economy CRC Connect community platform and the website to the extent necessary to protect IP and commercial in confidence information provided by participants, edited versions of the reports are available online. (see past projects).

Nineteen projects are underway across the five research programs (see current projects).

Our research is focused on our Participant's needs, is environmentally and socially responsible, and is designed to have commercial impact. It delivers on national and international agendas focused on a sustainable blue economy including Australia's commitment to cut emissions and initiatives to protect our oceans, Australia's commitment to the High-Level Panel for a Sustainable Ocean Economy, Ocean Decade Australia, and the United Nations (UN) 2030 Agenda for Sustainable Development SDG 14.

Professor Irene Penesis
Research Director

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2021 – 2022

5 COMPLETED PROJECTS

19 PROJECTS UNDERWAY

2 UPCOMING PROJECTS APPROVED

Areas of R&D include:

- Development of new engineering designs that can address the specific needs for the aquaculture industry to operate in high-energy environments (e.g., robust salmon feed delivery systems, novel offshore fish pens, artificial reefs, codes of practice for aquaculture vessels, autonomous technologies for safer operations).
- Development of solutions to decarbonise industry (e.g., decarbonising offshore aquaculture systems and operations through the development of renewable energy feed barges, offshore wind, wave energy and hydrogen microgrids and green hydrogen production).
- Changing the ocean accounting to reflect the true value of the ocean / blue carbon' ecosystems through ocean carbon markets assessments and frameworks for environmental management accounts and reporting for the blue economy.
- Development of production systems for offshore kelp mariculture and investigating challenges and opportunities for the oyster industry in the blue economy.
- Goal-oriented ocean planning through integrated approaches to marine spatial planning, ethics, values and social (and cultural) licence to operate in the blue economy.
- Informing policy and regulatory reform for enabling offshore aquaculture, and offshore renewable energy infrastructure, in Commonwealth waters.

17

CONTRACTED MILESTONES ACHIEVED

68

MILESTONES IN PROGRESS

18

YET TO START

These projects have a lifetime value of $31.7M supported by a Blue Economy CRC cash contribution of $13M.

The major research and training achievements, the collaborations with industry and government and utilisation of the outputs undertaken in these projects are described in the Research Program updates below.

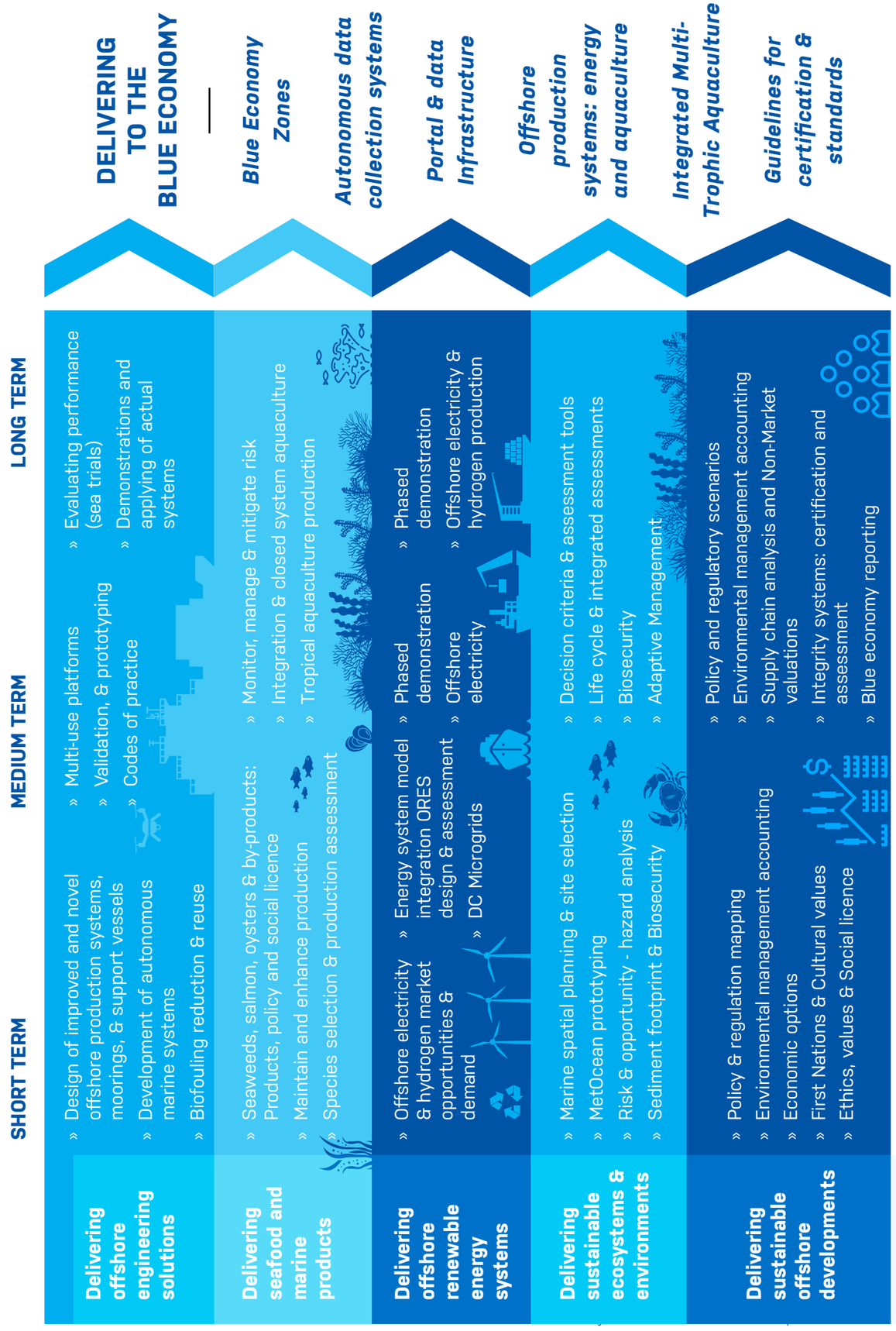
The Blue Economy CRC has approved 2 additional projects on offshore salmon and oyster production during this reporting period, with a Blue Economy CRC cash contribution of $1.24M and total project value of $3.55M. These projects will commence in Q1 2022-23. These projects will be complemented by others already underway and staged into the future to shape the overall research agenda.

The Blue Economy CRC continues to make progress against its research output obligations, with five additional Milestones completed during 2021-2022. The Blue Economy CRC has now completed 17 of its contracted milestones with a further 68 milestones currently in progress and 18 not yet scheduled to start. Drawing on the outcomes of its R&D activity over the last three years, the Blue Economy CRC will be undertaking a review of its milestones in the first half of 2022-23.

Each of the five Research Program Advisory Committees (RPAC) have met during this reporting period. These committees consist of an independent group of external experts who help guide and evaluate our research activity and review outcomes in order to increase the research impact and enhance the global integration of the Blue Economy CRC.

Thank you!

A warm thanks to all our participants, Research Executive Team, RPACs, Scientific Advisory Committee and Board for their resolve to work collaboratively to develop the Blue Economy CRC's research agenda.



Blue Economy CRC research and development plan

RESEARCH PROGRAMS

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 & TECHNOLOGY	PROGRAM 2: SEAFOOD & MARINE PRODUCTS	PROGRAM 3: OFFSHORE RENEWABLE ENERGY SYSTEMS	PROGRAM 4: ENVIRONMENT & 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.

Image courtesy of BMT

RESEARCH PROGRAM 1

Offshore Engineering and Technology

PROGRAM LEADER
Professor Chien Ming Wang
University of Queensland

DEPUTY PROGRAM LEADER
Dr Nagi Abdussamie
Australian Maritime College,
University of Tasmania

Research Program 1 had several major projects delivering results this year.

The *Developing a Robust Collar-Tie (1.20.006)* project, led by Dr Michael Heitzmann (UQ) produced – after extensive field testing - a prototype device capable of withstanding very high loads, and this design was patented in November 2021 (no. 2021903329).

The project is now focussed on the manufacture and deployment of the final prototype, in addition to preparing a manufacturing plan for a commercial product.

Akshay Krishna Ambika Harikumar (UQ) is undertaking his PhD scholarship as a part of the project *Developing a Robust Collar-tie (1.20.006)*.

He is investigating the tribological behaviour of fibre reinforced engineering thermoplastics and developing optimisation strategies for improving wear resistance of composite collar ties without sacrificing other composite properties.

So far, a comprehensive baseline characterisation of suitable materials has been conducted. Promising enhanced wear resistance properties have been obtained by using nano-clays as an additive in the composites. At the Blue Economy CRC Participants' Workshop held in Hobart in May 2022, Akshay was the runner-up in the 'Best Poster' award.

Dr Michael Heitzmann
University of Queensland

Akshay Krishna Ambika Harikumar
University of Queensland

Image courtesy of Dr Michael Heitzmann

The *MoorPower - Scaled Demonstrator (1.21.001)* project, led by Dr Alexandre Pichard (Carnegie Clean Energy) aims to design, install and operate a scaled prototype of MoorPower™ (a wave-powered barge) at Carnegie's private wave energy research facility in North Fremantle, Western Australia. The project commenced in October 2021 and has seen the completion of an environmental analysis at two high-energy locations to inform the device specifications. This process also took account of usage advice from industry partners, and potential manufacturers. In addition to the design of a prototype scale facility, work is also progressing on a commercial-scale version, including completion of extensive analysis to address a range of operational factors.

Dr Alexandre Pichard
Carnegie Clean Energy

Shujian Ma (UTAS) has been awarded a BECRC top-up for his PhD scholarship on *Wave Driven Compressed Air Energy Storage*, and this research project is an integral part of project *MoorPower – Scaled Demonstrator (1.21.001)*.

It aims to capture wave energy using compressed air energy storage technology. Shujian has developed a mathematical model which combined the hydrodynamic model for evaluating the dynamics of float and the thermodynamic model for evaluating the performance of the system.

The current model is being evaluated and a technical paper drafted.

Shujian Ma
University of Tasmania

The *Novel Offshore Fish Pen Design (1.21.002)* project, led by Prof Joerg Baumeister (GU) is developing the patented 'SeaDipper' and 'SeaFisher' conceptual designs (from a 2020 Scoping Study) to create safer, more efficient and affordable offshore fish pen structures.

An initial project workshop was held in May at the BECRC Participants' Workshop, with design parameters collected via detailed input from aquaculture industry partners.

On this basis, the project leader will initially focus on four different options for the 'SeaFisher' concept, followed by another round of industry consultation.

Prof Joerg Baumeister
Griffith University

For the *Robust Salmon Feed Delivery System (1.21.003)* project, Dr Rowan Paton of Advanced Composite Structures Australia is leading a team to help develop such systems for more exposed offshore sites.

The project commenced in March and Work Package 1 (examining the existing operating environment and challenges) was largely completed by 30 June. A review of the original project design concluded that three distinct phases of modelling for the system would be necessary.

The project team will also be focusing on the practicalities of monitoring alternative designs at offshore locations.

Dr Rowan Paton
Advanced Composite Structures Australia

Dr Simon Albert (UQ) is leading the project on *Enabling Autonomous Technologies for Aquaculture in Challenging Environments (1.21.004)*.

His research team will develop new methodologies utilising autonomous sensor networks and platforms to enhance the management of three existing oyster farming sites on the East Coast of Tasmania.

Simon Albert
University of Queensland

Dr Chris Shearer (BMT) heads the *Code of Practice for Aquaculture Vessels (1.21.005)* project. His research team is conducting a comprehensive review of existing standards to develop a new set of "Deemed to Satisfy" rules and regulations for offshore aquaculture vessels.

The Literature Review Report (the first Milestone) was prepared and issued, and planning for the Industry Engagement phase was commenced.

In addition, an initial meeting has been held with the Australian Maritime Safety Authority (AMSA) – the key regulatory entity in this field.

Dr Chris Shearer
BMT

Several other PhD Scholars and MPhil students are contributing to the Offshore Engineering and Technology research program and are progressing well with their research.

Nazhmiddin Nasyrlayev (UTAS) started his PhD on *Integrated Numerical Modelling Approach for Design of Offshore Aquaculture Structures (1.20.010)* under the supervision of Dr Ali Tolooiyan. In his project he is developing an integrated numerical modelling approach for design of offshore aquaculture structures. So far, he has done a literature review and skills acquisition for modelling the mooring line tension force for offshore fish pens. This project is a collaboration between UTAS, UWA, UQ and BMT.

Nazhmiddin Nasyrlayev
University of Tasmania

Thien Than Tun (AUT) started his PhD on *Energy-optimal control scheme for mobile robotic platforms in offshore aquaculture* under the supervision of A/Prof Loulin Huang.

He has completed a literature review on optimal control, aquaculture robots, modelling of unmanned/uncrewed underwater vehicles (UUVs), and environmental effects such as simplified hydrodynamic and hydrostatic forces. He made progress in generic dynamic modelling of UUVs and in identifying a suitable UUV platform and relevant technical parameters for the system.

He has published a conference paper that reviews the working environments and controller design for unmanned underwater vehicles in offshore aquaculture.

Thien Than Tun
Auckland University of Technology

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Avik Nandy (UQ) started his PhD on the *Use of Multispectral Imagery to Enhance Aquaculture Operations* under the supervision of Dr Simon Albert.

Hitherto, he has linked lab data collected from Bruny Island with the multispectral imageries to identify correlations, identified the challenges of using existing datasets from NOMAD (NASA bio-Optical Marine Algorithm Dataset) and IMOS Australia and automated image extraction process with part of cloud masking for Landsat 8/9 and Sentinel-2.

In the Blue Economy CRC Participants' Workshop held in Hobart in May 2022 Avik was awarded both the best poster award and the best presenter award.

Avik Nandy
University of Queensland

Mingyuan Ma (GU) started his PhD in *Hydroelastic analysis of offshore fish net cages under wave action* under the supervision of Prof Hong Zhang.

He is developing a semi-analytical approach for hydrodynamic analysis of open net fish pens under wave and current actions. He has made excellent progress in his PhD research and has published two journal papers and two conference papers based on his research findings.

Mingyuan Ma
Griffith University

Robert Tullberg (UQ) started his MPhil on *Offshore Seaweed and R-E Farms: Solutions for Integration and Co-location* under the supervision of Prof Chien Ming Wang. This project will develop novel solutions for integrating and co-locating offshore seaweed and renewable energy farms in Australia, in a collaboration between University of Queensland, the Climate Foundation and the offshore wind industry.

He has just published a review paper in the Journal of Marine Science and Engineering. This project has the potential to provide solutions that reduce capital and operating costs for sustainable seaweed cultivation in offshore environments to provide high-value products for export or domestic uses, while generating clean energy and contributing to mitigating carbon emissions.

Robert Tullberg
University of Queensland

RESEARCH PROGRAM 2

Seafood and Marine Products

PROGRAM LEADER
Professor Chris Carter
Institute of Marine and Antarctic Studies, University of Tasmania

DEPUTY PROGRAM LEADER
Professor Lindsey White
Auckland University of Technology

Our involvement in seaweed research is evolving and in the last year we have made a significant commitment to the development of offshore seaweed aquaculture.

Research Program 2 commissioned several major projects this year that will deliver industry-relevant outcomes and progress the BE CRC's research agenda.

The Climate Foundation and Southern Ocean Carbon Company have joined the Blue Economy CRC as participants. This has led to the development of a large general project to investigate various aspects of offshore seaweed cultivation to start in 2022-23.

Associate Professor Jeff Wright is the project leader of *Creating Opportunities for Bull Kelp Aquaculture (2.21.003)*, a general project extending from April 2022 to March 2026.

Following the *Kelp Aquaculture Scoping Study (2.20.001)*, bull kelp *(Durvillaea spp.)* was identified as a strong option for offshore cultivation as:

a) its natural habitat is high energy environments,

b) it has a very high alginate content, and

c) it could have potential to attenuate offshore sea conditions and potentially protect other offshore assets such as finfish farms. But the basic biological information required for its cultivation (reproduction, early lifecycle development and growth, hatchery methods and grow-out requirements) are not known, representing a significant knowledge gap for developing a bull kelp aquaculture industry.

This project will fill this knowledge gap. Once these hatchery methods are optimised, it will provide the basis to develop bull kelp cultivation as part of the BE CRC and the emerging Australasian seaweed industry.

Associate Professor Jeff Wright
University of Tasmania

There has been major activity with both the Australian and New Zealand salmon industry through development of research projects that will be started in the next 12 months.

Two industry partners, Tassal and Huon Aquaculture are collaborating with IMAS and CSIRO to support Atlantic salmon selective breeding program research on improving translation of experimental results into commercial situations.

In New Zealand, our participants New Zealand King Salmon and Cawthron Institute are working together with the University of Tasmania to investigate pin bones and skeletal form.

A new PhD project led by Dr Gianluca Amoroso is addressing *Skeletal Development in King Salmon, With an Emphasis on Intermuscular (pin) Bones Abnormalities (2.21.004).*

The project extends from 2022 to 2025. Poor skeletal health and deformities can pose a serious risk to the expected expansion of salmonids aquaculture into offshore and high energy farming environments which require fish with a robust skeletal system. Apart from impacting on welfare and performance of fish, deformities impact on final product processing efficiency and lead to increase in downgrade.

The goal of this project is to better understand pin bone development and abnormalities (and their link with spinal deformity) observed in fish as a reasonable proxy for assessing overall skeletal health. It will contribute to ensuring hatchery production of offshore-ready King salmon.

Leteisha Prescott (UTAS) **has joined the program as a PhD Student supervised by Prof Chris Carter. Her research focuses on *The Effects of Sustained Swimming on Long-term Changes to Chinook Salmon Form and Composition (2.20.003).***

Long-term exercise training improves swimming performance and aerobic scope in Chinook salmon, while swimming performance in fish with slight spinal deformity is compromised. Following exhaustive exercise, fish with slight spinal deformity require more time and oxygen to recover.

Long-term exercise training reduces visceral fat content and fat across the entire body, while slight spinal deformity increases protein content within whole-fillet regions.

Removal of pin bones from Chinook / King salmon by BE CRC PhD Student Leteisha Prescott

Brett Bolte (GU) started his PhD on *Exploiting filter feeding bivalves as a natural sampling platform (4.20.009)* under the supervision of Dr Carmel McDougall in a collaboration between Griffith University and CSIRO.

His project aims to exploit filter feeding bivalves as a natural eDNA sampling medium to determine the presence of some of the most crucial pathogens, including algal and bacterial blooms and parasites such as amoeba, in the Tasmanian aquaculture industry.

Specifically, this study aims to provide a more cost effective and continuous monitoring method for disease identification and potentially prevention of large-scale outbreaks.

Brett Bolte
Griffith University

Robin Cappaert (UTAS) started his PhD studying the *Influences on Composition and Ecology of Biofouling Communities Associated with Salmon Aquaculture (4.20.008)* under the supervision of Dr Camille White (UTAS).

His project aims to introduce novel ways for the Tasmanian salmon industry to better monitor and assess the biofouling pressures at certain times of the year and at specific sites. These monitoring systems can draw inspiration from other industries to provide a more holistic view on the issues of marine biofouling.

Robin Cappaert
University of Tasmania

RESEARCH PROGRAM 3

Offshore Renewable Energy Systems

PROGRAM LEADER
Professor Evan Gray
Griffith University

DEPUTY PROGRAM LEADER
Dr Kosala Gunawardane
Auckland University of Technology

DEPUTY PROGRAM LEADER
Dr Jana Orszaghova
University of Western Australia

Image courtesy of Saitec Offshore

Research Program 3 had several major projects delivering results this year.

In July 2021, the Blue Economy CRC released a new report on *The Offshore Wind Potential for Australia (3.20.007)* which evaluated the feasibility and potential of offshore wind to contribute to Australia's energy needs and identifies barriers to its large-scale development.

More than 2,000 GW could potentially be installed within 100km of current substations and excluding environmentally restricted and low wind areas – far in excess of total current electricity generation.

The project led by Dr Mark Hemer, CSIRO, brought together expertise from Australia's National Science Agency, 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.

This project was a critical piece of information in the advances of the legislation for offshore renewable energy in Australia (see Highlights section for more details).

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

Dr Eloise Wilson (UTAS) led the OES Study on the *Energy Requirements of Offshore Aquaculture as a Market for Ocean Energy (3.21.001)* that took place from July 2021 until April 2022. This completed project assessed the potential of aquaculture as a market for ocean renewable energy.

While the primary focus was offshore aquaculture, the project report also includes information from projects related to on-shore and nearshore aquaculture.

The technical attributes for relevant renewable energy technologies were considered in relation to aquaculture in several key countries. Case studies were built from current and potential projects that have successfully implemented or could implement renewable energy sources, to meet the energy demands of aquaculture operations. Opportunities and challenges for co-location of ocean renewable energy and offshore aquaculture were identified.

Prof Evan Gray (GU) is the project leader of *DC microgrids for offshore applications (3.20.004)*. This project started in September 2020 and will finalise in August 2023. This ongoing project targets the feasibility of deploying DC microgrids in a marine environment, for instance at an aquaculture installation or on an island.

The core undertaking is to build and operate a bench-scale (approx. 10 kW) DC microgrid that includes physical battery energy storage and emulated (by means of programmable power supplies) desalination, electrolyser and fuel cell, with software-emulated hydrogen storage.

Progress has been impacted by Covid and ensuing supply-chain issues affecting procurement, but all the major components (programmable power supplies, programmable load, batteries, DC/DC converters) are to hand and construction of the microgrid is currently underway.

PhD student Neil Salam has been working under this project in collaboration with *Optimal group, Pitt & Sherry and UTAS (GU)*. Richard has been participating in the building of the microgrid and has developed a review paper.

He will soon start his experiments, once the microgrid is operational in the laboratory.

The project *Seeding Marine Innovation in WA with a Wave Energy Converter Deployment in Albany (3.21.004)* led by Dr Hugh Wolgamot (UWA), started in December 2021 and will finalise in April 2024.

This new project will demonstrate wave energy's potential to power the aquaculture industry and enable an ecosystem of other surrounding activities including development of a test site/market demonstrator and academic research in multiple fields and institutions.

A prototype version of the M4 (short for 'Moored Multi-Modal Multibody') Wave Energy Converter will be deployed in King George Sound, Albany, funded by the CRC, WA Department of Primary Industries and Regional Development and University of Western Australia.

Dr Hugh Wolgamot
University of Western Australia

Image courtesy of Star of the South

FOREWORD | HIGHLIGHTS & ACHIEVEMENTS | CASE STUDIES | **RESEARCH PROGRAMS** | RESEARCH PROJECTS | EDUCATION & TRAINING | GOVERNANCE | FINANCIALS

Dr Alexandre Pichard (Carnegie Clean Energy) is currently leading the *Mooring Tensioner for WECs – MoTWEC (3.20.006)* project featured on our case studies. The goal of this ongoing project is to deliver a reliable, cost-effective mooring tensioner design, suitably verified for application to real Wave Energy Converter systems.

Dr Alexandre Pichard
Carnegie Clean Energy

It is expected that successful delivery of the mooring tensioner design and testing will lead to a step-change in the levelized cost of electricity for WECs, supporting lower cost of energy supply to the land-based electricity grid, offshore platforms and aquaculture sites.

The detail design of the 1/5th test-scale tensioner has been completed. CAD models have been finalised, drawing prepared and finite element analyses completed to verify that the stresses in the spring elements and steel fittings are within acceptable limits.

A fatigue testing rig is being constructed, culminating in a report detailing the design of the full-scale and test-scale tensioners and fatigue testing rig. A method for the manufacture of composite spiral spring elements has been developed and manufacturing trials on the spring elements are being conducted. A Provisional Patent covering the mooring tensioner arrangement developed under this project has been filed.

PhD student Richard Cai is working under this project and has produced a literature review of composite mooring tensioning applications that has been submitted to the Journal of Marine Science and Engineering for publication.

RESEARCH PROGRAM 4

Environment and Ecosystems

PROGRAM LEADER
Professor Chris Frid
Griffith University

DEPUTY PROGRAM LEADER
Dr Remo Cossu
University of Queensland

Following the review of the research plan in 2021, this year has been one full of significant progress with some key projects delivering and a number of new starts in areas that will address important areas of the Blue Economy CRC mission.

In July 2021, the Blue Economy CRC released a new report on *The Offshore Wind Potential for Australia (3.20.007)* which evaluated the feasibility and potential of offshore wind to contribute to Australia's energy needs and identifies barriers to its large-scale development.

Dr Kylie Pitt has developed the project *Advanced Monitoring to Maximise Fish Welfare in Offshore Aquaculture (4.21.001)* that is developing advanced artificial intelligence and self-learning tools to monitor fish health in offshore sites.

This approach is key to reducing the exposure to risk of staff in hostile offshore locations and delivering better welfare outcomes for the stock.

Dr Kylie Pitt
Griffith University

A major project on *Marine Spatial Planning for a Blue Economy (4.21.002)* under the leadership of *Prof Chris Frid (GU)* has started. Working with key industry, societal and government agencies this project will develop a framework for managing blue economy activities in Australia's marine estate.

The project seeks to develop approaches that ensure sustainable development and unlock economic benefits while offering equitable access and transparent processes.

This project provided extensive engagement beyond the project partners with state and federal government agencies, including NOPSEMA, DAF, DCEEW, AMSA, GA, Parks Australia and internationally (Marine Management Agency, UK and DFO, Canada).

Images courtesy of Marta Ribo (AUT)

During this year we have seen some of the first results of *A Novel Approach to Measuring the Depositional Footprint of the Blue Economy (4.20.004),* an ongoing project led by Prof Kay C. Vopel (Auckland University of Technology).

This project examines the assumption that the movement of aquaculture offshore waters will increase the horizontal dispersion of organic farm wastes and reduce the impacts on seafloor ecosystems.

This project is developing a protocol for assessing the depositional footprint of aquaculture systems operating in deep offshore waters, and it will conduct laboratory experiments to investigate the mineralisation of organic farm waste at the surface of deep-water sediment as a function of waste quality, quantity and sediment properties and biological assemblages.

The project will then critically evaluate and improve the parameterisation of sediment-seawater solute fluxes in ecosystem models and decision support tools used to assess blue economy activities. This year, the first lander deployment trials revealed suitable operational procedures for the safe deployment and recovery. A preliminary inspection of the data revealed a general agreement between eddy covariance and chamber data and a high quality of the chamber oxygen time series.

The Risks and Opportunities for the Blue Economy (4.20.006) **project led by Dr Beth Fulton (CSIRO) has recently finalised.**

This project has used extensive consultation with experts from emerging offshore sectors to understand the main risks posed to their development and their interactions with the environment and other sectors.

These analyses are available as risk matrices for further utilisation by regulators, planners and economic facilitators.

The project developed a legacy interface available to users online to evaluate different risks in an interactive manner.

As part of the support from the Blue Economy CRC to establish a new Blue Economy Zone (BEZ) for R&D on Bass Strait, offshore Burnie, a promising area of approximately 165km by 50km was identified in the southern-central region of Bass Strait.

The initial desktop site characterisation developed in 2020 and focused on readily available data was followed by an in-depth survey in 2021-2022. ***The Baseline Survey of the Blue Economy Zone (Phase II) (CRC.21.002)*** **led by Dr Remo Cossu, provided findings about ocean data (waves, currents, wind) as well as the benthic habitat and fisheries.**

The data have been analysed and will now be used to feed into discussions and developments for upcoming R&D activities in this zone.

Aaron Hibberd (UTAS) started his PhD in *Advances in benthic-pelagic solute flux modelling in marine environments* under the supervision of Dr Scott Hadley.

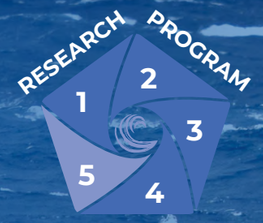
His project will contribute to quantifying coastal marine seafloor ecosystem functioning under proposed offshore aquaculture activities. Outcomes from his project can inform government and industry on appropriate site selection and monitoring techniques for offshore aquaculture.

This project is developed in collaboration with Tassal and CSIRO.

Adam Hibberd
IMAS, University of Tasmania

RESEARCH PROGRAM 5

Sustainable Offshore Developments



PROGRAM LEADER
Professor Marcus Haward
Institute of Marine and Antarctic Studies, University of Tasmania

DEPUTY PROGRAM LEADER
Associate Professor Ki-Hoon Lee
Griffith University

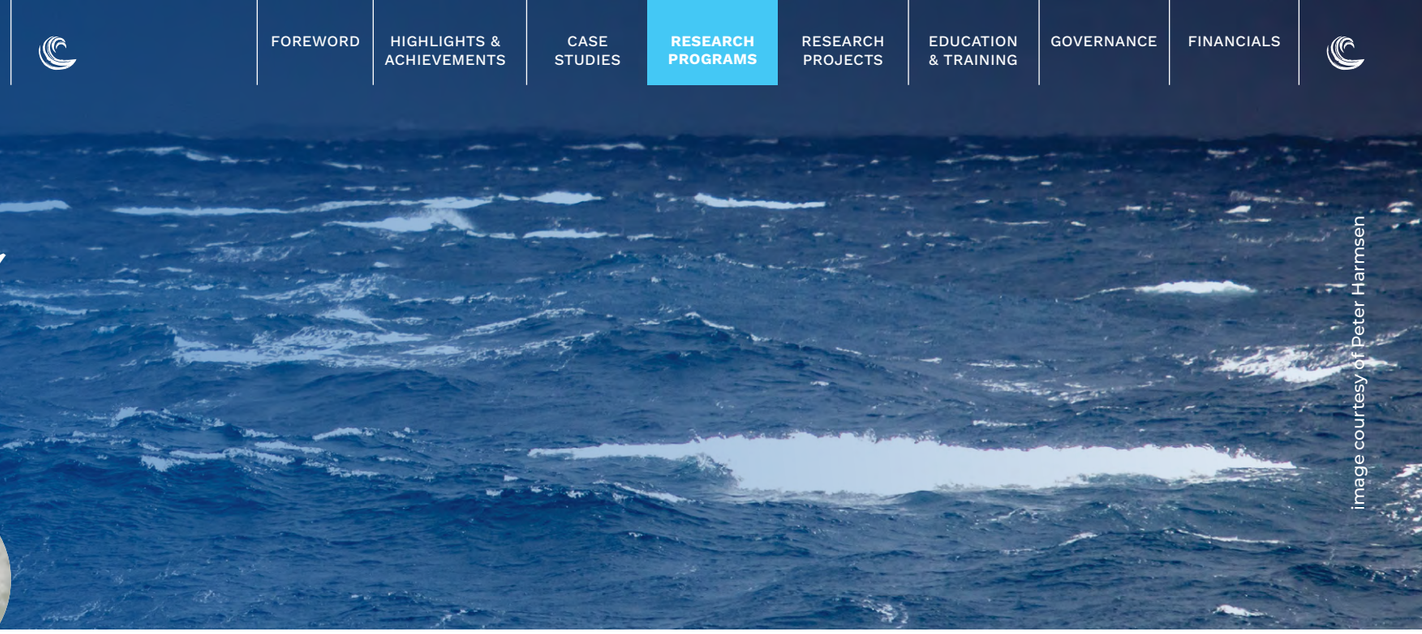


image courtesy of Peter Harmsen

This past year saw significant research activity undertaken in RP5.

The Environmental Management Accounting (EMA) **and** *Integrated Reporting for Blue Economy (5.21.001) project* **led by Prof Ki-Hoon Lee (GU) and the** *Cultural Licence to Operate in the Blue Economy (5.20.006) project* **led by Dr Cass Hunter (CSIRO) were established this year and provide key research contributions on applied and foundational research that can be utilised across the CRC.**

Both projects have a mix of established CRC partners and third parties, and importantly both are focused on emerging Australian government policy objectives.

Environmental Management Accounting research aims to develop innovative environmental management accounting, ocean accounting and integrated reporting across economy, society, and environment. Work on cultural licence to operate in the blue economy aims to assist in addressing the key challenge of shifting the industry sector from transactional participation through to transformational participation from authentic and relational foundations of consensus building alongside First Nation Peoples.

Chandima Jeewanthi Hapu Achchige also started her PhD at Griffith University on *Integrating Sustainability Strategy Within Environmental Management Accounting and Control: Towards Sustainability Management Accounting and Control* under the supervision of Prof Ki-Hoon Lee.

The Mapping and Analysis of Blue Economy Policy and Legislative Arrangements (5.20.007) project led by *Dr Pedro Fidelman (UQ)* was completed in October 2021 and has provided a relevant framework for CRC partners, the aquaculture and offshore renewables sectors and governments.

This project addressed the need for improved knowledge of the existing policy and legislative arrangements to reduce uncertainty in relation to where, what, when, how and by whom, blue economy activities are possible.

The project used cross-sector analyses to identify gaps and overlaps likely to impact on blue economy activities. The production of a searchable online database of such policy and legislative arrangements is already assisting industry, researchers and government in their decision-making and planning.

Dr Sebastian Leuzinger
Auckland University of Technology

The Ocean Carbon Markets in Australia and New Zealand (5.21.003) project led by Dr Sebastian Leuzinger (AUT) was a scoping project developed in 2021-22. This project produced a strategic assessment of ocean carbon markets and the role of the Blue Economy CRC in ocean carbon investment opportunities.

The project defined blue (ocean) carbon and methodologies associated, analysed the market size and risks, provided an overview of investment models and defined opportunities and the role of the Blue Economy CRC in these markets.

Multiple organisations were engaged in this project to provide a wholistic approach of participants and other key stakeholders in the sector. The results of this study showed that Australia's and New Zealand's blue economy participants are well placed to take advantage of their access to the natural capital of the ocean in the immature but emerging global ocean carbon markets.

The project Identifying the *Potential of Floating Artificial Benthic Ecosystems to Underpin Offshore Development (5.21.002)* is providing an assessment of current state of knowledge that will deliver a strategic roadmap to assist BE CRC research activities over the next 4-7 years.

Following on the scoping project Integrating *Blue Economy Governance Integrity Research (5.20.002)* led by Prof Charles Sampford (GU), a new general project, *Ethics, values, and social licence in the Blue Economy (5.20.005)* under the same leader kept advancing to deliver practical ethical guidance to blue economy decision-makers, empowering them to realise the values justifying their activities.

Prof Charles Sampford
Griffith University

The project explores ethical theories, declarations on corporate social responsibility, aspirational declarations and vision statements, values, perspectives and practices in the blue economy and local stakeholders' values and expectations.

The project will produce a world-first account of the ethical values at stake in the blue economy.

This year, the project has focused on how industries can consider, prioritise and implement the values justifying their operations to the communities in which they operate and hence providing a social license to operate.

The project is developing key outputs that help industry partners inform funders, boards and communities to secure the social license to operate in new environments.

Research Program 5 is continuing to develop its PhD program. There are also opportunities for PhD students in partner Universities, working in relevant areas to investigate opportunities for linkages with the program and the broader BE CRC.

Kelly Hoareau started her PhD under the supervision of Prof Marcus Haward (UTAS) on *Science, Technology and Decision-making in the blue economy: Addressing knowledge gaps (5.20.008)*. In this project, she will explore decision-making for blue economy programs, focusing on how the science-policy gap can be minimised or closed.

Kelly's project includes BMT as an industry partner, allowing for the Blue Economy CRC's distinctive industry-based PhD training program to address the needs of candidates, partners and the broader community.

Kelly Hoareau
IMAS, UTAS

Amara Steven also started her PhD on Responses to Risk: Blue Economy Explorations Using Behavioural Economics (5.20.009) under the supervision of Prof Darla Hatton MacDonald (UTAS).

The purpose of this project is to use behavioural economics approaches to explore and analyse the perceptions and trade-offs people are willing to make in order to expand the Blue Economy. In particular, the project will explore what shapes up ideas of risk and what can be done to manage risk. This work will provide a deep understanding of the factors underpinning decision-making and perceptions of what is an acceptable management of risk.

These insights will contribute to understanding appropriate policy and institutional arrangements to manage these risks and ensure societal objectives are met by future blue economy relevant policies.

Amara Steven
University of Tasmania

RESEARCH PROJECTS

CURRENT 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

Project Duration: 36 Months

Start Date: June 2020

1.21.001
Moorpower™ – Scaled Demonstrator

Lead Organisation: Carnegie Clean Energy

Project Leader: Alexandre Pichard

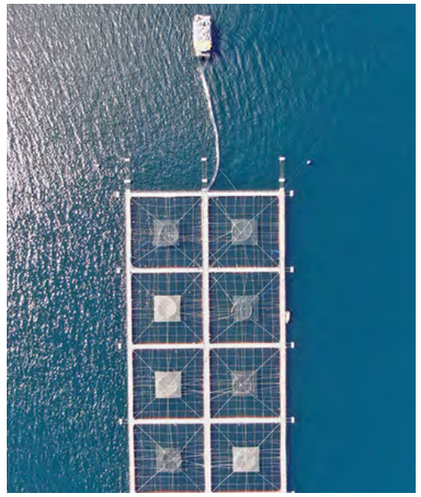
Blue Economy CRC Participant Organisations Involved: Advanced Composite Structures Australia, Carnegie Clean Energy, Climate KIC Australia, DNV Australia, Huon Aquaculture, Tassal Group, University of Queensland, University of Tasmania

Third Party Participant: AMC Search

Project Duration: 39 months

Start Date: September 2021

1.21.002
Novel offshore fish pen design: phase 1 (conceptual development)



Lead Organisation: Griffith University

Project Leader: Joerg Baumeister

Blue Economy CRC Participant Organisations Involved: Auckland University of Technology, Cawthron, DNV Australia, Griffith University, Huon Aquaculture, SINTEF, Tassal Group, TCOMS, University of Chile, University of Queensland, University of Tasmania

Project Duration: 24 months

Start Date: January 2022

1.21.003
Robust salmon feed delivery systems

Lead Organisation: Advanced Composite Structures Australia

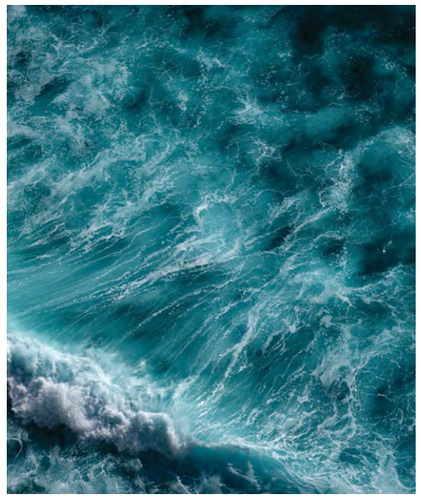
Project Leader: Rowan Paton

Blue Economy CRC Participant Organisations Involved: Advanced Composite Structures Australia, Griffith University, Pacific Engineering Systems International, Tassal Group, University of Tasmania

Project Duration: 42 months

Start Date: February 2022

1.21.004
Enabling autonomous technologies for aquaculture in challenging environments



Lead Organisation: University of Tasmania

Project Leader: Guy Williams

Blue Economy CRC Participant Organisations Involved: Griffith University, Huon Aquaculture, Oysters TAS, Southern Ocean Carbon Company, Tassal Group, University of Queensland, University of Tasmania

Project Duration: 42 months

Start Date: April 2022

1.21.005
Code of practice for aquaculture vessels

Lead Organisation: BMT

Project Leader: Chris Shearer

Blue Economy CRC Participant Organisations Involved: BMT, DNV Australia Pty Limited, Oysters TAS, Tassal Group, University of Queensland, University of Tasmania

Project Duration: 24 months

Start Date: March 2022

2.21.003
Creating opportunities for bull kelp aquaculture

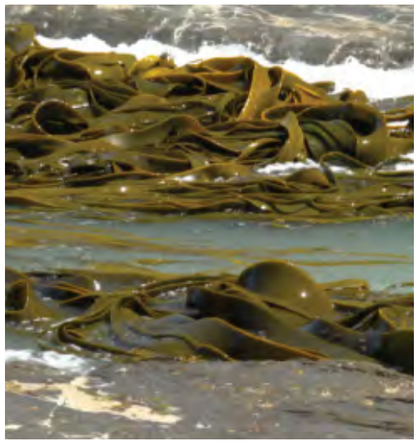
Lead Organisation: University of Tasmania

Project Leader: Jeff Wright

Blue Economy CRC Participant Organisations Involved: Auckland University of Technology, Cawthron, Southern Blue Reef, University of Tasmania

Project Duration: 48 months

Start Date: March 2026



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, Pitt & Sherry, University of Tasmania

Project Duration: 36 Months

Start Date: June 2020

3.20.006
Mooring tensioner for WECS - MoTWEC

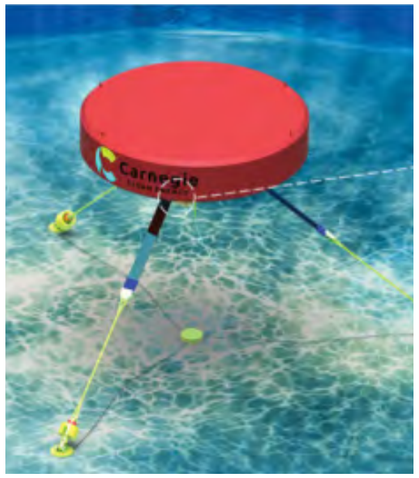
Lead Organisation: Carnegie Clean Energy Limited

Project Leader: Alexandre Pichard

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

Project Duration: 36 Months

Project Status: October 2020



3.21.004
Seeding marine innovation in SW WA with a WEC deployment in Albany

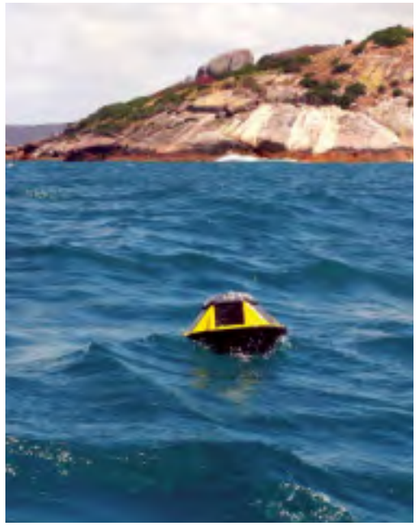
Lead Organisation: University of Western Australia

Project Leaders: Christophe Gaudin and Hugh Wolgamot

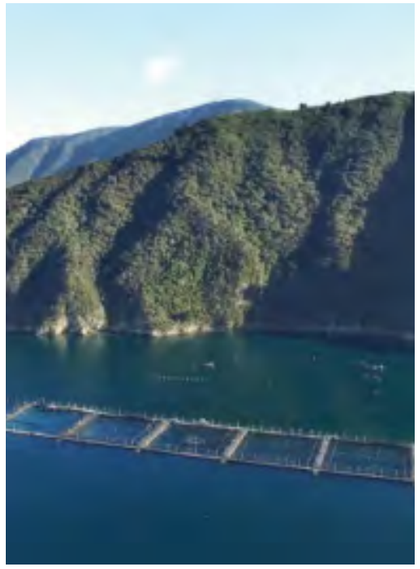
Blue Economy CRC Participant Organisations Involved: BMT, Climate KIC Australia, Huon Aquaculture, University of WA, University of Queensland, University of Tasmania

Project Duration: 30 months

Start Date: September 2022



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, East China Sea Fisheries Research Institute, Chinese Academy of Fishery Sciences, Auckland University of Technology

Project Duration: 36 Months

Start Date: January 2021

4.21.001
Advanced monitoring to maximise fish welfare in offshore aquaculture

Lead Organisation: Griffith University

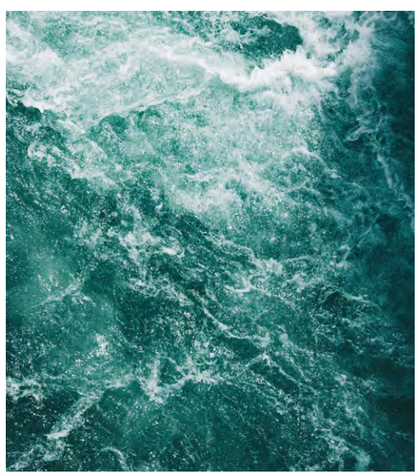
Project Leader: Kylie Pitt

Blue Economy CRC Participant Organisations Involved: Griffith University, Huon Aquaculture, Petuna Aquaculture, Tassal Group, University of Tasmania

Project Duration: 42 months

Start Date: April 2022

4.21.002
Marine spatial planning for a blue economy



Lead Organisation: Griffith University

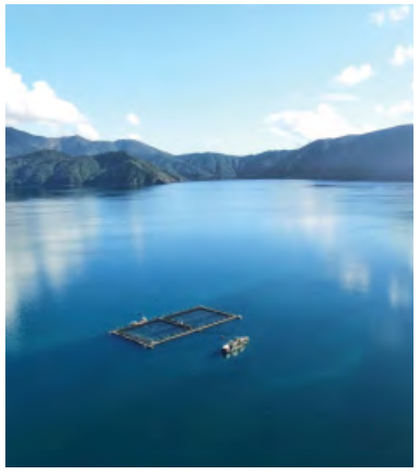
Project Leader: Chris Frid

Blue Economy CRC Participant Organisations Involved: BMT, CSIRO, Ghent University, Griffith University, Huon Aquaculture, Petuna Aquaculture, Southern Ocean Carbon Company, Tasmanian Government, Tassal Group, University of Queensland, University of Tasmania

Project Duration: 42 months

Start Date: March 2022

5.20.005
Ethics, values and social licence in the blue economy



Lead Organisation: Griffith University

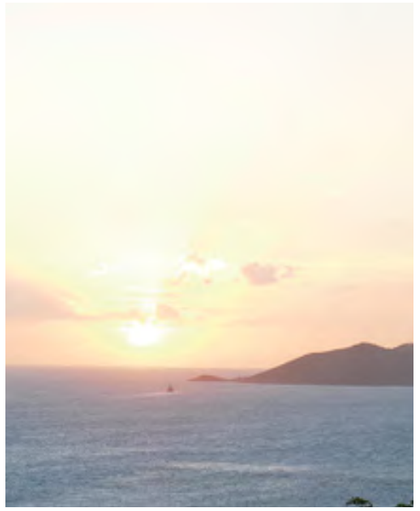
Project Leader: Charles Sampford

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

Project Duration: 36 Months

Start Date: November 2020

5.20.006
Cultural licence to operate in the blue economy



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

Project Leader: Cass Hunter

Blue Economy CRC Participant Organisations Involved: CSIRO, Plant & Food Research NZ

Third Party Participants: Wai Communications, Swinburne University of Technology

Project Duration: 18 months

Start date: February 2022

5.21.001
EMA & integrated reporting for the blue economy

Lead Organisation: Griffith University

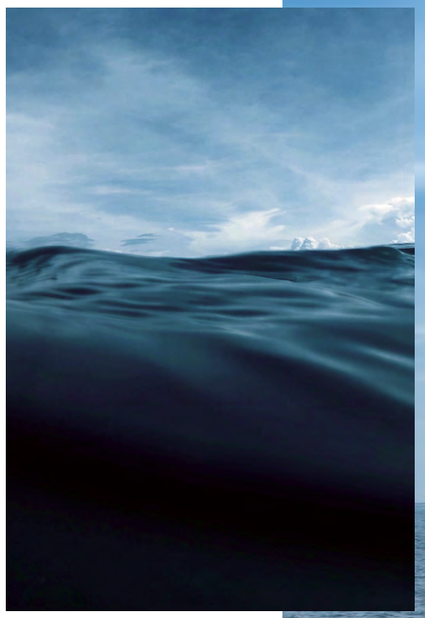
Project Leader: Ki-Hoon Lee

Blue Economy CRC Participant Organisations Involved: CSIRO, Griffith University, Oysters TAS Tasmanian Government, Tassal Group

Project Duration: 36 months

Start Date: November 2021

5.21.002
Identifying the potential of floating artificial benthic ecosystems to underpin offshore development



Lead Organisation: University of Tasmania

Project Leader: Marcus Haward

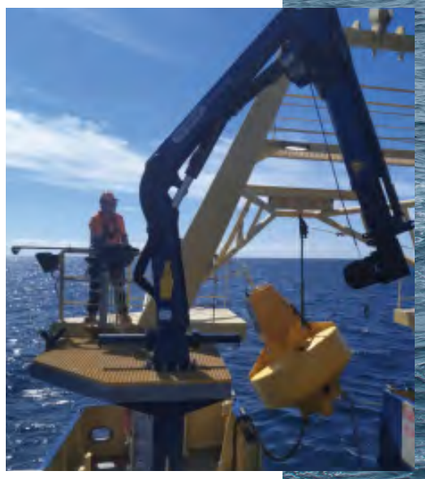
Blue Economy CRC Participant Organisations Involved: University of Tasmania, Southern Blue Reef, Macquarie University, Oysters TAS, Tasmanian Government, Smartcrete CRC, Climate Foundation Australia, Southern Ocean Carbon Company, Auckland University of Technology

Third Party Participant: De Blauwe Cluster VZW

Project Duration: 8 months

Start Date: February 2022

CRC.21.002
Baseline survey of the blue economy zone (Phase II)



Lead Organisation: University of Queensland and Griffith University

Project Leader: Remo Cossu and Chris Frid

Blue Economy CRC Participant Organisations Involved: CSIRO, Griffith University, Tassal Group, University of Queensland, University of Tasmania, Xylem

Project Duration: 9 months – extended to 31 July 2022

Start Date: April 2021

CRC.22.001
2022 Tasmanian Salmon Symposium

Lead Organisation: Blue Economy CRC

Project Leader: John Whittington

Blue Economy CRC Participant Organisations Involved: Blue Economy CRC and Tasmanian Government

Project Duration: 5 months

Start Date: April 2022

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Image courtesy of Sabella

COMPLETED PROJECTS

3.21.001
OES Study on the energy requirements of offshore aquaculture as a market for OE

Lead Organisation: University of Tasmania

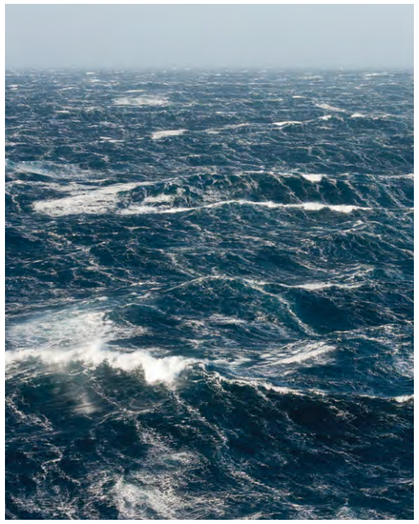
Project Leader: Eloise Wilson

Blue Economy CRC Participant Organisations Involved: University of Tasmania, OceanPixel, University of Chile

Third Party Participants: Pacific Northwest National Laboratory, Aquatera

Project Duration: 9 months

Completed Date: April 2022



4.20.006
Risks & opportunities for the blue economy

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

Project Leader: Beth Fulton

Blue Economy CRC Participant Organisations Involved: BMT, Carnegie Clean Energy, Cawthron, CSIRO, DNV Australia, Griffith University, Huon Aquaculture, Macquarie University, New Zealand King Salmon, OceanPixel, Oysters TAS, Pacific Engineering Systems International, Petuna Aquaculture, Sabella SA, Saitec, Tasmanian Government, University of Queensland, University of Tasmania

Project Duration: 18 months

Completed Date: May 2022

5.20.007
Mapping and analysis of blue economy policy and legislative arrangements

Lead Organisation: University of Queensland

Project Leader: Pedro Fidelman

Blue Economy CRC Participant Organisations Involved: BMT, Tasmanian Government, University of Queensland, University of Tasmania

Project Duration: 12 months

Completed Date: August 2021

5.21.003
Ocean carbon markets in Australia and New Zealand

Lead Organisation: Auckland University of Technology

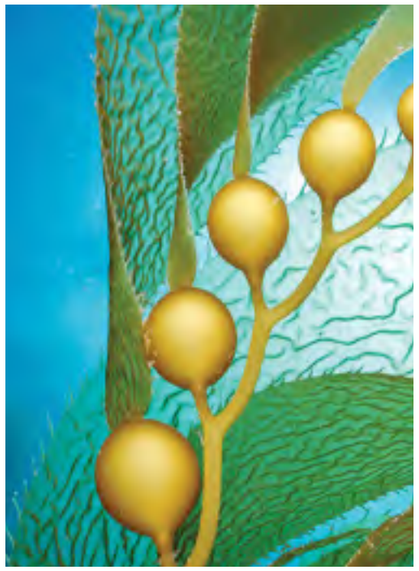
Project Leader: Sebastian Leuzinger

Blue Economy CRC Participant Organisations Involved: Auckland University of Technology, Carnegie Clean Energy, Climate Foundation, Climate KIC Australia, CSIRO, Saitec, Southern Ocean Carbon Company, Tasmanian Government, University of WA, University of Tasmania

Third Party Participants: OCT Emissions, Kelp Blue

Project Duration: 5 months

Completed Date: March 2022



CRC.20.001
Developing a framework for a blue economy zone

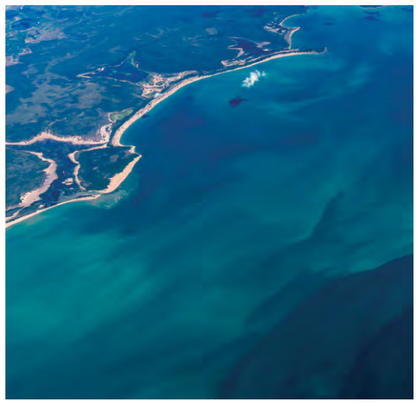
Lead Organisation: University of Queensland

Project Leader: Philip Marsh

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

Project Duration: 6 months

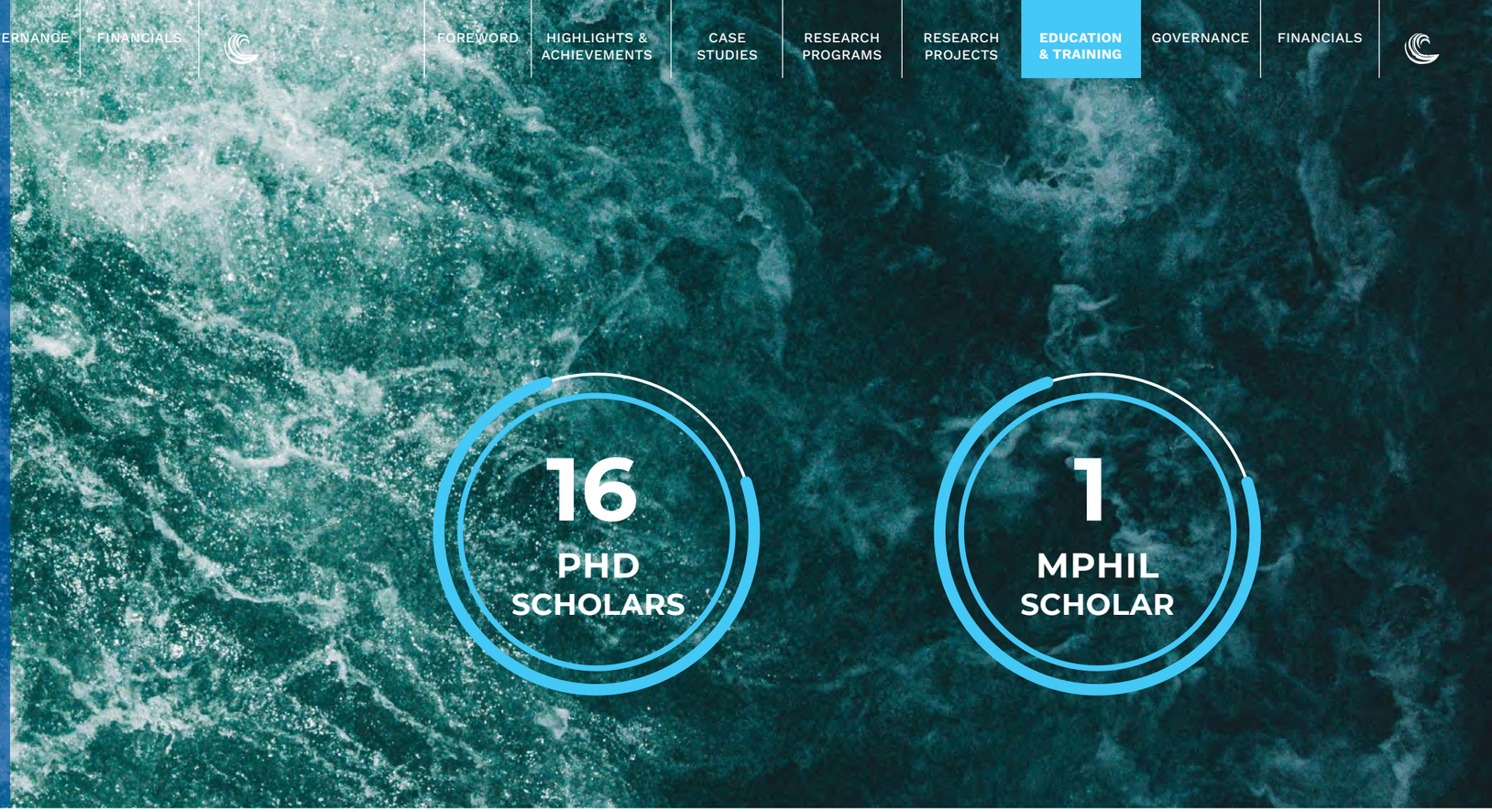
Completed Date: August 2021



EDUCATION & TRAINING

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 a range 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 blue economy industries and develop detailed cross-disciplinary knowledge.



PhD Scholars Program

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 Blue Economy CRC is aiming to deliver approximately 50 PhD graduates over its lifetime. Since early 2020, new PhD scholarships have been awarded as part of general projects, and these scholarships have continued to be a feature of such projects funded through the past two financial years. At the end of the 2021-22, seven additional PhDs students had commenced research within general projects, with several others due to start in the first Quarter of 2022-23.

A significant number of PhDs and MPhil scholarships have also been awarded through the funding of stand-alone PhD projects. At the end of the 2021-22, five additional PhDs (and one MPhil) commenced stand-alone scholarship projects.

The Blue Economy CRC is aiming to deliver approximately 50 PhD graduates over its lifetime.

In addition, funding has been formally confirmed for several scholarship applicants that are due to commence PhDs in the initial months of 2022-23. Over the next year, the intention is that PhDs will continue to be awarded either through general projects, or stand-alone scholarships assessed on a case-by-case basis.

As of June 2022, the Blue Economy CRC has 16 PhD Scholars and 1 MPhil Scholars (shown in the table below).

The 2022 BE CRC participants Workshop included a showcasing of the BE CRC's PhD program, with most of the PhD cohort (and some additional PhDs undertaking relevant research at participant universities) presenting a poster depicting their thesis topic. Workshop attendees had several opportunities to talk directly with the PhDs about their research, and then lodge votes for the awarding of prizes for: (1) best poster; (2) best presenter, with the winner (in both cases) Mr Avik Nandy from the University of Queensland then making a short presentation at the workshop.

A number of the PhD Scholars were sponsored by the Blue Economy CRC to attend the 2021-22 Collaborate-Innovate Conference held by Cooperative Research Australia.

The Blue Economy CRC is planning its first week-long summer school for PhD Scholars and postdoctoral research fellows to be hosted by the University of Western Australia, Marine Renewable Energy Australia in Albany, Western Australia during January 2023.

The summer school will train the cohort with detailed cross-discipline knowledge to work in future blue economy industries, provide opportunities for professional development such as industry visits, networking opportunities and public outreach. It is anticipated the summer school will be held biennially.

Current PhD and MPhil Scholars

Student	Akshay Krishna Ambika Harikumar (PhD)
Start	2020
Expected Completion	2023
Project Title	Developing a robust collar tie
Host Institution	The University of Queensland (UQ)
Primary Supervisor & Industry Research Advisor	Dr Michael Heitzmann, UQ Dr Brad Evans, Tassal Group

Student	Neil Salam (PhD)
Start	2020
Expected Completion	2023
Project Title	DC Microgrids for offshore applications
Host Institution	Griffith University (GU)
Primary Supervisor & Industry Research Advisor	Prof Evan Gray, GU Craig Dugan, Optimal Group Australia

Student	Yuan Zhen Cai (PhD)
Start	2021
Expected Completion	2024
Project Title	Mooring Tensioner for WECs - MoTWEC
Host Institution	The University of Queensland (UQ)
Primary Supervisor & Industry Research Advisor	Dr Michael Heitzmann, UQ Dr Brad Evans, Tassal Group

Student	Aaron Hibberd (PhD)
Start	2021
Expected Completion	2024
Project Title	Investigating Thresholds in the Metabolic Response of Sediment to Organic Enrichment
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Dr Scott Hadley, UTAS Joel Cooper, Tassal Group

Student	Mingyuan Ma (PhD)
Start	2021
Expected Completion	2023
Project Title	Hydrodynamic analysis of offshore fish cages
Host Institution	Griffith University (GU)
Primary Supervisor & Industry Research Advisor	Prof Hong Zhang, GU Lex Mulcahy, Pacific ESI

Student	Avik Nandy (PhD)
Start	2021
Expected Completion	2024
Project Title	Use of multispectral imagery to enhance aquaculture operations
Host Institution	The University of Queensland (UQ)
Primary Supervisor & Industry Research Advisor	Dr Simon Albert, UQ Frances Huddlestone, Oysters Tasmania

Student	Leteisha Prescott (PhD)
Start	2021
Expected Completion	2025
Project Title	The effects of sustained swimming on long-term changes to Chinook salmon form and composition
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Prof Chris Carter, UTAS Dr Jane Symonds, Cawthron Institute

Student	Amara Steven (PhD)
Start	2021
Expected Completion	2025
Project Title	Responses to risk: Blue economy explorations using behavioural economics
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Darla Hatton-MacDonald, UTAS Stephanie Thornton, AOEG

Student	Shujian Ma (PhD)
Start	2021
Expected Completion	2024
Project Title	Wave Driven Compressed Air Energy Storage
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Prof. Xiaolin Wang, UTAS Dr Alex Pichard, Carnegie Clean Energy

Student	Kelly Hoareau (PhD)
Start	2021
Expected Completion	2025
Project Title	Science, Technology, and Decision-making in the Blue Economy: Addressing knowledge gaps
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Prof. Marcus Haward, UTAS Dr David Rissik, BMT Australia

Student	Brett Bolte (PhD)
Start	2021
Expected Completion	2025
Project Title	Exploiting filter feeding bivalves as a natural sampling platform
Host Institution	Griffith University (GU)
Primary Supervisor & Industry Research Advisor	Dr. Carmel McDougall, GU Dr Pascal Craw, Dr Andrew Bissett, Dr James Wynne, CSIRO

Student	Thien Than Tun (PhD)
Start	2021
Expected Completion	2025
Project Title	Energy-optimal control scheme for mobile robotic platforms in offshore aquaculture
Host Institution	Auckland University of Technology (AUT)
Primary Supervisor & Industry Research Advisor	A/Prof. Loulin Huang, AUT Grant Rosewarne, New Zealand King Salmon

Student	Nazhmiddin Nasyrlayev (PhD)
Start	2021
Expected Completion	2025
Project Title	Integrated Numerical Modelling Approach for Design of Offshore Aquaculture Structures
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Dr Ali Tolooiyan, UTAS Zac Couper, BMT Australia

Student	Chandima Jeewanthi Hapu Achchige (PhD)
Start	2022
Expected Completion	2025
Project Title	Integrating sustainability strategy within Environmental Management Accounting and Control
Host Institution	Griffith University (GU)
Primary Supervisor & Industry Research Advisor	Prof Ki-Hoon Lee, GU Dr Leo Dutra, CSIRO

Student	Robert Tullberg (MPhil)
Start	2022
Expected Completion	2023
Project Title	Offshore Seaweed and R-E Farms: Solutions for Integration and Co-location (MPhil)
Host Institution	The University of Queensland (UQ)
Primary Supervisor & Industry Research Advisor	Prof Chien Ming Wang, UQ Dr Brian von Herzen, The Climate Foundation

Student	Robin Cappaert (PhD)
Start	2022
Expected Completion	2025
Project Title	Influences on composition and ecology of biofouling communities associated with salmon aquaculture
Host Institution	University of Tasmania (UTAS)
Primary Supervisor & Industry Research Advisor	Dr. Camille White, UTAS Dr Brad Evans, Tassal Group

Student	Alana Knight (PhD)
Start	2022
Expected Completion	2026
Project Title	Social licence reporting to support blue economy development and expansion in Australia
Host Institution	Griffith University (GU)
Primary Supervisor & Industry Research Advisor	Prof Christopher Fleming, GU Dr Leo Dutra, CSIRO

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-Profit 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 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.

There are four sub-committees which are listed below.

Directors

Name	Role	Since	Number of Meetings Eligible to Attend	Number of Meetings Attended
Greg Johannes	Chair	5 July 2019	6	6
Gunilla Burrowes	Director	5 July 2019	6	6
Greg Vickery	Director	5 July 2019	6	6
Rhys Edwards	Director	5 July 2019	6	6
Nick Elliott	Director	5 July 2019	6	6

Finance, Audit and Risk Management Committee (FARM)

The purpose of the Finance, Audit and Risk Management (FARM) Committee is to provide advice to the Board on issues to do with financial management and performance, risk management and audit. The FARM committee met on three occasions in 2021-22.

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 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 five occasions in 2021-22.

Name	Role	Organisation
Dr Nick Elliott	Director, Chair of SAC	See Director profile
Dr Raymond Bannister	Member	Senior Environmental Officer, EPA Tasmania
Dr Brad Evans	Member	Senior Manager Breeding and Research, Tassal Group
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
Dr Martin Renilson	Independent Member	Director, Renilson Marine Consulting
Assoc Prof Fatemeh Salehi	Member (appointed November 2021)	School of Engineering and Deputy Director, Macquarie Sustainable Energy Research Centre, Macquarie University
Dr Helen Fitton	Independent Member (appointed November 2021)	Director, Phycosolutions
Dr Nic Bax	Member (until November 2021)	Director Marine Biodiversity Hub, CSIRO
Prof Ian MacKinnon	Independent Member (until July 2021)	Faculty of Science and Engineering, QUT

Participants Advisory Committee (PAC)

The Participants Advisory Committee (PAC) provides advice to the Board on 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 three occasions in 2021-22.

Name	Role	Organisation
Greg Johannes	Chair of Board, Chair of PAC	See Director profile
Terry Bailey	Member	Executive Dean, College of Sciences and Engineering, University of Tasmania
Dr ir Margriet Drouillon	Member	Chief Business Officer, The Aqua UGent consortium
The Aqua UGent consortium	Member	Head of Business Development, BMT
Stephanie Thornton	Member	Cluster Manager, Australian Ocean Energy Group
Dr Ian Dutton	Member	Director Marine Resources, The Department of Natural Resources and Environment Tasmania
Prof Udaya K. Madawala	Member	Professor Faculty of Engineering, The University of Auckland
Phillipa Ormandy	Member	Director, Business Development and Global, CSIRO
Jonathan Fiévez	Member	CEO, Carnegie Clean Energy
Mark Asman	Member	Head of Aquaculture, Tassal Group

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 2021-22.

Name	Role	Organisation
Gunilla Burrowes	Director, Chair of CAC	See Director profile
Pene Snashall	Member	Corporate Communications & Community Relations Manager, Huon Aquaculture
Nathalie Almonacid	Member	R&D and EMMAP Coordinator, MERIC
Jacquie Ray	Member	Petuna Aquaculture (Managing Director, Timmins Ray Public Relations)
Genevieve Worrell	Member (until June 2022)	Media and Communications Coordinator, University of Queensland
Caroline Hounsell	Member (appointed June 2022)	Head of Responsible Business, Tassal Group
Angela Williamson	Member (until May 2022)	Senior Manager – People & Communities, Tassal Group

Team

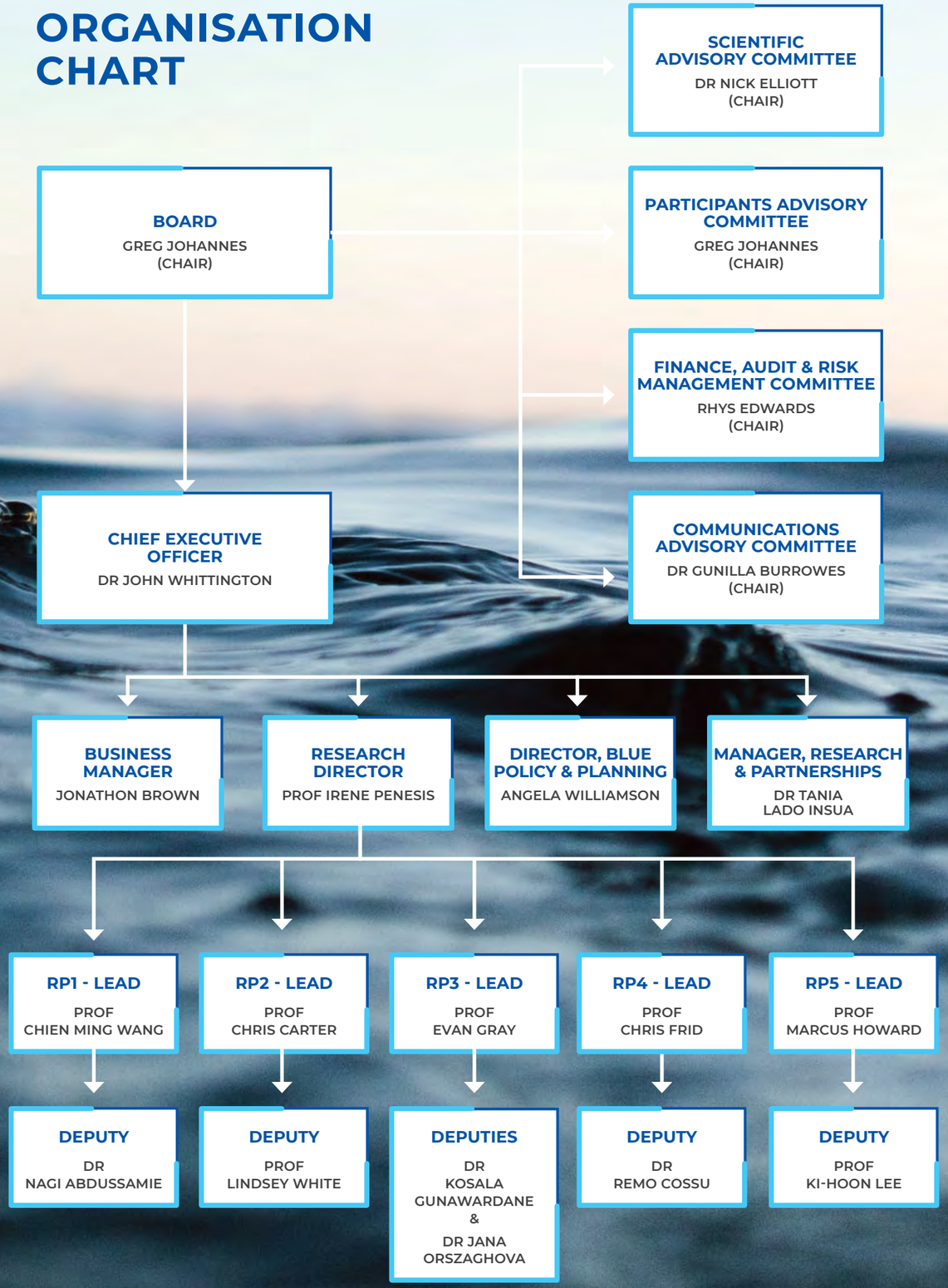
Name	Organisation	Role	Time Commitment
Dr John Whittington	Blue Economy CRC	CEO	95%
Prof Irene Penesis	Blue Economy CRC*	Research Director	100%
Jonathon Brown	Blue Economy CRC	Business Manager & Company Secretary	100%
Dr Tania Lado Insua	Blue Economy CRC* (commenced October 2021)	Manager, Research and Partnerships	100%
Angela Williamson	Blue Economy CRC (commenced May 2022)	Director, Blue Policy & Planning	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 (until September 2021)	Research Program 3 Leader	60%
Prof Evan Gray	Griffith University (appointed September 2021)	Research Program 3 Leader	60%
Dr Kosala Gunawardane	Auckland University of Technology	Research Program 3 Deputy Leader	20%
Dr Jana Orszaghova	University of Western Australia (appointed December 2021)	Research Program 3 Deputy Leader	20%
Dr Beth Fulton	CSIRO (until August 2021)	Research Program 4 Leader	60%
Prof Chris Frid	Griffith University (appointed August 2021)	Research Program 4 Leader	60%
Dr Remo Cossu	The University of Queensland	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 (until August 2021)	Research Program 5 Deputy Leader	20%

ORGANISATION CHART



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BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

FINANCIAL REPORT FOR THE PERIOD 1 JULY 2021 TO 30 JUNE 2022

BLUE ECONOMY CRC-CO LTD | ACN 634 684 54

Australian Government
Department of Industry, Science and Resources

AusIndustry
Cooperative Research Centres Program

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Directors Report

Blue Economy CRC-Co Ltd
For the year ended 30 June 2022

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 2021 to 30 June 2022 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 43 Participant organisations from industry, research and government, based around Australia and internationally.
The Company's short-term objectives are to:

- Develop an industry led research portfolio with a network of Participants, from research, industry, and government;
- 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;
- Implement the Blue Economy CRC's Higher Degree by Research Education Program to support the development of trained workforce for the future.

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 that create healthy aquaculture growing conditions 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.

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Directors Report

Meetings of Directors

During the financial year, 6 meetings of directors were held. Attendances by each director were as follows:

Directors Meetings

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

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 Fullbright 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 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 (CAMAC). He was for 7 years the Honorary Consul in Queensland for the Republic of Indonesia and he remains an active member of the Australian 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 Australia 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 (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 for 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.

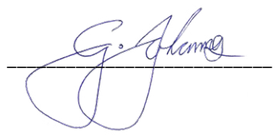
Contributions on winding up

In the event of the company being wound up, ordinary members are required to contribute a maximum of $10 each. At 30 June 2022, the total amount that members of the Company are liable to contribute if the Company is wound up is $10.

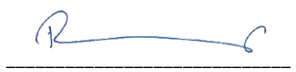
Auditor's Independence Declaration

A copy of the Auditor's Independence Declaration for the period ended 30 June 2022 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 20th day of October 2022

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Hobart TAS 7000
GPO Box 1681 Hobart TAS 7001
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 2022, 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

21 October 2022

Statement of Profit or Loss

Blue Economy CRC-Co Ltd
For the year ended 30 June 2022

	NOTES	2022	2021
Funding & Program Revenue			
Funding & Program Revenue	12	10,307,580	6,907,607
Total Funding & Program Revenue		**10,307,580**	**6,907,607**
Other Revenue			
Interest Income		3,501	7,214
Cash Flow Boost		-	100,000
Total Other Revenue		**3,501**	**107,214**
Total Revenue		**10,311,081**	**7,014,821**
Expenditure			
Consulting & Legal Fees		170,491	153,421
Depreciation & Amortisation Expense		16,649	11,046
Directors Fees		177,233	157,534
Employee Benefit Expense		727,317	673,319
Finance Fees		111,891	18,648
General Administration		158,655	164,663
Marketing & Communications		119,794	63,255
Research & Development Expenditure		8,637,325	5,619,281
Travel		188,225	46,440
Total Expenditure		**10,307,580**	**6,907,607**
Net Surplus / (Deficit) for the year		**3,501**	**107,214**

The accompanying notes form part of these financial statements. These statements should be read in conjunction with the attached

Statement of Financial Position

Blue Economy CRC-Co Ltd
As at 30 June 2022

	NOTES	30 JUN 2022	30 JUN 2021
Assets			
Current Assets			
Cash and Cash Equivalents	3	3,016,404	4,126,654
Financial Assets	5	2,000,000	2,000,000
GST Receivable		53,880	-
Other Current Assets	7	1,287,521	1,259,131
Trade and Other Receivables	4	1,532,289	633,150
Total Current Assets		**7,890,094**	**8,018,935**
Non-Current Assets			
Property, Plant & Equipment	6	2,468,091	1,989,351
Total Non-Current Assets		**2,468,091**	**1,989,351**
Total Assets		**10,358,185**	**10,008,286**
Liabilities			
Current Liabilities			
Deferred Revenue	11	7,033,728	7,302,338
GST Payable		-	98,970
Lease Liability	10	150,857	45,221
Provisions	8	42,068	31,870
Trade and Other Payables	9	1,144,099	494,668
Total Current Liabilities		**8,370,752**	**7,973,067**
Non-Current Liabilities			
Lease Liability	10	1,876,718	1,928,004
Total Non-Current Liabilities		**1,876,718**	**1,928,004**
Total Liabilities		**10,247,470**	**9,901,071**
Net Assets		**110,715**	**107,214**
Accumulated Funds			
Surplus / (Deficit) for the year		110,715	107,214
Balance at end of year		**110,715**	**107,214**

The accompanying notes form part of these financial statements. These statements should be read in conjunction with the attached

Statement of Cash Flows

Blue Economy CRC-Co Ltd
For the year ended 30 June 2022

	NOTES	2022	2021
Operating Activities			
Receipts from grants and participants		10,053,814	11,857,734
Payments to suppliers and employees		(10,674,152)	(8,786,826)
GST refunds/(payments) on operating items		56,394	(279,175)
Interest received		3,501	7,215
Net Cash Flows from Operating Activities	20	**(560,443)**	**2,798,949**
Investing Activities			
Payment for property, plant and equipment		(485,144)	(14,746)
GST refunds/(payments) on capital items		44,104	1,341
Net Cash Flows from Investing Activities		**(441,040)**	**(13,405)**
Financing Activities			
Payment of lease liability		(108,767)	(15,385)
Net Cash Flows from Financing Activities		**(108,767)**	**(15,385)**
Net Cash Flows		**(1,110,250)**	**2,770,159**
Cash and Cash Equivalents			
Cash and cash equivalents at beginning of period		4,126,654	1,356,496
Net change in cash for period		(1,110,250)	2,770,159
Cash and cash equivalents at end of period		3,016,404	4,126,654

Statement of Movements in Equity

Blue Economy CRC-Co Ltd
For the year ended 30 June 2022

	2022	2021
Equity		
Opening Balance - Accumulated Funds	107,214	-
Increases		
Surplus for the Period	3,501	107,214
Total Increases	**3,501**	**107,214**
Closing Balance - Accumulated Funds	**110,715**	**107,214**

Notes to the Financial Statements

Blue Economy CRC-Co Ltd
For the year ended 30 June 2022

1. General Information

(i) Basis of Preparation

Blue Economy CRC-Co Ltd is a not-for-profit company limited by guarantee, incorporated and domiciled in Australia. These general purpose financial statements have been prepared in accordance with the Corporations Act 2001 and Australian Accounting Standards Simplified Disclosures.

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

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 a 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 12.

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 when the Company obtains control of the funds, economic benefits are probable and the amount can be measured reliably. Where a grant may be required to 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 part 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 18.

(iv) Gifts and Donations

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

(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 impairment 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 the 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 a part of the cost of acquisition of an asset of 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) Leases

The company recognises a right-of-use asset and a lease liability at the lease commencement date excluding short term leases and lease for which the underlying asset is of low value. An asset is considered low-value when it is expected to cost less than $10,000. 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 or 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 determines, the company's incremental borrowing rate. Generally, the company uses its incremental borrowing rate as the discount rate.

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.

(i) 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 the income tax and therefore no provision for income tax is made in these financial statements.

(j) Financial Assets and 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.

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Financial assets and financial liabilities classified as held for trading are measured at fair value though 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.

(k) Research and Development Expenditure

Research and development expenditure is recognised as an expense in the period incurred. At the financial year end, the research and development costs will be reviewed and any costs eligible for asset recognition under AASB 138 Intangible Assets will be capitalised.

Intangible assets arising from the development activities are recognised when the resources are available to complete the assets and future economic benefits from the use or sale of assets is probable. In assessing whether Intellectual Property falls within the scope of AASB 138, it will be assessed against a set of criteria and then allocated into one of two phases, the research phase or the development phase.

An intangible asset arising from the development will be recognised if, and only if, the recognition criteria is met. The cost of an internally generated intangible asset is the sum of expenditure from the date when the intangible asset first meets the recognition criteria, expenses previously recognised will not be able to be reinstated to this cost base.

(l) 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 the 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 the employee service are rendered.

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

Defined Contribution superannuation benefits

All employees of the company receive defined contribution superannuation entitlements, for which the company pays the fixed superannuation guarantee contribution (currently 10.5% 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.

	2022	2021
3. Cash and Cash Equivalents		
Business Transaction Account	3,016,404	4,126,654
Total Cash and Cash Equivalents	**3,016,404**	**4,126,654**

	2022	2021
4. Trade and Other Receivables		
Current		
Accounts Receivable	1,532,289	633,150
Total Trade and Other Receivables	**1,532,289**	**633,150**

	2022	2021
5. Financial Assets		
Current		
CBA Term Deposit	2,000,000	2,000,000
Total Financial Assets	**2,000,000**	**2,000,000**

	2022	2021
6. Property, Plant and Equipment		
Capital Works in Progress		
Hydrogen Equipment - Project and Installation Costs	298,636	-
Total Capital Works in Progress	**298,636**	**-**
Leasehold Improvements		
Leasehold Improvements at Cost	126,865	-
Accumulated Depreciation of Leasehold Improvements	(8,385)	-
Total Leasehold Improvements	**118,480**	**-**
Plant and Equipment		
Plant and Equipment at Cost	42,870	27,332
Accumulated Depreciation of Plant and Equipment	(19,470)	(11,206)
Total Plant and Equipment	**23,400**	**16,126**
Right of Use Asset		
Hydrogen Equipment - Right of Use Asset	2,027,575	1,973,225
Total Right of Use Asset	**2,027,575**	**1,973,225**
Total Property, Plant and Equipment	**2,468,091**	**1,989,351**

	2022	2021
7. Other Assets		
Current		
Prepayments	1,287,521	1,259,131
Total Other Assets	**1,287,521**	**1,259,131**

	2022	2021
8. Provisions		
Annual Leave Liability	42,068	31,870
Total Provisions	**42,068**	**31,870**

	2022	2021
9. Trade and Other Payables		
Current		
Accounts Payable	112,198	187,305
Accrued Expenses	970,024	265,765
Accrued Wage	8,500	3,634
Credit Cards	11,874	4,233
FBT Payable	2,040	(446)
PAYG Withholdings Payable	37,040	33,131
Superannuation Payable	2,423	1,046
Total Trade and Other Payables	**1,144,099**	**494,668**

	2022	2021
10. Lease Liability		
Current		
Hydrogen Equipment < 12 months	150,857	45,221
Total Current	**150,857**	**45,221**
Non-Current		
Hydrogen Equipment < 5 years	1,698,734	1,649,484
Hydrogen Equipment > 5 years	177,984	278,520
Total Non-Current	**1,876,718**	**1,928,004**
Total Lease Liability	**2,027,575**	**1,973,225**

	2022	2021
11. Deferred Revenue		
Government Contributions		
CRC Program Grant Received in Advance	3,440,216	4,942,741
Total Government Contributions	**3,440,216**	**4,942,741**
Participant Contributions		
Participant Contributions Received in Advance	3,593,512	2,359,597
Total Participant Contributions	**3,593,512**	**2,359,597**
Total Deferred Revenue	**7,033,728**	**7,302,338**

	2022	2021
12. Results from Operating Activities		
Funding & Program Revenue		
CRC Program Grant	7,240,405	2,610,495
Participant & Project Contributions	3,067,175	4,297,112
Total Funding & Program Revenue	**10,307,580**	**6,907,607**
Other Revenue		
Cash Flow Boost	-	100,000
Interest Income	3,501	7,214
Total Other Revenue	**3,501**	**107,214**
Net Realised Revenue	10,311,081	7,014,821
Reconciliation of Net Result		
Government Contributions Expended	3,144,513	2,610,495
Participant Contributions Expended	7,163,067	4,297,111
Net Result	3,501	107,214

13. 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 the 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.

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14. 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
Mr Greg Johannes	Board Chair
Mr Greg Vickery	Board Director
Ms Gunilla Burrowes	Board Director
Mr Nick Elliott	Board Director
Mr Rhys Edwards	Board Director
Prof Irene Penesis	Research Director
Ms Angela Williamson	Director, Blue Policy and Planning
Mr Jonathon Brown	Business Manager

	2022	2021
Amounts paid or payable to key management personnel are as follows:		
Short-term employee benefits	925,813	684,505
Post Employment benefits	-	-

15. 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:

	2022	2021
In-kind Contributions		
Staff in-kind contributions	7,120,325	3,765,650
Other in-kind contributions	1,585,044	2,003,977

16. Unrecognised Contractual Commitments

At balance date the entity had the following commitments for expenditure:

- Obligations to make payments under a site access agreement with a participant. The sum of the cash obligations under this agreement is $3,000,000.

	2022	2021
Unrecognised Contractual Commitments		
Payable within 1 year	1,500,000	1,500,000
Payable outside 1 year	1,500,000	3,000,000

	2022	2021
17. Remuneration of Auditors for:		
Auditing or reviewing the financial statements	9,180	3,500

18. 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.

19. 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 2022 approximately 43% (2021: 37%) of the Company's cash contributions of $10,038,971 (2021: $9,858,947) was sourced from Participants and 57% (2021: 63%) from the Commonwealth of Australia.

20. Cash Flow Information

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

	2022	2021
Cash Flow Reconciliation		
Profit for the year	(7,808)	107,214
Interest on RoU Lease	108,767	15,385
Depreciation & Amortisation	16,649	11,046
Changes in Assets & Liabilities		
(Increase)/Decrease in Trade & Other Receivables	(899,139)	(19,150)
(Increase)/Decrease in Other Current Assets	(29,130)	9,960
Increase/(Decrease) in GST Payable	(152,850)	(156,536)
Increase/(Decrease) in Trade & Other Payables	650,171	(117,378)
Increase/(Decrease) in Provisions	10,198	2,901
Increase/(Decrease) in Other Current Liabilities	-	(5,834)
Increase/(Decrease) in Deferred Revenue	(257,301)	2,951,340
Cashflows from Operations	**(560,443)**	**2,798,948**

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21. Entity Details

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

Building "N"

Maritime Way

Newham, TAS 7248

Directors Declaration

Blue Economy CRC-Co Ltd
For the year ended 30 June 2022

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:

1. Comply with Australian Accounting Standards applicable to the Company and Division 60 of the Australian Charities & Not-For-Profits Commission Regulations 2013; and
2. Give a true and fair view of the financial position of the Company as at 2022 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.

Chairperson - Non-Executive

20 October 2022

Date

Director - Non-Executive

20 October 2022

Date

BDO

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Australia

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 2022, the statement of profit or loss and other comprehensive income, the statement of changes 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 2022 and of its financial performance for the year then ended; and

(ii) Complying with Australian Accounting Standards – Simplified Disclosures 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.

Responsibilities of responsible entities for the Financial Report

The responsible entities of the registered entity are responsible for the preparation and fair presentation of the financial report in accordance with Australian Accounting Standards – Simplified Disclosures and the ACNC Act, and for such internal control as the responsible entities determine is necessary to enable the preparation of the financial report that is free from material misstatement, whether due to fraud or error.

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

The responsible entities of the registered entity are responsible for overseeing the registered entity's financial reporting process.

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)

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DAVID PALMER
Partner

Hobart, 21 October 2022

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