BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

SHORT SUMMARY

3.21.001 – OES Study on the Energy Requirements of Offshore Aquaculture as a Market for Ocean Energy

KEY POINTS

- Ocean renewable energy and offshore aquaculture are two industries that are likely compatible for co-location; ORE has the potential to provide power for offshore aquaculture and can decrease the environmental impact of operations by providing power at sea and replacing the reliance on diesel.
- Integrating ocean renewable energy technologies with aquaculture systems requires several pre-development activities including techno-economic analysis, engineering design, and optimization (e.g., sizing) to ensure a good fit with the aquaculture energy system and the application/user needs.
- An increased understanding of the energy demands associated with aquaculture systems across different projects (species and location specific) is required to improve understanding of ocean renewable energy applications.
- Offshore finfish aquaculture is a likely candidate for co-location because these operations use a large range of systems and equipment, such as for lighting, feeding, refrigeration, domestic activities, and monitoring, that need power.
- This project was commissioned by the International Energy Agency Ocean Energy Systems Technology Collaboration Program (IEA-OES). The Australian Blue Economy Co-operative Research Centre partnered with the United States of America Pacific-Northwest National Laboratory, to meet the needs of this project, bringing together a team of researchers, with contributions from four Blue Economy CRC partners, along with that from many other international contributions to this project.

THE CHALLENGE

Traditionally, marine resources and coastal zones are managed independently, excluding multiple activities to exist within the same region. The exclusion of co-locatable activities, coupled with the expansion of global aquaculture, has placed increased pressure on coastal and nearshore marine environments. Currently, there is limited data, funding for research efforts and industry development to assist in the implementation of co-locating offshore aquaculture and ocean renewable energy. This challenge was identified by the IEA-OES, wishing to understand the challenges and opportunities in co-locating these sectors.

THE OPPORTUNITY

Ocean renewable energy technologies have the potential to provide an alternative, sustainable, at-sea energy source for offshore aquaculture, while offshore aquaculture has the potential to provide a market for ocean renewable energy technologies, subsequently aiding the advancement of the industry.

The Blue Economy CRC is funded in part under the Australian Government's CRC program administered by the Department of Industry, Science, Energy and Resources.

BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

SHORT SUMMARY

3.21.001 – OES Study on the Energy Requirements of Offshore Aquaculture as a Market for Ocean Energy

OUR RESEARCH

This report assessed the potential of aquaculture as a market for ocean renewable energy. While the primary focus was offshore aquaculture, this report also included information from projects related to onshore and nearshore aquaculture.

Firstly, the technical attributes for each renewable energy technology are described, the relative advantages and challenges for their application to the aquaculture sector are identified and the technology readiness levels are discussed.

This report then provides an overview of the current status of the aquaculture industry in a few key countries—mainly OES member nations, large aquaculture-producing nations, or those who are interested in offshore aquaculture—including examples of energy requirements for different aquaculture operations.

This report also highlights case studies from projects that are researching or have successfully implemented renewable energy, both ocean renewable energy and other renewable sources, to meet the energy demands of aquaculture operations. The case studies presented in this report include all major marine-based aquaculture types and a range of renewable energy technologies, with a focus on ocean renewable energy, to provide examples and lessons learned for co-locating ORE and offshore aquaculture.

This report then identifies the potential opportunities and challenges for co-location of ocean renewable energy and offshore aquaculture. In addition to the general opportunities and challenges for co-location, examples of opportunities and challenges in several countries (Australia, Chile, China, Indonesia, the Philippines, and the United States) were identified. Examples of offshore aquaculture and ORE are the main focus, but because these industries are emerging, opportunities and challenges also include nearshore aquaculture as well as other renewable energies because associated similarities and learnings may be applicable.

Finally, this report summarises the reviewed literature and offers recommendations for further research needs and for identifying potential pathways for the expansion of co-location opportunities based on the findings of this report.

OUTCOMES

This report summarises the available information on the energy demands of aquaculture operations in several countries. While energy data are limited at this time, this report provides a useful representation of how aquaculture energy demands vary by aquaculture type, farmed species, and/or country.

NEXT STEPS

Based on the information presented in this report, several recommendations to expand the potential for co-location and further understanding of powering offshore aquaculture with ORE have been identified.

- More information, including finer-resolution data, about energy demand and the associated energy demand profiles (e.g., daily, monthly, seasonally, for specific stages/processes) for offshore aquaculture operations is needed

The Blue Economy CRC is funded in part under the Australian Government's CRC program administered by the Department of Industry, Science, Energy and Resources.

BLUE ECONOMY
COOPERATIVE RESEARCH CENTRE

Australian Government
Department of Industry, Science, Energy and Resources

AusIndustry
Cooperative Research Centres Program

SHORT SUMMARY

3.21.001 – OES Study on the Energy Requirements of Offshore Aquaculture as a Market for Ocean Energy

NEXT STEPS (cont.)

- Hybrid energy solutions (e.g., solar PV and tidal energy, solar PV and wave energy, diesel and wave energy, etc.) have the potential to increase the use of ORE technologies for aquaculture operations by offering more reliable and clean ways to supply power, replacing the current reliance on diesel.
- Further research on the environmental and social effects of co-locating ORE and offshore aquaculture is to facilitate consenting processes of projects and to support strategic marine spatial planning.
- Increase the uptake of ORE for aquaculture-relevant applications, there is a need to engage with and educate aquaculture stakeholders (e.g., owners, facility managers, vessel operators, technology providers of moorings/pens/feed barges, policy makers, regulatory agencies, financial organizations, communities, etc.) on sustainable energy transitions.
- Identify licensing of existing national or regional marine spatial plans to find countries or regions that require co-location or offer pathways to development can aid industry planning efforts.
- Increased support through government funding to make ocean renewable energy a viable and cost-competitive alternative to diesel or other renewable energies used in aquaculture production.

PROJECT TEAM

- Eloise Wilson, University of Tasmania
- Dr. Mark Hemer, CSIRO
- Mikaela Freeman, Pacific Northwest National Laboratory
- Dr. Lysel Garavelli, Pacific Northwest National Laboratory
- Dr. Michael L.S. Abundo, OceanPixel
- Dr. Gonzalo Tampier Brockhaus (Organisation)

PROJECT REPORTS/PUBLICATIONS

Freeman, M.C., Garavelli, L., Wilson, E., Hemer, M., Abundo, M.L., Travis, L.E. 2022. Offshore Aquaculture: A Market for Ocean Renewable Energy. Report for Ocean Energy Systems (OES). April 2022.

SHORT SUMMARY AUTHOR

Eloise Wilson (University of Tasmania)

The Blue Economy CRC is funded in part under the Australian Government's CRC program administered by the Department of Industry, Science, Energy and Resources.