Environmental Effects for Permitting for Marine Renewable Energy Off-Grid Applications

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Workshop report from the
International Conference on Ocean Energy, Melbourne, Australia

Background

Research and monitoring around marine renewable energy (MRE) devices has sought to understand effects that will drive permitting/consenting and licensing decisions for large, grid-scale projects. However, many near-term and likely long-term uses of MRE include powering remote coastal and island communities via micro-grids and direct supply, as well as providing power at sea for offshore aquaculture, ocean observation, navigation markers, and other uses. These MRE deployments may operate on a much smaller scale than grid-connected MRE devices for utility scale. There has been little focus on the potential environmental effects of these increasingly more common micro-grid or off-grid uses. The smaller MRE devices required for these applications are likely to have different, and possibly fewer, environmental effects than large-scale MRE projects.

The time is right to start exploring the potential environmental effects that might be expected from smaller scale (i.e., micro-grid and off-grid) wave, tidal, and other MRE devices and projects. Therefore, there is a need to determine what additional or different information and data may be needed to inform and streamline permitting/consenting for these projects. In September 2024, OES-Environmental and Aquatera Ltd hosted a workshop at the 2024 International Conference on Ocean Energy (ICOE) in Melbourne, Australia, to discuss the potential environmental effects of micro-grid/off-grid MRE devices with interested MRE researchers, regulators and advisors, technology and project developers, and consultants.

The workshop included a brief presentation about OES-Environmental, the reasons for focusing on micro-grid/off-grid applications, and the potential environmental effects (or stressor-receptor interactions) that have been given priority to date in research and regulatory contexts. The presentation was followed by an overview of four use cases for breakout group discussions:

1. Wave energy to power a coastal community off the island of Eua, Tonga
2. Tidal energy to provide power to the Kimberley Port Authority in Broome, Australia
3. Wave energy to be co-located with and provide power to an aquaculture farm off the coast of Tasmania, Australia
4. Wave energy to provide power and enable ocean-observing autonomous underwater vehicles recharge at sea, off the coast of New South Wales, Australia.

Following the description of the use cases, three breakout groups were formed around "coastal communities" (combining the discussions around use cases 1 and 2), "offshore aquaculture" (use case 3), and "ocean observation" (use case 4), using the hypothetical scenarios developed for each use case to address the following discussion points:

- What key species/habitats/uses are of most concern around MRE development?
- Which stressor-receptor interactions will be of greatest concern for the use case, and how significant are those concerns?
- Will the smaller-size devices and smaller-scale projects have less effect than grid-scale devices and can regulatory processes address these differences proportionately?
- How should we manage and monitor the potential effects associated with these smaller devices and projects?

Approximately 23 people from nine countries attended the workshop. The list of attendees' organizations is provided as appendix.

Icebreaker Poll Question

Before the general presentation, the team used Poll Everywhere to ask the audience an icebreaker question ("What brought you to this workshop?") and took a few minutes to discuss the responses.

The three main recurring entries were 'environmental', 'risk', and 'interest', with some other entries directly related to the topic of the workshop like 'micro grid', 'aquaculture', and 'aquaculture and marine energy' (Figure 1).

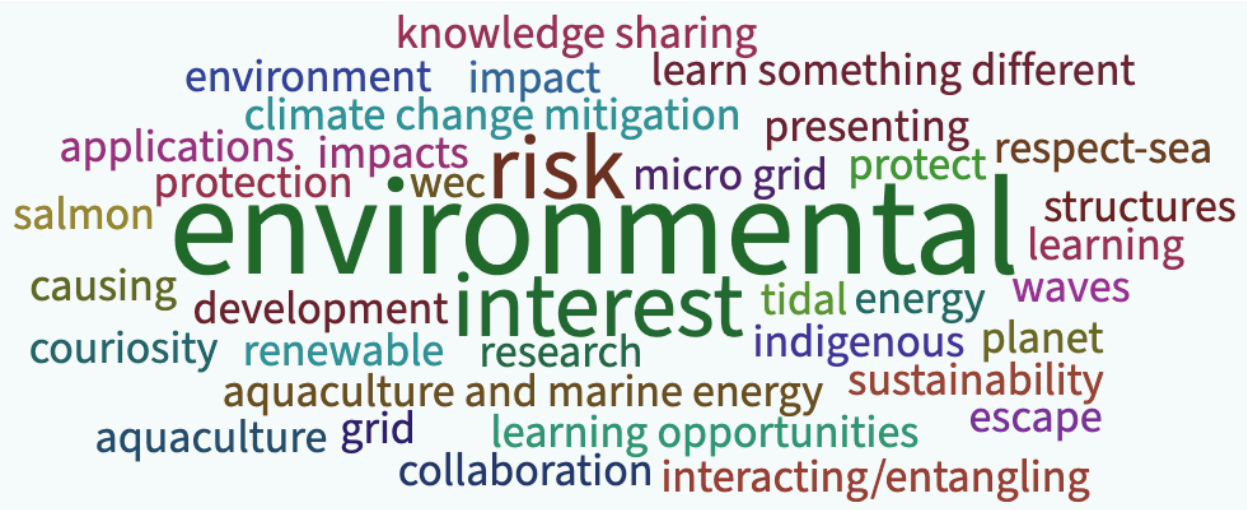

Figure 1. *Word cloud of responses to the icebreaker poll question "What brought you to this workshop?".*

Discussion

The breakout discussions centered around each of the four use cases; the Tonga use case and Kimberley Port Authority use case were discussed within the same "coastal communities" group but are reported separately. The breakout groups were guided by the discussion questions, and Poll Everywhere was used to report from each group. Through Poll Everywhere, each participant reported what stood out for them from their group's discussion; participants were allowed multiple answers for each question. The subsections below present those report-out responses (with necessary grammatical edits where appropriate), combined when addressing similar points, and augmented by notes from the group facilitators.

Tonga coastal community wave energy use case

- What key species/habitats/uses are of most concern around MRE development?
    - The local communities and their practices must be considered.
    - There is a need to understand how remote communities in the Pacific would look at these technologies differently than elsewhere.
    - Looking at the effects of the wave energy converter (WEC) for this community in the long-term future: 20 years down the road - did it do what it said it would do? Was it as safe as promised? Were there more/less environmental effects/interactions?
    - In this group, everyone focused on the effect within the community but what about the response from neighbor communities (e.g., envy, criticism, etc.).
- Which stressor-receptor interactions will be of greatest concern for the use case, and how significant are those concerns?
    - Other than having to take into account the concerns over the impact on wildlife, what stood out most was the effect a WEC might have on the community's way of life. The community should be properly informed that the WEC is a possibly dangerous device to be around with an exclusion zone around it that should not be entered.
    - Curiosity of kids and risk of collision; video monitoring can be used as an educational opportunity.
- Will the smaller-size devices and smaller-scale projects have less effect than grid-scale devices and can regulatory processes address these differences proportionately?
    - This question was not addressed by the group.
- How should we manage and monitor the potential effects associated with these smaller devices and projects?
    - Importance of reference sites for comparison.
    - Baseline studies needed before doing monitoring to compare and see if there is an impact.
    - Think of climate change and leverage comparable undeveloped sites for long-term monitoring.

  - Lived experiences from remote communities are essential in these types of discussions.
  - Importance of engagement with local community to understand what is important to them in siting WECs.
  - Education of the community about the installation.
  - Planning for the curiosity of animals and people.

Kimberly Port tidal energy microgrid use case

- What key species/habitats/uses are of most concern around MRE development?
  - Proximity to significant areas (e.g., spiritual, fishing, etc.).
  - Context/specificity of the area to take into consideration.
- Which stressor-receptor interactions will be of greatest concern for the use case, and how significant are those concerns?
  - This question was not addressed by the group.
- Will the smaller-size devices and smaller-scale projects have less effect than grid-scale devices and can regulatory processes address these differences proportionately?
  - Decommissioning stage should be an essential part of every project, be precisely understood, and must be well funded with mandatory budget.
  - It is important to accurately estimate decommissioning and planning for a proper budget, and developing a sufficient plan to remove the technology. Examples have proven that with a limited budget/plan, it can be damaging to future progress.
- How should we manage and monitor the potential effects associated with these smaller devices and projects?
  - Environmental studies to show the impact or not of the devices.
  - Consider monitoring even if predicted low risk as validation of risk level might be needed (e.g., algal bloom from changes in oceanographic systems).
  - Impact assessments, mammals, logs, seaweed entanglement. May be infrequent.
  - Reassuring and informing the communities about what tidal energy is, should be part of any project.

Tasmania aquaculture & wave energy co-location use case

- What key species/habitats/uses are of most concern around MRE development?
  - Sharks, whales, dolphin, seals, fish.
  - Seals often use fish farm structure for haul-out and may feed on wild fish aggregating around them.
  - Recreational uses (boats, whale watching, surfers).
- Which stressor-receptor interactions will be of greatest concern for the use case, and how significant are those concerns?
  - Noise, entanglement, changes in habitat, displacement.
  - Electromagnetic fields (EMFs) concern with stakeholders.

  - Attraction of seals to a WEC may be a concern for aquaculture operators.
  - Environmental interactions that are increased by aquaculture system or the combined nature of the two (e.g., entanglement).
  - MRE devices attached to the barge or fish pens could reduce potential impacts such as entanglements.
  - Potential for new challenges (entanglement due to close location of MRE and aquaculture systems and biofouling support or haul-out platform) but also positive around reduced noise and spill risk by replacing diesel generators. Help with public opinion to run monitoring program for these concerns.
  - Use of anti-fouling.
- Will the smaller-size devices and smaller-scale projects have less effect than grid-scale devices and can regulatory processes address these differences proportionately?
  - Having a stand-alone WEC vs being on aquaculture feed barge may change how it is permitted; if the WEC is part of the structure that exists the permitting may be easier.
  - Combining the physical structures may be the simplest way to permit and operate an aquaculture farm with wave energy devices, rather than treating them as separate projects.
  - Streamline through integration (e.g., MoorPower) or WEC attached to net pens/existing structure; could this reduce regulatory requirements and reduce environmental effects, especially entanglement and habitat change?
  - Environmental permitting needs to take into account the decrease in boat trips, noise, diesel, and spill risk from using a WEC instead of generators.
  - The addition of a WEC smaller than pens and feed barge could result in much smaller impact than the overall aquaculture system.
- How should we manage and monitor the potential effects associated with these smaller devices and projects?
  - Combining these projects and incorporating environmental monitoring devices could make a big difference for social license, and create opportunities for community engagement.
  - Opportunities for synergistic monitoring, can use monitoring equipment from the aquaculture farm to monitor the WEC or maintenance vessels to help with monitoring of WEC, environmental DNA (eDNA) platform, etc.
  - Build a monitoring system into the WEC, especially to produce publicly facing videos.
  - Incentivize data collection.

Ocean observing subsurface vehicle wave energy recharge use case

- What key species/habitats/uses are of most concern around MRE development?
  - Whales (right, blue, humpback), dolphins, sharks (hammerhead, nurse).
  - Humans (commercial fishing, recreational fishing, boating).

    - Importance of determining competing use impacts and potential compensation.
    - Living resource data that are specific to the jurisdiction or location.
    - Local knowledge is key.
    - Know your environment: Australian Marine Spatial Information System, Protected Matters Search Tool.
- Which stressor-receptor interactions will be of greatest concern for the use case, and how significant are those concerns?
    - How will the long-term presence of the equipment modify the surrounding micro-environment?
    - Socioeconomic: Interactions with fisheries/recreational fishing.
    - Underwater noise, mooring lines, EMFs from subsea cables, fouling leading to some potential attraction.
- Will the smaller-size devices and smaller-scale projects have less effect than grid-scale devices and can regulatory processes address these differences proportionately?
    - The Australian permitting process seems to be a nearly insurmountable burden to overcome. The state, federal, regional, and Tribal permissions make it sound daunting. Australia is just early enough in development that only pre-permitted test sites are being used as of now.
    - Australian marine parks may not allow it (legacy).
    - Broader environmental protection act – it would depend on the risk appetite of the minister at the time.
    - Smaller projects may not have to do a full formal assessment if you can demonstrate that it won't have an impact.
    - The key is having evidence that the overseas knowledge is relevant to the new location (e.g., no research on penguins in the northern hemisphere).
- How should we manage and monitor the potential effects associated with these smaller devices and projects?
    - Build trust with the community before asking for siting projects.
    - There is a range of stakeholders needing to be engaged and approached with separate strategies (e.g., traditional owners).
    - First step is education and the second is asking for permission.
    - Approaching stakeholders from a solution-oriented perspective rather than introducing new concerns.
    - Thorough and continual stakeholder engagement.
    - Discussion on the potential value that the observation equipment can add for other stakeholders is needed.
    - Create a detailed, accurate project description including a decommissioning plan.
    - Consider life cycle of deployment including operation & maintenance and decommissioning.
    - Need to consult with marine parks or other local authority.

- Design can be catered to account for certain use cases/stakeholders outside of traditional MRE.
- Share data!

Next Steps

The input from the breakout group discussions during the workshop will be leveraged for the "off-grid applications" task of OES-Environmental Phase 5, which will focus on:

- Describing use cases for remote communities, islands, and power at sea,
- Assessing the scale of environmental effects of smaller off-grid devices, and
- Adapting the knowledge gained from grid-scale devices to smaller-scale applications.

Appendix 1 – Attendee List

Organization	Number of participants	Country
BMT	1	Australia
Commonwealth Scientific and Industrial Research Organisation	1	Australia
Department of Climate Change, Energy, the Environment and Water, New South Wales	1	Australia
Department of Energy, Environment and Climate Action, Victoria	1	Australia
Echoview Software	1	Australia
Swinburne University of Technology	1	Australia
Tidetech	1	Australia
University of Melbourne	1	Australia
Water Research Laboratory, University of New South Wales	1	Australia
Ghent University	1	Belgium
Nova East Wind	1	Canada
Marine Energy Research and Innovation Center, Universidad Austral de Chile	1	Chile
Ashikaga University	1	Japan
Insightful Modelling	1	New Zealand
Tonkin & Taylor	1	New Zealand
Nanyang Technological University	1	Singapore
Aquatera Ltd*	1	UK
European Marine Energy Centre	1	UK
Atlantic Marine Energy Center, Coastal Studies Institute	1	USA
Pacific Northwest National Laboratory*	5	USA
Pacific Ocean Energy Trust	1	USA
Sandia National Laboratory	1	USA
Water Bros, C-Power	1	USA

* Organizers of the workshop.