

UK-Indonesia Network for Supporting Marine Renewable Energy Development in Tropical Waters

Summary Report

Executive Summary

In December 2021, academics and practitioners from the UK and Indonesia convened for a series of discussions on the potential for development of marine renewable energy (MRE) infrastructure in Indonesian waters.

Split across three events, the aim of the exercise was *“to unite people, and foster dialogues, in the interests of working across academia, policy, and industry to accelerate the development of successful marine renewable energy projects in Indonesia.”*

A diverse programme of presentations and collaborative workshops addressed the following topics:

- **Panel Discussion 1** - UK-Indonesia Renewable Energy Landscape, towards Energy Resilience Opportunity from the Ocean
- **Panel Discussion 2** - What does the Marine Renewable Energy Industry look like – Past, Present and Future
- **Panel Discussion 3** - Challenges of MRE Industry
- **Breakout Group Discussions** - Recommendations for supporting a MRE roadmap in Indonesia
- **Panel Discussion 4** - Developing Project Collaboration for Marine Renewable Energy for Powering the Blue Economy in Indonesia

This report gives an overview of the main outcomes of the event, with a particular focus on the challenges and opportunities highlighted during breakout discussions.

Panel Discussion 1

UK-Indonesia Renewable Energy Landscape, towards Energy Resilience Opportunity from the Ocean

Yudo Dwinanda Priaadi, of the Ministry of Energy and Mineral Resources in Indonesia, outlined Indonesia’s current commitments and roadmap to reach net zero targets. Plans to build an energy ‘supergrid’ and incorporate smart technology will support the connectivity needed to efficiently use renewable energy sources and address mismatch between locations of points of supply and

demand. He outlined the key challenges facing Indonesia's low carbon energy transition and encouraged international partners to approach the Ministry and work in collaboration.

Giulia Agnisola, of Marine Scotland, spoke on marine planning and policy elements from a UK perspective. She outlined Scotland's unique National Marine Plan, and gave an overview of efforts to develop tidal, wave and offshore energy. Lessons learned during these efforts involved adapting to new technologies, accounting for environmental impacts, and developing a sound marine planning system.

Panel Discussion 2

What does the Marine Renewable Energy Industry look like – Past, Present and Future

Gareth Davies, of the Aquatera Group, spoke on characteristics of blue energy markets in Indonesia. He highlighted the importance of a market approach, incorporating distribution of demand into MRE development decisions. He also noted the trade-offs between connecting remote areas or enabling them to become self-sufficient. Through addressing costs and benefits he showed a clear case for developing MRE in Indonesia.

Dernis Mediavilla, of the European Marine Energy Centre (EMEC), spoke about experiences of, and lessons learned from, developing specific test centres for MRE technologies in Scotland, discussing how they may be applied in other areas. She underlined the focus on reducing the time, cost, and risk involved in development, and the importance of collaborative efforts to exchange knowledge and build partnerships.

Raeanne Miller, of the MASTS Renewable Energy Forum (MREF) and Aquatera, spoke about MREF's approach to collaborative working across disciplines. She captured key contributions of the MREF, and how that has benefitted Scotland's MRE development. She emphasised the importance of interdisciplinary working.

Panel Discussion 3

Challenges of MRE Industry

Joanne Porter, of Heriot Watt University Orkney Campus, presented key challenges highlighted by a series of surveys. Conducted in Orkney, the surveys monitored the material impacts on MRE (namely biofouling) in real-life environments. Porter summarised lessons to be taken on board by future programmes.

Dr Irfan Syarif Arief, of Institut Teknologi Sepuluh Nopember, presented recommendations for the design of marine energy infrastructure to support the blue economy. Two case studies demonstrated differing needs across coastal areas in Indonesia, showing how they can relate to recommendations for technology to be developed.

Oliver Rag, of Orbital Marine Power, presented on Orbital's work to develop a floating tidal platform that operates as a tidal turbine system. Key advantages of the platform include its buoyancy and relative ease of installation and repair. Orbital has worked with Aquatera technology to determine areas of possible deployment in Indonesia.

Dr Mohammed Almoghayer, of Offshore Renewable Energy Catapult, introduced Catapult's role as the UK's leading technology innovation and research centre for offshore renewable energy. The presence of an independent industry driver like Catapult could prove to be an effective way to foster innovation and accelerate MRE development in Indonesia.

Jess Malcolm, of Marine Scotland's Consenting Team, gave an overview of the consenting and licensing process in Scotland, highlighting how it links into wider marine planning priorities. She noted typical constraints, including site selection, environmental processes, and other marine users, and relevant learnings for an Indonesian context.

Inka Yusgiantoro, of The Purnomo Yusgiantoro Center, presented on financial challenges and opportunities in the MRE sector at the Indonesian and global scale. He highlighted Indonesia's significant capacity for MRE and noted the importance of collaborations between government agencies and research institutions.

Sjarief Widjaja, of Indonesia's Ministry of Marine Affairs and Fisheries, summarised the broader industry and economic landscape that must be considered when planning for MRE as part of the blue economy in Indonesia. Several existing assets feed into the blue economy, including from sectors such as fisheries and tourism.

Breakout Group Discussions

Recommendations for supporting a MRE roadmap in Indonesia

Four breakout workshops, split over two events, enabled delegates to discuss the opportunities and challenges facing different facets of MRE development.

1. Materials and Design

Opportunities	Challenges
<p>Minigrids and microgrids could supply small, remote communities with MRE, replacing diesel generators.</p> <p>Potential for training and capacity-building on small islands would allow communities to maintain MRE infrastructure independently.</p> <p>Interest in development of solar-powered compressor systems for storing energy, rather than using expensive batteries on remote islands.</p> <p>New technologies such as ‘pendulum’ wave energy converters have potential, though first need piloting in Indonesian waters.</p> <p>There is scope for adaptation of well-established on-land solar technology to resist corrosion for offshore use.</p> <p>Vessel-focused anti-biofouling efforts, such as GloFouling Partnerships, could potentially be applicable to MRE.</p> <p>Smaller projects could involve emerging academics such as MSc students, who could progress testing and monitoring operations of deployed MRE.</p>	<p>Solutions to biofouling and corrosion and standards for monitoring have not been fully addressed for MRE.</p> <p>The design and robustness of technology may not be sufficient for use by local communities in remote locations. Academic-industry collaborations may progress prototypes further towards deployment.</p> <p>The size of devices must be considered carefully, to establish their appropriateness for the characteristics of the area where they will be deployed.</p> <p>Transport container size and crane availability can act as a constraint, which should be considered during equipment design and deployment.</p> <p>Calculations around returns on investment remain uncertain.</p> <p>At present, not all locations have compatible infrastructure for MRE.</p>

2. Market, Business Model and Financial Aspects

Opportunities	Challenges
<p>Indonesia’s geographical characteristics give it significant potential for MRE development.</p> <p>Unconventional financing methods, such as blended finance, present opportunities for funding. For example, early-adopter investors could provide initial funding during development, followed by other financing such</p>	<p>MRE is lagging behind more mature renewable energy technologies, such as solar. There is the need to prove MRE’s potential to attract investors.</p> <p>Governmental policies focus more on mature renewable energy technologies than MRE, making it challenging to accelerate MRE’s</p>

<p>as capital markets or crowdfunding at later stages.</p> <p>There is potential for carbon tax profits to be invested in MRE.</p> <p>There is proven demand for off-grid energy in isolated coastal areas.</p> <p>The Cirata Floating Solar Photovoltaic (FPV) Plant provides a useful business model in terms of its operation and integration with other energy resources.</p> <p>Indonesia's state-owned enterprises (BUMN) may have Corporate Social Responsibility funds available for MRE development.</p>	<p>development.</p> <p>The roadmap and financing plan for development and execution of MRE are not currently comprehensive.</p> <p>There is economic and political risk associated with funding marginal projects.</p> <p>Transition to MRE would incur high development costs and could increase the cost of electricity for consumers.</p>
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3. Environmental Aspects

Opportunities	Challenges
<p>MRE infrastructures can act as de-facto MPAs given other marine activities (namely fishing) are often prohibited or limited in their vicinity.</p> <p>Fisheries management can benefit from de-facto exclusion zones that help stocks recover.</p> <p>There are opportunities for engagement with local communities, especially in relation to the UN's Sustainable Development Goals.</p> <p>Small-scale MRE can empower local communities to use resources more efficiently, for example by providing capacity to refrigerate fisheries products.</p> <p>MRE infrastructure can create artificial marine habitats, such as reefs, which promote biodiversity.</p> <p>It is possible MRE could play a role in coastal protection.</p>	<p>There are many knowledge gaps concerning the ecological impacts of MRE development in Indonesia.</p> <p>There is a lack of clarity about how environmental considerations are taken into account within consent and planning policy for MRE.</p> <p>Disturbance to ecosystems from the deployment and installation of MRE infrastructure can negatively affect biodiversity.</p> <p>MRE infrastructure can affect habitat characteristics and connectivity, such as through affecting wave patterns or water temperature.</p> <p>The displacement of fishing and other marine activities can mean environmental issues transfer to a new location, and remain unresolved.</p>

<p>MRE could be co-located with other marine activities such as aquaculture.</p>	<p>Some MRE developments such as offshore wind present collision risks for seabirds.</p> <p>Electrical cables can disturb habitats and alter the behaviour of species sensitive to electric currents.</p> <p>MRE presents a biosecurity risk, such as through providing a potential substrate for invasive organisms to populate via biofouling.</p> <p>MRE could make ecosystems more vulnerable and less resilient to natural disasters such as earthquakes or tsunamis.</p>
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4. Community and Policy

Opportunities	Challenges
<p>Policy could provide the means for training and upskilling island and coastal community populations in managing and utilising MRE.</p> <p>Policy action can facilitate collaboration and shared knowledge to map out solutions across Indonesia.</p> <p>The dispersed nature of MRE could facilitate rights to access self-contained energy grids for communities across Indonesia.</p> <p>Policy could recognise that MRE poses a means of combating global climate change, which threatens coastal communities and the Indonesian economy.</p> <p>MRE provides a policy solution for providing energy to off-grid communities, that would otherwise be challenging and costly to supply, helping to deliver on national energy targets.</p> <p>Demonstrator islands could be supported by</p>	<p>There is a lack of a detailed policy framework for MRE, potentially signalling a disconnect between aspiration and action.</p> <p>There is a need to calculate the costs of not decarbonising to help justify MRE rollout as affirmative policy.</p> <p>There is a need to balance the priorities of global decarbonisation against local economic needs and opportunities.</p> <p>Policy must benefit both centralised urban and remote rural communities.</p> <p>There is the potential for friction between centralised top-down policy and local governance.</p> <p>A lack of capacity and knowledge at the local level, alongside potential aversion to risk, may need to be addressed to meet MRE needs.</p> <p>Expectations that communities will maintain</p>

<p>policy and co-design solutions alongside communities.</p> <p>Policy support could position MRE as a means to work towards the decarbonisation of Indonesia's fishing fleet, which is currently primarily powered by fossil fuels.</p> <p>Clean energy can attract support from higher education, funders, and government.</p> <p>A focus on clean energy can attract tourism.</p> <p>Established inland renewable energy technologies can provide lessons through analogous solutions.</p>	<p>MRE need to be kept realistic - they are dependent upon available resources, perceived benefits, and capacity.</p> <p>MRE may lead to conflict with other marine activities, particularly those that benefit local communities (such as fishing).</p> <p>Policy needs to recognise that climate change poses a risk to coastal communities and potentially MRE infrastructure.</p> <p>There are cultural challenges to overcome to achieve gender equality and inclusion, which is necessary to effectively utilise human resources and abilities and meet the UN Sustainable Development Goals.</p> <p>Community-inclusive activities require significant preparation and development prior to successful rollout and accomplishment.</p> <p>There is a challenge in defining what constitutes communities in the context of MRE.</p>
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Panel Discussion 4

Developing Project Collaboration for Marine Renewable Energy for Powering the Blue Economy in Indonesia

Julio Retana, of MENTARI, introduced the MENTARI programme as a cooperative project aimed at supporting the development of low carbon energy in Indonesia. The programme incorporates collaboration with stakeholders to help Indonesia achieve inclusive economic growth, poverty reduction, electrification, and climate change goals.

Luky Adrianto, of the Faculty of Fisheries and Marine Sciences at Bogor Agricultural University, spoke on how the Blue Economy Development Index (BEDI) can be used as a metric to measure progress in the development of the blue economy. Ocean governance that utilises BEDI's three pillars - ocean capital, social capital, and sustainability capital - can help countries direct their efforts towards the most fruitful, sustainable, and inclusive opportunities.

Achmad Affandi, of Indonesia's Ministry of Education, Cultures, Research and Technology, introduced the Kedaireka funding platform, a programme that provides match funding for projects which meet three key criteria:

1. Provide tangible improvement or positive impacts for universities.
2. Offer solutions to national-scale or industry problems.
3. Create opportunities for the participation of students.

Conclusions

Dr Gareth Davies, of Aquatera, reiterated the need for academic-industry collaboration to build MRE in Indonesia. He highlighted the close ties and relevance connecting Indonesia and the UK, and identified the common building blocks for MRE and the blue economy.

Dr Trika Pitana, Dean of Marine Engineering Faculty, Institut Teknologi Sepuluh Nopember, shared words of support and motivation for the building of the consortium going forward, and underlined the need for strong collaboration and innovative solutions to move to MRE in Indonesia.

Timeline

Building upon the themes raised in plenary sessions and workshop discussions, delegates set out the following timeline, detailing next steps for collaboration towards the rollout of MRE in Indonesia, and spanning short- and long-term actions.

Early 2022

- Delivery of Summary Report of the UK-Indonesia Network MRE Workshops.

Ongoing throughout 2022

- Find and link with relevant people in Indonesia with knowledge on the Indonesian environment and ecology.
- Identify opportunities for policy alignment, including across sectors, for decarbonisation.
- Support work to improve Technology Readiness Level to enable deployments at sea.

Late 2022

- Build knowledge on the physical environmental context (such as interactions with natural disasters), economic and engineering uncertainties, and dependence on different scales.
- Assess depth of knowledge of MRE development in Indonesia - what do we know and what don't we know? What is planned, over what timescales?
- Consider both the engineering and ecological consequences of biofouling.

2022 onwards

- Build knowledge of vulnerable taxa and habitats.
- Examine potential cumulative impacts at an early stage, starting with lessons learned elsewhere.

Follow on Achievements

December 2021- British Council Going Global partnerships proposal submitted and funded.

January 2022- British Council Going Global Partnership project started. Runs through until end of December 2024. Collaboration between HWU, Institut Teknologi Sepuluh Nopember and Aquatera Ltd.

February 2022- Kedaireka proposal submitted, led by ITS Nopember for building of consortium IBEC: Blue Energy for Blue Economy Centre of Excellence.

July 2022-Kedaireka funding proposal awarded.

June 2022-British Council Going Global Partnerships project virtual programme delivered to 76 students across Eastern Indonesia and HW Online students.

July-August 2022 British Council Going Global partnerships in country challenge-based learning programme with participants from across Indonesia and from HWU faculty plus online student representative.

August 2022 onwards: continuation of British Council Going Global Partnerships programme into its second year with published journal outputs being prepared and initiation of Kedaireka activities. Further research and teaching collaboration funding being followed up with guidance from British Council Jakarta.