Technology Collaboration Programme
by IEA

ICOE 2024
KEY TAKEAWAYS

INTERNATIONAL CONFERENCE ON OCEAN ENERGY

17–19 SEPTEMBER 2024, MELBOURNE, AUSTRALIA

OES OCEAN ENERGY SYSTEMS

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INTRODUCTION

THE MISSION AND MOMENTUM OF ICOE 2024

This cultural presentation was not merely a showcase of tradition. It was a powerful symbol of the deep-rooted connection between local communities and their natural environments. It shows the importance of respecting and integrating traditional knowledge and community practices in modern endeavors, such as the development of ocean energy.

The International Conference on Ocean Energy (ICOE) is a relevant event for professionals, researchers, and policymakers from around the globe dedicated to the advancement of ocean energy. This biennial conference, renowned for its focus on the development of ocean energy - wave energy, tidal and ocean currents, ocean thermal energy and salinity gradient - continued its tradition of fostering innovation, collaboration, and dialogue in the sector.

ICOE 2024 marked a significant milestone as it was held in Melbourne, Australia, on September 16-18, making it the first time the event ventured as far afield as the Southern Hemisphere.

This event aims to provide comprehensive exchanges of recent experiences and demonstrations of ongoing efforts. The conference is also seen as a platform to facilitate networking opportunities and share perspectives on current trends and future directions in the ocean energy field. Its significance lies not only in disseminating cutting-edge research but also in shaping the policies and market strategies that will govern the future of sustainable ocean energy.

ICOE 2024 in Australia was uniquely distinguished by the vibrant spirit of Australia. The opening ceremony captured this essence brilliantly, featuring a traditional Aboriginal performance that highlighted the country's rich cultural heritage. This memorable beginning set a compelling tone for the conference, emphasizing the blend of tradition and innovation—a photo from the event illustrates this remarkable moment.

> Australia is buzzing with projects that showcase the importance of ocean energy for a more sustainable future. Ocean energy is no longer a question, but a need for us to reach net zero targets globally.

Professor Irene Penesis | Blue Economy CRC
CHAIR OF ICOE 2024

THE IMPACTFUL REACH OF ICOE 2024

The ICOE 2024 programme covered all aspects of the ocean energy sector, from markets and technology developments to socio-economic and environmental aspects and future investment opportunities.

Participants: ICOE 2024 attracted over 230 attendees.

Countries Represented: Delegates and speakers from over 20 countries.

Major Actors:
Science (40%): Researchers presented 165 scientific papers, contributingto a deeper understanding of technological potentials and limitations.

Policy (20%): Policymakers from various national and international bodies discussed regulatory frameworks and cooperative strategies to support the ocean energy industry.

Industry (40%): Leading companies and startups showcased innovative products and systems, highlighting commercial progress and investment opportunities.

ICOE 2024 was a hub of dynamic interactions, with engaging dialogues during breaks. The event featured high-level presentations with inspired attendees, fostering a productive environment for new partnerships.

INTRODUCTION TO SESSION TRACKS

ICOE 2024 was structured around three focused tracks, each designed to address the multifaceted aspects of ocean energy development. These interconnected tracks were specifically developed to explore the diverse challenges and opportunities within the sector, ranging from market dynamics and technical advancements to socio-economic and environmental impacts:

TRACK 1
Markets and Building Demand

This track explored the global market opportunities for ocean energy, addressing how to effectively build demand and foster market penetration. Discussions centered on marine energy markets, identifying areas for growth and the factors influencing investor decisions. Participants discussed relevant policy frameworks and incentive structures for market adoption. Key takeaways included the importance of coherent policies, international cooperation, and public awareness in driving the market forward for ocean energy solutions.

TRACK 2
Technical Developments

Technical advancements in ocean energy were at the forefront of this track, with a focus on wave and tidal energy technologies, Ocean Thermal Energy Conversion (OTEC), and the challenges and solutions related to grid integration. Experts presented the latest innovations designed to enhance the efficiency and reliability of marine energy systems. Significant progress in materials technology, power take-off systems, installation and maintenance strategies, and device resilience under extreme marine conditions were highlighted.

TRACK 3
Socio-Economic and Environmental Impacts

This track addressed the broader socio-economic and environmental implications of deploying ocean energy systems. Key discussions were around the development of supportive policies and regulations that balance growth with environmental sustainability. The role of marine spatial planning was emphasized as critical for the responsible development of ocean energy projects, particularly in minimizing conflicts with other marine activities and conserving marine ecosystems. Lessons learned from the offshore wind sector provided valuable insights into community engagement, ecosystem-based management approaches, and the integration of renewable energy projects into local economies. Participants agreed on the need for comprehensive regulatory frameworks that support innovation while ensuring environmental and social benefits.

INTRODUCTION TO ICOE SESSIONS

A series of targeted sessions were designed to address the spectrum of challenges and opportunities within the ocean energy sector - from exploring technical innovations and discussing robust financing options to emphasizing the importance of sustainability and community engagement:

Flagship Ocean Energy Projects
Industry leaders in the wave and tidal energy sectors convened to discuss major flagship projects, with a particular focus on technical advancements and deployment strategies that are driving the industry forward.

Surfing the Waves: Developments in Wave Energy Technology
Latest advancements in wave energy technology, featuring cutting-edge research and pilot projects designed to fast-track the sector's commercial viability.

Turning the Tide: Developments in Tidal Energy Technology
Latest developments in tidal energy, offering insights into technology optimization, environmental impacts, and best practices for deployment.

Financing Ocean Energy
Representatives from the Netherlands Enterprise Agency, Clean Energy Finance Corporation, and Ocean Impact Organisation explored various financial models, investment opportunities, and funding challenges. Discussions centered on creating a robust financial ecosystem to support the growth of ocean energy.

Building Support: Ethics, Values, Cultural and Social License
Academics and representatives from Indigenous communities highlighted the critical importance of securing cultural and social licenses for ocean energy projects. The discussions underscored the need for ethical practices and robust community involvement as foundations for successful energy development.

Human Capacity Building: Jobs and Training
This session addressed workforce development within the ocean energy sector, focusing on training programs, job creation, and skills transfer as crucial elements for industry growth.

Powering Up: Grid & Off-Grid Integration, Power Take-off and Control
There were in-depth discussions about integrating ocean energy into both grid and off-grid systems, exploring innovative power take-off and control mechanisms that enhance system efficiency and reliability.

Global Markets & Opportunities
International experts discussed the expansion of the global market for ocean energy. The focus was on opportunities in the Asia-Pacific region, strategic partnerships, and fostering cross-border collaborations.

Knowledge Sharing & Transfer
The focus was on the importance of sharing knowledge and experiences across different projects and regions to support the scaling and sustainability of ocean energy solutions.

Plenary Sessions on Responsible Development and Environmental Considerations
These sessions featured discussions on responsible ocean energy development and environmental protection, with a focus on regulatory practices and ecological assessments.

02
VOICES FROM THE CONFERENCE

This chapter presents perspectives from attendees of ICOE 2024. Through a series of in-depth interviews, we capture the essence of the conference, highlighting challenges and future perspectives in the field.

By sharing these voices, we hope to carry forward the collaborative spirit of ICOE, providing views that inspire and inform the global ocean energy community.

Cameron Grebe

Cameron Grebe is the Deputy CEO at the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), where he leads the Strategic Regulation and Improvement Division. With over 16 years of experience as an environmental engineer, adviser, and general manager at companies like BHP, Woodside Energy, and Shell Global Solutions International, Cameron brings a wealth of industry expertise to his role.

Given The Offshore Infrastructure Regulator's (OIR) critical role in regulating both the offshore oil and gas sector and the emerging offshore renewables industry, how do you see the process of gaining and maintaining social license evolving for offshore renewables compared to the more established oil and gas sectors?

The expectations of the public and heightened community and stakeholder interest in offshore energy developments have never been greater, which means independent oversight, regulatory accountability and transparency are more important than ever.

Our approach to project delivery, as well as collaboration and engagement with communities and other marine users in early projects will set the benchmark for the future offshore renewables industry.

Acceptance of the offshore wind industry will be reliant on early moving projects delivering renewable power in a safe and responsible manner.

It is essential for both industry and government regulators to build trust and develop and maintain a social licence to operate and regulate, to ensure we can do our jobs effectively.

With NOPSEMA's extensive experience in the oil and gas industry, what key lessons from these sectors can be applied to ensure the safe and responsible development of offshore renewable energy projects?

Underestimating the importance of effective engagement to the success or failure of a project can be costly. Not only can it impact reputation, but it can see projects significantly delayed or not carried forward.

Australia has unique physical, ecological, social and cultural aspects that will influence whether offshore renewable energy projects can meet societal expectations and be delivered safely and responsibly.

These aspects need to be identified and understood to determine whether different or innovative approaches to risk management are needed.

Sufficient work must be done and effort made early in the planning and design phases of offshore renewables projects to establish the context and mitigate risks or impacts associated with offshore renewable energy developments.

What do you see as the most significant technical and regulatory challenges facing the Australian ocean energy sector today?

Australia's ocean economy relies on the long-term health and resilience of the ocean.

Understanding the impacts on the marine environment early in feasibility stages will be key to developing innovative technology solutions and strategies to reduce and mitigate impacts in order to secure project approvals.

Considering Australia's ambitions within the offshore renewables sector, how important is international collaboration for achieving technological innovation, regulatory alignment, and market expansion?

Australia in a fortunate position with respect to information sharing through international engagement where the experiences of established offshore wind jurisdictions can be leveraged. Our national and international collaborations help develop regulatory excellence by sharing expertise, information, and best practice.

> It is essential for both industry and government regulators to build trust and develop and maintain a social licence to operate and regulate, to ensure we can do our jobs effectively.

Lily Wain

Lily Wain is part of the Commercial Team at the European Energy Marine Centre (EMEC), where she identifies and develops opportunities to expand EMEC's portfolio for marine demonstration projects. She leads proposals for marine energy projects and coordinates the pipeline of technology demonstration projects coming to EMEC, from feasibility to contract stage.

> Test centres are essential in driving standardisation, playing a crucial role in the development and application of industry standards, and help mitigate risks and reduce costs.

What was your primary takeaway from ICOE 2024?

My primary takeaway from ICOE 2024 is the immense potential and excitement surrounding the marine energy sector. The innovations and advancements presented highlight a future where ocean energy could play a critical role in global clean energy solutions. However, realising this potential requires significantly raising the industry's profile to attract essential funding and investment, especially from high-level regulators and policymakers. Continued advocacy and strategic visibility are crucial to secure the support needed for scaling up. The conference underscored that, with the right attention and resources, marine energy can make a substantial impact on sustainable energy goals.

Based on the insights from this conference, how do you see the role of test centers in the ocean energy sector evolving in the coming years?

In the coming years, test centres will play an increasingly vital role in advancing ocean energy by bridging the innovation 'valley of death' through provision of affordable and independent testing and demonstration for developers. Test centres are essential in driving standardisation, playing a crucial role in the development and application of industry standards, and help mitigate risks and reduce costs. By establishing and applying industry standards, test centres reinforce credibility and foster investor confidence in ocean energy technologies. Furthermore, their role as hubs for collaboration and knowledge sharing will support a unified industry approach, accelerating innovation and enabling developers to overcome key technical and financial challenges in marine energy deployment.

What are the key challenges facing the ocean energy sector today?

The ocean energy sector faces several key challenges, with funding being a primary hurdle; securing consistent funding and investment is essential for scaling technology development and commercialisation. The sector also struggles with supply chain limitations, as many necessary components and specialised services are still nascent, driving up costs and delaying progress. Regulatory hurdles add complexity as navigating environmental and permitting requirements can be time-consuming and costly. Finally, raising awareness and gaining public and policy support remain critical to advancing ocean energy as a viable part of the global energy mix.

How can test centers like EMEC collaborate with financial institutions, policymakers, and industry leaders to overcome barriers in the ocean energy sector?

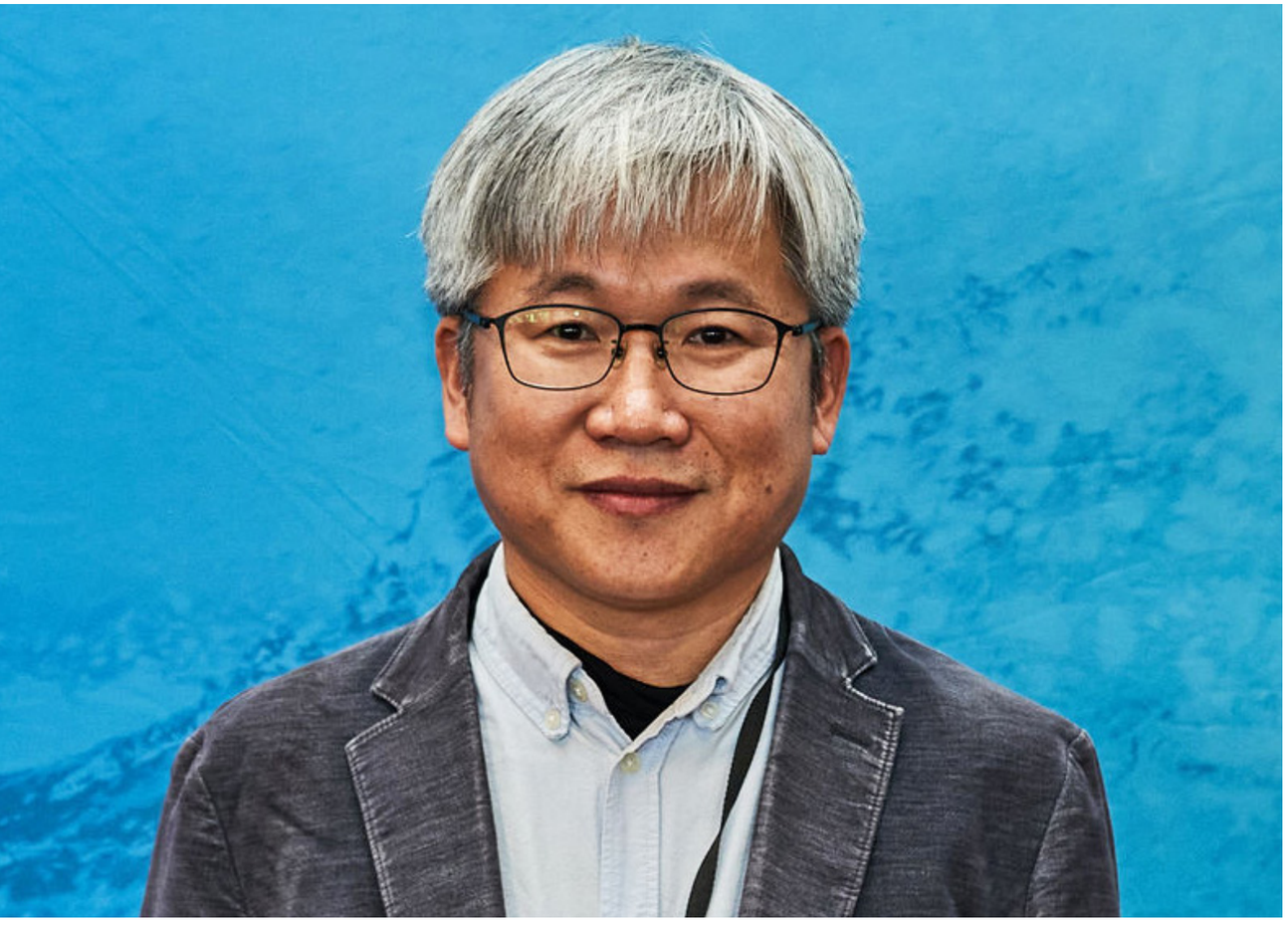
Test centres like EMEC can play a pivotal role in overcoming barriers in the ocean energy sector by collaborating closely with financial institutions, policymakers, and industry leaders. Through partnerships with financial institutions, test centres can provide data-backed validation, reducing investor risk and attracting funding critical for scaling-up. Engaging with policymakers helps streamline regulatory pathways, addressing permitting and environmental concerns that often delay projects as well as ensuring consistent R&D and revenue support is in place. By working with industry leaders, test centres can foster standardisation, improve supply chain resilience, and promote shared knowledge on technology advancements. Together, these collaborations enhance credibility, reduce costs, and build a unified approach to accelerate marine energy development.

What do you value most about attending a conference like ICOE, and how does it contribute to your professional or organizational goals?

Attending the ICOE is invaluable because it gathers the entire marine energy sector in one place, offering a unique opportunity to gain a holistic view of recent innovations, research, and industry trends. The concentrated presence of experts and organisations provides direct insights into what's been achieved and what lies ahead for ocean energy. This event supports professional and organisational growth, facilitating connections with industry, learning about emerging technologies, and understanding the broader sector. For a small and growing field, these insights and relationships are crucial to driving impactful projects and aligning with future developments in marine energy.

Jin-Hak Yi

Dr. Jin-Hak Yi is the principal research scientist and director of the Ocean Space Development and Energy Research Department at the Korea Institute of Ocean Science and Technology (KIOST). With a strong background in Structural Dynamics he is involved in multiple tidal energy development projects and serves as a member of the IEA-OES Executive Committee and an expert on IEC TC 114.



What was your primary takeaway from ICOE 2024?

I think ICOE 2024 is a conference that introduces the technological advancement accumulated so far in relation to the industrialization of ocean energy, discusses the barriers each country encounters in fostering the ocean energy industry, and discusses how to overcome such barriers. Compared to solar PV and wind power that have already been commercialized, ocean energy technology, which is a latecomer, must not only improve the technological readiness level but also have the task of not falling behind in competition with already commercialized renewable energies. Ocean energy has many advantages. In the case of a tidal power generation system, it has the advantage of being able to generate electricity consistently without being affected by the season or weather and predict long-term power generation relatively accurately. In the case of wave power generation, it has the advantage of not having much fluctuation in power generation compared to wind or solar PV. I think the most important thing is to develop technologies that can further enhance the advantages of ocean energy and overcome its disadvantages. From this ICOE 2024, these efforts from universities, research institutes, industries, and policymakers have been well presented and discussed between experts all over the world.

How do you see the future of ocean energy evolving based on the insights from this conference?

As well known, ocean energy is an energy source that can be used infinitely as long as the solar system exists, and it can play a significant role in renewable energy like wind and solar energy. It is an important field from an industrial perspective as many companies pursuing ESG management are joining RE100, and it is an aspect that must be developed in order to achieve the 2050 carbon net-zero target. However, it also has to compete with wind and solar energy, which are leading renewable development. From the developer's perspective, it is difficult to say that ocean energy is vaguely necessary because they want to introduce a system with low electricity costs and higher reliability. In addition, due to the energy crisis that occurred after the recent war between Ukraine and Russia, several European countries are considering increasing nuclear power generation, and Korea is also promoting CF100 (Carbon Free 100), which includes nuclear power in the system. I think that ocean energy is being forced to compete with not only wind and solar power but also nuclear power. Therefore, if we want to increase distribution through continuous investment and R&D in ocean energy, we need to explain the advantages of ocean energy more objectively and in detail. At this conference, there was a presentation that clearly demonstrated the advantages of wave power generation, and such efforts should be combined to make policymakers realize that it is necessary to invest in the ocean energy sector even if the current cost is slightly higher.

What are the key challenges?

If we are to talk about the key challenges, it would be technological innovation for cost reduction. In the case of tidal power generation systems, a total of 130MW systems will be installed by several companies in various sea areas by 2029 in the UK. The strike price is about 200 pounds/MWh, which is 1.3 to 2 times higher than the strike price of floating offshore wind power, which is relatively new and also very expensive. It is widely known that onshore wind power and solar power are already approaching the grid parity of the

> In the case of a tidal power generation system, it has the advantage of being able to generate electricity consistently without being affected by the season or weather and predict long-term power generation relatively accurately.

level of 50 pounds/MWh. In order to increase the supply of renewable energy beyond wind and solar power, which have already been sufficiently industrialized, ocean energy should also contribute. Current ocean energy systems can be said to be technically sufficiently proven. However, they are not yet economically feasible, and therefore, technological development for cost reduction is absolutely necessary.

How can collaboration between policymakers, industry leaders, and research institutes like KIOST effectively address and overcome the key barriers facing the ocean energy sector?

The key barriers in the ocean energy sector can be broadly divided into technological, economic, environmental, and social barriers. In the case of technological barriers, it is thought that various technical difficulties that arise in the design, production, construction, and maintenance stages can be solved by developing and applying new technologies through collaboration between universities, research institutes, and industries. Since problems that were not considered during the design stage can arise during operation, long-term test runs are absolutely necessary. Economic barriers can be relieved by innovative technological advancement and co-location with offshore wind or coastal infrastructures such as breakwaters and also by disseminating ocean energy systems into niche markets such as off-grid remote islands to achieve an economy of mass from an industrial point of view. In terms of environmental and social barriers, the barriers are expected to be at a level similar to that of offshore wind power or offshore solar power, and it is thought that supplementation of government policies, etc., will be necessary to overcome these barriers in terms of environmental and social acceptance.

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Can you share any innovative technologies or projects you learned about at ICOE 2024 that you believe will significantly impact the industry?

In order to more actively foster the ocean energy industry, technological standardization and the establishment of a certification system are also important parts. For this purpose, IEC TC 114 and IEC RE/ME are making great efforts. During this ICOE, there was a session on the measurement of tidal power generation systems. The presentation by the Italian CNR group was particularly interesting. They presented the large towing tank test results of a performance test and load measurement of a tidal turbine developed by ORPC in the United States as part of the CRIMSON project. Their efforts can contribute to making the technical specification on load measurement, IEC TS 62600-3, more realistic and applicable to the coming tidal energy converters. UNH (University of New Hampshire)'s presentation was also interesting. They were developing a very elaborate test plan, such as introducing an optical fiber sensor to measure the load at the blade root. In addition to performance under these actual operating conditions, by measuring the load, it is possible to evaluate whether the design was properly manufactured, and furthermore, it is thought that the durability and reliability of the system can be evaluated. This research will be a significant milestone in the load measurement sector.

Allison Johnson

Allison Johnson leads a team that manages stakeholder engagement, communications, workforce development, small business engagement, strategic planning, and evaluation for Department of Energy's marine energy and hydropower R&D programs. She joined the Water Power Technologies Office (WPTO) in 2018 after prior experience at DOE, the Environmental Protection Agency, and NATO.

What was your primary takeaway from ICOE 2024?

I can't choose just one takeaway, so I'll highlight two. First, marine energy technology developers globally are embracing innovative business models, pinpointing specific market needs with unique, sometimes niche, value propositions. Without naming specific companies, I gained insights into several that have a laser focus on highly specialized markets and use cases. I'm eager to see how this focused approach will pay off for them. Second, many technology developers are taking a thoughtful approach to how they define success and failure in their work. There's a recognition that rapid scaling isn't always the answer, and jumping from one exciting opportunity to the next doesn't always give you enough time to fully learn from your experience and apply your lessons learned. Sometimes, the best thing you can do after a major demonstration is to put your head down, revisit and refine technology, and work through pain points until you're confident you have a better product. If you can afford the downtime, you might just find yourself better prepared when that next opportunity arrives.

From your experience at ICOE 2024, which discussion or initiative around stakeholder engagement or community outreach did you find most impactful, and why?

One of my favorite sessions was the panel on the final day on supporting remote and island communities. Panelists discussed the unique opportunities and challenges of expanding renewable energy in remote communities, and this panel offered a refreshing and balanced mix of perspectives. The panel included voices from a funding provider, a technology developer, and two representatives from Pacific Islander and Indigenous communities. This diversity led to an enriching discussion on the importance of allowing communities to drive their own energy transitions and meaningfully supporting them in their ambitions. I appreciated hearing perspectives from outside the marine energy sector and am grateful to the panelists for taking the time to share their viewpoints with us.

Based on your interactions at the conference, how do you see the role of public engagement evolving in the future of ocean energy?

Public engagement will be crucial as marine energy continues to scale, and it's important to approach it with intention. In our work at the Department of Energy, we focus on opportunities at a national level, serving the broader American public. While we can't overlook our broader communications responsibility, it will be increasingly important to engage local communities—and those interested in exploring marine energy—in a targeted and meaningful way. Communities shouldn't just be viewed as potential end-users or customers; they should be recognized as informed collaborators and vital contributors to the workforce for future projects. Both DOE, as the sponsor of these projects, and developers have roles to play in this process. Personally, I'm interested in clarifying the ideal engagement roles of government sponsors versus project developers. Whatever it looks like, fostering a sense of shared investment and mutual benefits will be critical for the success of these initiatives.

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From your perspectives what are the key challenges in engaging diverse stakeholders in the ocean energy sector?

One of the key challenges in engaging diverse stakeholders in the marine energy sector is that building relationships and building trust takes time. This trust must be cultivated with communities, offtakers or customers, and regulators, each of which has its own concerns and priorities. Fostering strong, trusting relationships with varied stakeholders requires sustained effort, and I consider this work to be as critical as the actual engineering and design efforts. However, time is money, and this type of engagement needs to be properly budgeted and funded alongside the technical aspects of a project.

How can the ocean energy sector improve its communication strategies to better highlight successes and engage the public?

To effectively highlight successes and engage the public, it is important to involve trusted intermediaries in any communication strategy. For example, if you have an open water demonstration, inform local media and invite them to cover the event. Additionally, budget for a photographer or videographer and create a press kit to support your communications. With the limited number of devices, we should see every demonstration as an opportunity to educate the public about marine energy. Engaging local influencers and community leaders as ambassadors can also help build trust and excitement around these projects.

What do you value most about attending conferences like ICOE?

The chance to connect with passionate professionals from around the world. These events offer invaluable opportunities to exchange ideas, learn about the latest technological and policy advancements, and discuss common challenges. Also, as a representative of a government funder, ICOE provides a platform to showcase U.S. progress and gauge how our funding strategy compares to other government programs. At ICOE 2024, we announced the Department of Energy's largest marine energy funding opportunity to date—$112.5 million for wave energy—and the response has been great. It's exciting to see the growing visibility of the U.S. in the marine energy sector and the expansion of the DOE Marine Energy Program since I joined in 2018. At ICOE 2022, we announced what was then our largest funding opportunity—$45 million for tidal energy. I am excited to see if we can break our own record once again at ICOE 2026!

> However, time is money, and this type of engagement needs to be properly budgeted and funded alongside the technical aspects of a project.

Pablo Ruiz-Minguela

Dr. Pablo Ruiz-Minguela leads Wave Energy projects at TECNALIA. With 31 years of R&D experience, including 19 years in wave energy, he has managed over 25 international research projects and holds multiple patents and publications. His qualifications include an MSc in Industrial Engineering, an MSc in Advanced Manufacturing Technology, an MBA, and a recent PhD in Energy Engineering.

> Conference sessions highlighted the importance of gaining and maintaining social dialogue to ensure projects are delivered in a safe and responsible manner.

What was your primary takeaway from ICOE 2024?

Ocean energy has the potential to provide a clean and renewable source of power, offering significant environmental benefits like reducing greenhouse gas emissions, decreasing reliance on finite resources and helping preserve ecosystems vulnerable to the impacts of climate change. Australia has a huge and promising future for ocean energy and, in particular, wave energy. Being blessed with very consistent waves, Australia is making steady progress to harness this untapped resource responsibly and sustainably. Conference sessions highlighted the importance of gaining and maintaining social dialogue to ensure projects are delivered in a safe and responsible manner. It is a good reminder for engineers that the success of ocean energy not only hinges on techno-economic issues, but also on engaging with local communities, environmental groups, and other stakeholders to ensure that ocean energy projects are socially and environmentally sustainable.

Which discussion did you find most impactful, and why?

Knowledge sharing is crucial to avoid repeating early engineering mistakes across the sector. Despite the numerous benefits it can bring, such as improved innovation, greater cost-efficiency and better risk management, ocean energy stakeholders continue to underexploit this cross-fertilization strategy. Actually, leveraging on global experience and embracing failure as learning opportunities can transform past setbacks into stepping stones for future sector success. Technical webinars organised in Europe for disseminating practical ocean sector experience, periodic data sharing workshops led by IEA-OES and the US, and conference sessions such as "Learning from Success and Failure" and "Knowledge Sharing and Transfer" are excellent examples that can help shift this trend.

How do you see the future of ocean energy evolving based on the insights from this conference?

The future is bright based on the flagship projects, developer plans and technology showcase sessions presented at the conference. Several promising collaborations between technology developers and industrial investors are already happening. This tendency demonstrates the impact that publicly funded programmes have on increasing technological maturity, making those projects more attractive and leveraging private capital.

What are the key challenges facing the ocean energy sector today?

Research and innovation (R&I) efforts are still needed to drive the development of ocean energy technology, accelerate the progress towards industrial roll-out and help deliver on the ambitious international capacity targets. Currently, the sector is reaching the demonstration and pre-commercial stage, and the biggest challenge is the deployment and operation of ocean energy devices at sea for long periods to optimise their design and performance and validate business models for investors. The results of pilot projects will produce significant learnings and a wealth of data but require effective private and public collaboration to mobilise considerable financial resources and reduce the remaining uncertainties through site-specific innovation activities.

How can policymakers and industry leaders collaborate to overcome these barriers?

Policymakers and industry leaders can collaborate in several ways to overcome barriers to ocean energy development and encourage investment in ocean energy:

- Establishing clear and supportive regulatory frameworks.
- Fostering public-private partnerships.
- Creating joint R&I initiatives that can accelerate technological advancements.
- Incentivising sharing of data and experience.
- Offering financial incentives to reduce the risks associated with ocean energy projects.
- Building positive relationships with local communities and environmental groups.
- Working with international bodies to exchage best practices, standards and enabling technologies.

Hélène Chabbert

Hélène Chabbert holds a master's degree in energetics and renewable energy and has been an integral part at Météolien for 3 years, in charge of marine renewable energy studies. She has been taking part in several projects to assess wave and tidal resources and production in mainland France, the Caribbean and Polynesia.

> At ICOE 2024, I presented a poster on a wave atlas in French Polynesia. This part of the world consists of 118 islands, where local electricity generation is highly carbon-intensive due to its reliance on fossil fuels imported by boat. The atlas provides a detailed reanalysis of sea states and wave energy fluxes with a spatial resolution of 5 km, a temporal resolution of 3 hours and a temporal depth of 30 years.

What was your primary takeaway from ICOE 2024?

I was intrigued to learn that, despite Australia's excellent marine energy resources and the presence of wave energy converter manufacturers, the development in this sector has not progressed as much as I expected. It highlights a potential opportunity for growth and innovation. I think it's essential to emphasize the importance of including communities and First Nations in the development of marine energy projects. This aspect is often overlooked, and recognizing their insights and contributions can greatly enhance the success and sustainability of such initiatives.

What are the key challenges currently facing the ocean energy sector?

The wave energy sector presents a really great potential in terms of resource both importance and large repartition around the world, but it is quite difficult for people to understand this resource properly. Much more difficult than irradiation for PV, for example. The necessity of spectral analysis and the double dimension of the power matrix make the whole process unintuitive: we have to advocate a lot for this wave energy sector to build trust and confidence in this new opportunity for electricity production.

Stakeholders, particularly technology providers, need to transition from a "start-up" mindset—focused on investors and demonstrations—to an industrial approach that prioritizes clients and technical specifications and actual WECs. This shift is essential for effective project modeling and business planning, as difficulties arise when technology providers hesitate to share their technical details with project developers and production modeling teams.

What implications do you think your research could have on policy-making or industry practices in the ocean energy sector?

At ICOE 2024, I presented a poster on a wave atlas in French Polynesia. This part of the world consists of 118 islands, where local electricity generation is highly carbon-intensive due to its reliance on fossil fuels imported by boat. The atlas provides a detailed reanalysis of sea states and wave energy fluxes with a spatial resolution of 5 km, a temporal resolution of 3 hours and a temporal depth of 30 years. It consists of a database containing the time series of sea states and energy variables and various maps showing the statistics of certain key variables.

The special feature of this program is that the results are made available as Open Data, as requested by all the players involved, to give territories easier access to knowledge of the renewable wealth of their part of the ocean, which is reachable with current technologies. Making this data available via OpenData should enable the various players in the region to take hold of these tools and use them to make decisions about their energy future, and foster transitions towards greater resilience and respect for the environment.

Given Meteolien's diverse portfolio in renewable energies, what unique insights did you bring to ICOE 2024, and how have these contributed to the dialogue on ocean energy development?

Meteolien, established 19 years ago, has been a key player in the wind energy sector as an engineering consultancy from the beginning, and actively participating in every phase of the industry's development. In the evolving marine energy sector, Meteolien envisions future developments and leverages its extensive experience to support both public and private clients. We rely on our expertise and advanced tools for resource modeling, database management, and the production of atlases and maps. Additionally, Meteolien has successfully implemented renewable energy projects in remote areas and /or on islands.

What do you value most about attending conferences like ICOE, and how do these experiences support your professional development?

I enjoy being able to meet other marine energy players with whom I have worked long distance or whom I haven't yet had the opportunity to meet. At ICOE 2024, I was able to talk to Australians and New Zealanders stakeholders who I don't often meet at European conferences. This type of event makes it possible for me to meet fellow professionals working in the same field as me and to discuss our missions. But it's also a chance to meet other people working in the sector and to broaden my vision about the different roles in the marine energy sector.

Jonathan Fievez

Jonathan Fievez has served as CEO of Carnegie Clean Energy since 2018, driven by a deep commitment to sustainability and a strong foundation in technical expertise. Under his leadership, Carnegie has become a significant player in the global move toward clean energy, advancing the development and commercialization of the innovative CETO wave energy technology

What was your primary takeaway from ICOE 2024?

Being the first time this conference has been held in Australia, it was particularly good to see Australian government agencies in attendance. Notably absent were the politicians. The key takeaway being that, in an Australian context at least, there's still a long way to go to before ocean energy is in the national dialogue.

How do you see the future of ocean energy evolving based on the insights from this conference?

A notable change was with introduction of the considerable wave energy deployment focussed funding coming from the US DoE. The US team had a relatively large contingent and it's clear (subject to recent political changes) that the US are ramping up efforts to catch up to Europe in the wave energy space. It also seemed there were fewer, but more credible developers in attendance, which is a positive for the industry as it simplifies things for investors. I expect this trend to continue.

What are the key challenges facing the ocean energy sector today?

As the sector matures and larger deployments become more of a focus, a key challenge is to ensure that all deployments really move the needle in terms of progress toward economic projects. This means deployed technologies must be both reliable and, upon extrapolation to a modest scale (say 20 MW for grid application), able to achieve an economic return when coupled with realistic capital and economic support. Anything not meeting these criteria risks damaging the reputation of the sector whilst soaking up limited funding and support. The sector has a window of opportunity to get this right or face a very long and difficult journey without government support.

How can policymakers and industry leaders collaborate to overcome barriers in this sector?

Policymakers hold the key to much of the funding that the industry relies on. As a developer we would encourage policymakers to engage with us more directly when policies are being developed. They may also be surprised how willing industry leaders, especially developers are willing to collaborate, essentially sacrificing some competitive advantage for a better chance at a successful industry. Policymakers could facilitate (or more strongly, require through support) collaboration between developers to increase value for money from funding whilst encouraging knowledge sharing between developers.

What do you value most about attending a conference like ICOE, and how does it contribute to your professional or organizational goals?

As Carnegie is currently in the build phase of a deployment, the ability to discuss face to face and in one place with a variety of suppliers, policymakers, competitors and researchers has great practical value. Many of these people have only corresponded with our team on video calls prior to an event like this. There's also the value in sharing the challenges with understanding individuals has on motivation levels.

> Policymakers hold the key to much of the funding that the industry relies on.

Mikaela Freeman

Mikaela Freeman is a research scientist at the Pacific Northwest National Laboratory. Mikaela holds a Master's degree in marine policy and social science, which she applies in her work on marine renewable energy. Her research focus on understanding environmental effects as well as socioeconomic effects contributing to the OES-Environmental initiative. Beyond research, she is committed to fostering outreach and engagement with regulators, stakeholders, and communities, as well as pioneering efforts in co-locating marine renewable energy with aquaculture.

> While understating on environmental interactions has been increasing over the years, there remains a need to continue to collaborate to reduce uncertainty, share knowledge through venues like ICOE and OES-Environmental, and work together to progress ocean energy in a responsible manner.

What was your primary takeaway from ICOE 2024?

It is an exciting time to be a part of the ocean energy community! So much progress is being made advancing technical feasibility and deploying more devices, improving understanding of environmental effects, elucidating social and community perspectives, progressing opportunities within the blue economy, and so much more.

Having opportunities like ICOE to bring together members of the international ocean energy community and collaborate fuels everyone's passion to contribute to the success of ocean energy.

Which discussion did you find most impactful, and why?

Discussions on the social aspects (social and economic effects, community engagement, social and cultural license, etc.) of ocean energy development were very impactful, especially as there was such an emphasis on this and great conversations about it throughout ICOE 2024. I am grateful to be a part of this community that is not only passionate about ocean energy as a solution to help mitigate climate change, but that also understands the need to consider and address potential impacts on people and communities as part of responsible development.

Given your expertise in marine policy, could you share your perspective on any discussions related to this field at ICOE 2024?

It has been great to see the progress made over the last several years, which has been due in large part to supportive policies and government funding to advance research and development. However, this is not the case in all countries and in particular, many governments are focused on offshore wind at this time. These offshore wind policies do not necessary include ocean energy, though there is hope that they may pave the way for ocean energy in the future. However, there remains a need to include ocean energy in marine policies and clean energy goals and to continue increasing support from governments in terms of funding, research, and more.

Given your contribution to the OES-Environmental 2024 State of the Science Report, how did the environmental discussions at ICOE 2024 reflect or expand upon the findings presented in the report?

Presentations and discussions at ICOE reinforced what was shared in the 2024 State of the Science report that there are many efforts working to advance the state of understanding about environmental effects of ocean energy, from innovations in environmental monitoring technologies to monitoring campaigns around device deployments to research addressing remaining uncertainties like collision risk from tidal energy turbines. It was also great to hear more about developing areas of exploration such as assessing effects when scaling up to larger arrays or for off-grid applications of ocean energy like for aquaculture or remote or islanded communities. While understating on environmental interactions has been increasing over the years, there remains a need to continue to collaborate to reduce uncertainty, share knowledge through venues like ICOE and OES-Environmental, and work together to progress ocean energy in a responsible manner.

What do you value most about attending a conference like ICOE, and how does it contribute to your professional goals?

International conferences like ICOE are so important, particularly for a developing industry like ocean energy, because they allow for leaders in the community to come together and share ideas and research, discuss challenges, and work together to find solutions and chart a path forward for the industry. From a personal/professional aspect, especially being an early career researcher, ICOE really helps in growing my network by providing a venue to meet members of this community from all over the world, and expanding my understanding of the challenges or opportunities ocean energy is facing in different countries and the various solutions being applied to tackle the exciting challenge of advancing ocean energy.

John Whittington

Dr John Whittington is the CEO of Blue Economy CRC which is an independent company and a Cooperative Research Centre under the Australian Government's CRC Program. The Blue Economy CRC brings together industry, government, and research partners with expertise in marine renewable energy, maritime engineering, aquaculture, environmental assessments and policy and regulation. Through industry-focussed research and training, the Blue Economy CRC paves the way for innovative, commercially viable and sustainable offshore developments and seafood production.

What was your primary takeaway from ICOE 2024?

My primary takeaway from ICOE 2024 was the strong commitment by the global ocean energy community to develop sustainable ocean-based energy systems for the future. This international community is characterised by high levels of cooperation, trust and collaboration which is important given the complexity of the task and the availability of funds to develop and demonstrate technologies.

How do you see the future of ocean energy evolving based on the insights from this conference?

Ocean energy is likely to evolve where there is significant public funding provided to assist developers demonstrate technologies at a commercial scale. This will require targeted and progressive policy settings aligned with geographies are that are well suited to commercial demonstration projects. This includes having high a quality ocean energy resource that is not subject to extremes and that is very close to existing networks or demand.

From a research standpoint, what are the key challenges currently facing the ocean energy sector?

A key challenge for the ocean energy sector is to demonstrate the full life cycle cost of ocean energy. This requires clear demonstrations of capacity, survivability, and ongoing maintenance for ocean energy installations at scale. A key challenge for will be securing the significant investments required over long periods of time. This also requires good modelling showing the complementarity of ocean energy to solar and wind, and how it can be integrated into a broader portfolio of renewable energy solutions. A good example of this is the Ocean Wave Energy in Australia.

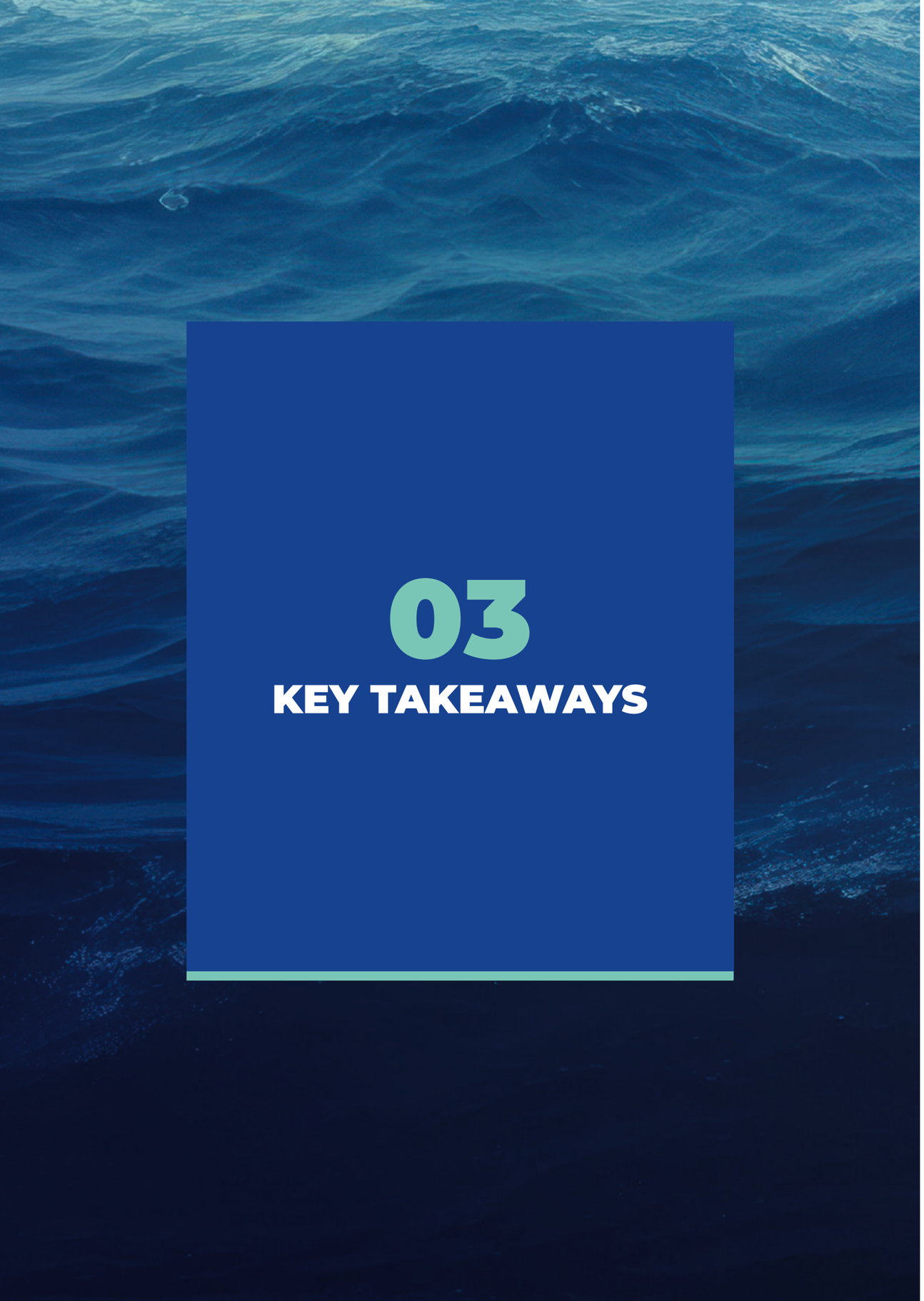
Can you share any innovative technologies or projects you learned about at ICOE 2024 that you believe will significantly impact the industry?

An innovative technology that will significantly impact the industry is the development of MoorPower scaled demonstrator. By utilizing moored infrastructure, either through new builds or retrofitting, the MoorPower technology provides a scalable alternative to fossil fuels for off-grid electrification. The maturity of the design and the identification of clear use cases will enable this technology to rapidly establish itself as a viable, cost effective way of decarbonizing otherwise hard to abate emissions.

What do you value most about attending a conference like ICOE, and how does it contribute to your professional or organizational goals?

ICOE provides an excellent opportunity to meet with end users, government regulators and developers to share ideas and understand each other's challenges and opportunities. The conferences multidisciplinary format helps bring into context complexity of the challenges ahead but also helps identify risks and solutions that might not otherwise be evident.

> A key challenge for the ocean energy sector is to demonstrate the full life cycle cost of ocean energy. This requires clear demonstrations of capacity, survivability, and ongoing maintenance for ocean energy installations at scale. A key challenge for will be securing the significant investments required over long periods of time.



03
KEY TAKEAWAYS

The ICOE 2024 conference highlighted substantial progress and emerging trends in ocean energy, with discussions centered around technological advancements, stakeholder engagement, investment needs, policy frameworks, socio-economic considerations, global collaboration, and future strategic directions.

1. TECHNOLOGICAL ADVANCEMENTS AND CHALLENGES

Progress and innovation

Participants presented significant advancements in wave and tidal energy projects. However, the high cost associated with their development and deployment remains a major challenge. Improving reliability is needed which involves rigorous testing and refinement of equipment to withstand oceanic forces and corrosive saltwater. There is also a continuous need for innovation in power take-off (PTO) to improving efficiency. Scalability requires modular designs that can be customized to different marine environments and energy needs, facilitating broader deployment.

Wave Energy

While wave energy has potential for widespread utility, developers are currently looking for opportunities in off-grid applications to accelerate commercial viability. These applications include powering oceanographic equipment and existing offshore infrastructure with smaller devices typically under 100 kW. These units are ideal for targeted markets such as community micro-grids, where the demand for electricity is high and installation costs are relatively low compared to larger, utility-scale projects. This strategic focus allows for quicker implementation and return on investment in these niche areas, paving the way for future expansion into broader applications.

Tidal Energy

Tidal developers are concentrating on utility-scale and community-scale deployments, especially for distribution and transmission networks. Tidal energy is also positioned to decarbonize energy for remote communities and high-demand users where it can replace carbon-heavy sources.

OTEC

OTEC technology not only produces continuous, stable baseload electricity but also has the potential for other beneficial by-products and applications. While current implementations are relatively small, there is significant potential to scale up OTEC systems to provide a substantial share of energy needs, particularly in tropical regions that can provide the necessary temperature gradients year-round. High initial capital costs and the need for technological improvements to increase efficiency are current barriers to wider adoption.

2.
KEY PRIORITIES FOR INDUSTRY GROWTH

Demonstrations projects
The need for extended sea trials was highlighted as essential for validating technologies and demonstrating their reliability, scalability, and performance. These projects help build investor confidence by proving the viability of ocean energy systems under real-world conditions.

Innovation in core components
Advancing key components such as power take-off (PTO) systems, foundations, moorings and electrical connections is a priority. Improvements in these areas are important for enhancing efficiency, reducing maintenance costs, and increasing the economic attractiveness of ocean energy projects.

Development of standards and certification
Establishing industry standards and certification frameworks is emphasized as critical to ensure consistency and quality and also to streamline project approvals and promote sector-wide reliability.

Numerical modelling
Improved modelling and simulation tools are needed for optimizing design, predict performance, and plan deployment strategies. These tools help mitigate risks, enhance efficiency, and support better operational planning.

Focus on cost reduction
Reducing costs through technological innovation and scaling is identified as essential for the sector's commercial success. Lowering the levelized cost of energy (LCOE) is a key objective to make ocean energy more competitive with other renewable sources.

3.
ENABLING AND SUPPORTING TECHNOLOGIES

Advanced materials for durability
The use of advanced materials is seen as essential for extending the lifespan of ocean energy devices. These materials help systems withstand harsh marine environments, reducing maintenance costs and improving overall reliability.

Real-Time sensors for monitoring
Real-time sensors play a critical role in monitoring operational performance and environmental impacts. These sensors enable continuous data collection, which helps operators optimize system performance and quickly respond to potential issues, enhancing system resilience and safety.

Control systems for optimization
Advanced control systems are highlighted for their ability to optimize energy output and improve efficiency. By dynamically adjusting system operations based on environmental conditions, these control technologies help maximize energy capture and operational stability.

Adoption from other sectors
Many enabling technologies, such as those used in offshore oil and gas, are being adapted for ocean energy applications. This cross-industry adoption brings proven solutions that can help ocean energy technologies scale more effectively and become financially viable.

4. SOCIO-ECONOMIC AND ENVIRONMENTAL CONSIDERATIONS

Balancing development with environmental responsibility

The importance of minimizing environmental impacts, particularly on marine ecosystems, was discussed. Developing eco-friendly technologies and implementing monitoring systems to track environmental effects are seen as essential for aligning ocean energy projects with sustainability goals.

Gaining social license to operate

Establishing a social license to operate is essential for long-term project success. Inclusion of diverse perspectives, including those of Indigenous and coastal residents, are highlighted as key to ensuring projects are socially equitable and address the concerns of affected populations.

Socio-economic benefits for local communities

Ocean energy has the potential to offer significant socio-economic benefits, including reducing reliance on carbon-intensive energy sources, promoting local job creation, and supporting local economies.

Ensuring social equity and long-term viability

The sector is encouraged to adopt practices that support social equity. This involves considering socio-economic impacts alongside environmental protection to ensure the development of ocean energy benefits all stakeholders fairly.

5. GLOBAL COLLABORATION AND KNOWLEDGE SHARING

International partnerships for overcoming shared challenges

Collaboration across borders can help to overcome technical, financial, and regulatory challenges. By sharing resources, expertise, and experiences, countries and organizations can accelerate technological progress.

Knowledge sharing to build industry standards

Test centers and research institutions can give an important contribution in establishing industry standards and providing independent validation.

Leveraging lessons from more established markets

Learning from the experiences of mature offshore wind markets, for example, allows emerging ocean energy sectors to streamline their regulatory processes and develop effective market strategies.

Unified approach for innovation

A collaborative, unified approach among developers, policymakers, and researchers enables shared knowledge on technology advancements, supporting the scaling of ocean energy. This approach also allows countries to collectively address socio-economic and environmental considerations.

6. FINANCIAL STRATEGIES

Innovative financing models
The need for innovative financing models to attract private investment is a key theme.

Public funding as a strategic tool
Public funding at early development stages can signal the viability of ocean energy to investors and reduce the financial risks that often accompany emerging technologies. Public funding is also highlighted as a strategic tool to de-risk projects, making them more attractive to private investors.

Public-Private partnerships
Strong partnerships between public institutions and private investors can help mobilize the significant funding required to bridge the gap from pilot projects to commercial-scale deployments.

7. POLICY AND REGULATORY FRAMEWORKS

Supportive policies and market incentives
Supportive policies, including targeted financial incentives, are needed to reduce the risks associated with ocean energy projects, as well as market incentives that emphasize the complementarity of ocean energy with other renewable sources.

Streamlined permitting processes
Streamlined permitting and efficient regulatory pathways are highlighted as necessary to reduce project timelines and costs. This approach, combined with financial incentives and industry standards, can help drive investment and development in the ocean energy sector.

International collaboration for regulatory alignment
International collaboration is recognized as essential for achieving regulatory alignment and sharing best practices. Learning from countries with established offshore wind can help to create a robust policy environment for ocean energy.

8. FUTURE OUTLOOK AND STRATEGIC DIRECTIONS

Optimism for ocean energy's role
A strong sense of optimism was present in the discussions, with experts confident in the potential of ocean energy to contribute to the global renewable energy mix. Realizing this potential will require sustained innovation, strategic partnerships, and ongoing advocacy to integrate ocean energy more fully into renewable energy strategies.

Path to commercial viability
Key priorities moving forward include the continuous development of next-generation technologies, improved modelling tools, and adoption of enabling technologies from other sectors.

04

ADVANCING KNOWLEDGE

RELEASE OF THE
OES-ENVIRONMENTAL 2024
STATE OF THE SCIENCE REPORT

ENVIRONMENTAL EFFECTS OF MARINE RENEWABLE ENERGY DEVELOPMENT AROUND THE WORLD

In an effort to deepen understanding and guide future developments in the ocean energy sector, the OES-Environmental has released the 2024 State of the Science Report. This comprehensive document, published on the first day of the conference, provides an extensive overview of the environmental impacts associated with the development of marine energy technologies, including wave, tidal, and ocean thermal energy conversion (OTEC), as well as riverine turbines.

Key Findings and Focus Areas

The report synthesizes the latest scientific research and monitoring data, focusing particularly on advancements made since the previous 2020 report. It covers a broad spectrum of environmental stressors such as changes in flow, noise pollution, and habitat disruption, and evaluates their impacts on diverse receptors including marine mammals, fish, invertebrates, and even human dimensions such as recreation and tourism.

Contributions and Collaborative Effort

Contributors to the report include OES-Environmental country representatives from 16 participating countries, who collectively provided critical insights into each chapter. This collaborative effort has resulted in a robust compendium of the potential environmental effects of ocean energy development, making it an invaluable resource for policymakers, regulators, researchers, and industry stakeholders.

The full report and executive summary are available for download, providing stakeholders and the public access to the most up-to-date information on the environmental effects of ocean energy technologies. This report continues the dialogue on sustainable marine energy development and highlights the importance of ongoing research and international cooperation in minimizing environmental impacts.

> The 2024 State of the Science report has continued to add to our understanding of the potential risks from the operation of tidal, wave, and other marine energy devices on marine animals, habitats, and ecosystem processes. The evidence from small arrays is sufficient for us to begin to provide guidance on how to avoid or mitigate most risks, with the possible exception of collision risk with tidal turbine blades. This state of knowledge ought to accelerate consenting as we move towards larger arrays. The report looked more deeply into potential social and economic effects of marine energy, how to best work with stakeholders, and the importance that education and engagement can have on social acceptance and planning for the future workforce. New areas of focus on this report include examining the larger system effects of marine energy arrays including cumulative effects with other anthropogenic activities, and marine energy effects on tropical ecosystems.
>
> Dr. Andrea Copping
> SENIOR RESEARCHER AT PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL)

05

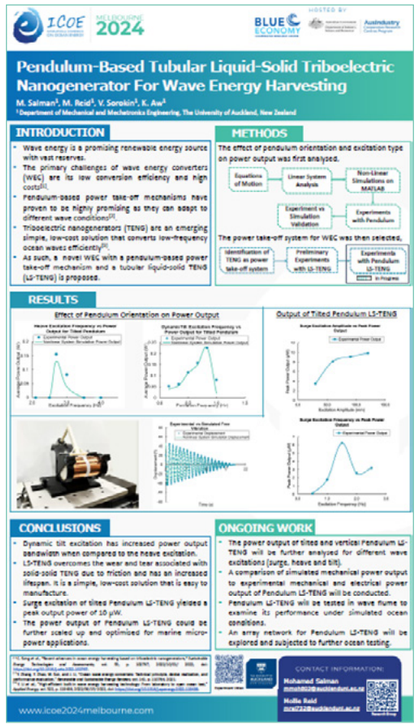
HIGHLIGHTING EXCELLENCE

IEA-OES POSTER AWARDS

ICOE 2024 is also a stage to celebrate exceptional research contributions. The IEA-OES Poster Awards, a prestigious recognition at ICOE, highlight the innovative efforts of researchers in the field of ocean energy. It recognizes individual excellence and encourage innovation within the sector.

This year, IEA-OES honored three remarkable researchers for their contributions to ocean energy. These awards spotlight significant findings and methodologies that have the potential to influence the industry.

WINNERS HIGHLIGHT



FIRST PRIZE

Presented by

Mohamed Salman, Mollie Reid, and their team from the Department of Mechanical and Mechatronics Engineering at the University of Auckland

Poster Title

Pendulum-Based Tubular Liquid-Solid Triboelectric Nanogenerator for Wave Energy Harvesting

Research Focus

The research introduces a novel wave energy converter (WEC) that utilizes a pendulum-based power take-off mechanism coupled with a tubular liquid-solid triboelectric nanogenerator (LS-TENG). By introducing a new type of TENG, this design shows a creative approach to solving longstanding issues of efficiency and durability in wave energy converters.

SECOND PRIZE

Presented by

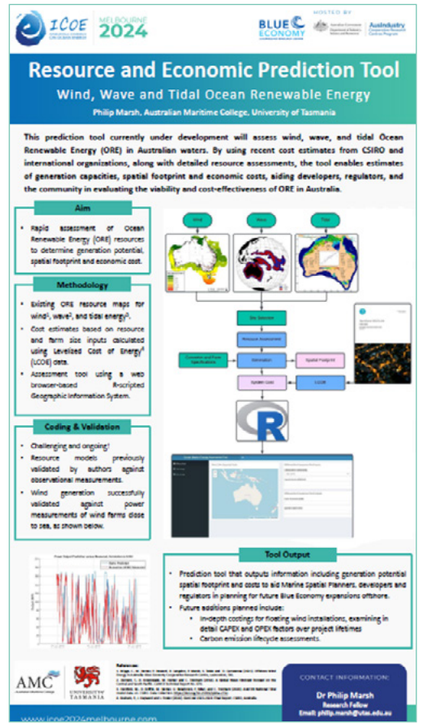
Dr. Philip Marsh from the Australian Maritime College at the University of Tasmania

Poster Title

Resource and Economic Prediction Tool

Research Focus

The main goal is to develop a tool that integrates wind, wave, and tidal data to provide comprehensive resource assessments and economic predictions for ocean energy projects in Australia. The tool provides essential outputs that include generation potential, spatial footprint, and detailed cost analysis to support marine spatial planners, developers, and regulators.



THIRD PRIZE

Presented by

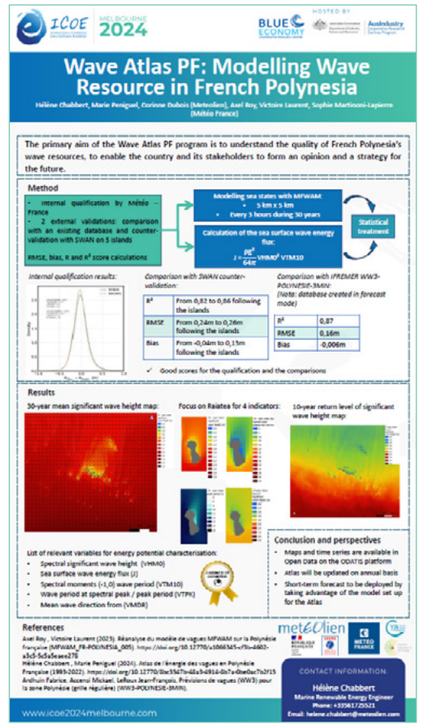
Hélène Chabbert and her team from Meteolien, in collaboration with Météo France

Poster Title

Wave Atlas PF: Modelling Wave Resource in French Polynesia

Research Focus

The primary goal of the Wave Atlas PF project is to comprehensively map and understand the wave resources in French Polynesia to aid local stakeholders in developing informed strategies for future energy solutions. While focused on French Polynesia, the methodologies and findings can be adapted for other global regions, aiding in the global expansion of wave energy utilization.



06
CONCLUSION

SUMMARY OF THE OVERALL IMPACT OF ICOE 2024

ICOE 2024 concluded as a notable event in Australia that significantly drove forward the discourse and development within the ocean energy sector. The conference effectively showcased the latest advancements, addressed current challenges, and outlined future pathways in this dynamic field, highlighting its critical importance to Australia's expanding role in the global ocean energy sector.

Hosting the event in Australia allowed participants to gain insight into the advancements being made in ocean energy across this part of the world. Numerous research institutions and universities are actively advancing the field, which shows the truly global nature of ocean energy and the worldwide spread of innovation and expertise in this sector.

By gathering global experts, researchers and policymakers under one roof, ICOE 2024 fostered an invaluable exchange of ideas and encouraged partnerships that may catalyze the next generation of technologies in ocean energy.

Optimism about the future of ocean energy was palpable, with many experts expressing confidence in the sector's potential to contribute significantly to global renewable energy mixes. However, achieving this potential requires continued innovation, strategic partnerships, and persistent advocacy to raise the profile of ocean energy within broader renewable energy discussions.

The spirit of the conference demonstrated a collective commitment to enhancing the scalability and sustainability of ocean energy solutions, ensuring an important role for ocean energy in the global energy transition.

ACKNOWLEDGMENTS WORDS FROM IEA-OES

We extend our deepest gratitude to all those who contributed to the success of ICOE 2024.

A heartfelt thank you to the organizers who meticulously planned and executed the conference, ensuring an enriching experience for all attendees.

Our sincere appreciation also goes to the distinguished speakers, whose expertise and insights contributed to the conference's high level engagement.

Finally, we thank all participants who attended and contributed to the good discussions, sharing their knowledge and enthusiasm for advancing ocean energy. We greatly appreciated the friendly atmosphere at the conference, which contributed to making the event exceptionally enjoyable.

Thank you for making ICOE 2024 a memorable and impactful event.

The Cabinet, on behalf of the Executive Committee of IEA-OES

ABOUT IEA-OES

Ocean Energy Systems (OES) is a Technology Collaboration Programme (TCP) within the International Energy Agency (IEA).

The **Technology Collaboration Programme** supports the work of independent, international groups of experts that enable governments and industries from around the world to lead programmes and projects on a wide range of energy technologies and related issues. The experts in these collaborations work to advance the research, development and commercialisation of energy technologies. The scope and strategy of each collaboration is in keeping with the IEA Shared Goals of energy security, environmental protection and economic growth, as well as engagement worldwide.

www.ocean-energy-systems.org