AUSTRALIAN OCEAN ENERGY GROUP

20 June 2020

The Hon Angus Taylor MP
Minister for Energy and Emissions Reduction
Department of Industry, Science, Energy and Resources
Australian Government

**Australian Ocean Energy Group (AOEG) response to Technology Investment Roadmap Discussion Paper**

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## Australian Ocean Energy Group (AOEG)

The Australian Ocean Energy Group (AOEG) is an Industry-led cluster formed to accelerate innovation of ocean energy technology development in Australia as a commercial, low carbon energy source, suitable for multiple industrial and community applications. The development of capabilities in this sector will support energy independence, decarbonisation and job creation, both domestically and internationally.

By virtue of being an industry cluster, AOEG operates as a collaborative group of stakeholders. Our members span from research institutions to technology and project developers, as well as a range of service and equipment suppliers and end-user segments. *A list of members is provided as Attachment A.*

"Co-opetition"[1] is a key value of AOEG. Traditional competitors, such as wave and tidal technology development companies, are working together to innovate new market strategies for commercial development. This cooperative approach returns significant benefits at regional, national, and international levels.

In addition to a national presence, AOEG operates in the international stage as well. The organisation is an active member of two international bodies which enable the transfer of overseas technical knowledge applied to Australian setting. AOEG is alternate delegate to CSIRO in representing Australia on the IEA-Ocean Energy Systems (OES), an international ocean energy technology collaboration with 26 member countries. In addition, AOEG is a representative to the new ***EL-066 Marine Energy – Wave, Tidal and other Water Current Converters***, which enables Australia to become a full member of the International Electrotechnical Commission for Marine Energy Standards – Technical Committee 114. *More on this below.*

## Ocean Energy

Ocean energy refers to the massive energy which can be harnessed from ocean waves, tides, currents, and ocean temperature differentials. The natural movement of water within oceans creates a vast resource from which energy can be extracted and transformed into electricity and other useful purposes, such as hydrogen production, desalinated water and other uses.

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[1] Co-opetition definition: collaboration between business competitors in the hope of mutually beneficial results.

The International Renewable Energy Agency (IRENA) has noted, "The potential of oceans as an energy source is staggering – more than sufficient to meet global electricity demand well into the future…"[2]. And, a 2016 report published by Earnst & Young et Associes, states, "For wave, tidal (range and stream), OTEC and salinity gradient, Ocean Energy Systems estimates a worldwide potential of 337 GW that could be developed by 2050, which would create nearly 300,000 direct jobs and allow reducing C02 emissions by 1 billion tons3. This estimate conveys a vision of the technical potential and does not take into account the current and expected policy framework"[3].

Within the global context, Australia has numerous competitive advantages which could, with Government support, see Australia secure a market leadership position in this sector. This potential is multiplied when partnered with other major sectors, such as offshore solar/wind farms or hydrogen production.

## Comments on Proposed Technology Investment Roadmap Discussion Paper

Our central recommendation is to ***request the addition of ocean energy (OE) technologies into the roadmap's prioritised shortlist as a source of "electricity generation/supply".*** We believe ocean energy technologies are worthy of inclusion in the Technology Roadmap as well as public investment as a significant means to achieve the Government's innovation objectives. The following explains why.

- **Jobs/economic growth.** While considered an emerging technology, Australia's ocean energy industry is demonstrating significant potential to grow. In September 2018, an independent survey conducted by BDO Sydney assessed the significance of the marine energy sector. This survey measured annual growth of the industry in terms of maturity of the technologies, job creation, number of projects deployed domestically and internationally, and revenue generation.

  In the financial period from July 2017 to June 2018, six marine energy companies spent over AU$7M developing their marine technologies. Additionally, during the report period, the sector employed 66 full time equivalent (FTE) staff and hired 68 industrial suppliers. For the same period in the coming financial year, these same companies expected to increase expenditures to AU$25M – a 257% increase for just the technology developers alone. The next survey is planned for the 3rd quarter 2020 to validate the projections. ***Exponential growth is expected in future surveys when the full value chain is incorporated into the analysis.***

  As the ocean energy sector matures, a wide range of unique Australian market opportunities will be established, ***leading to corresponding jobs and additional economic benefits to Australia.*** Key market opportunities include:

  - Remote communities. Through creation of integrated ocean energy micro-grid systems communities will enjoy numerous complementary and ancillary benefits. Ocean Energy microgrids support multiple sources of renewable energy which, when combined, can meet the load demand of various modular technologies, such as hydrolyzers, desalination units, waste water treatment units, etc.
  - Aquaculture (see further explanation below under "Food Production")
  - Marine security (national defence)
  - Desalination
  - Hydrogen production
  - Remote operations (oil & gas, etc.)
  - Ocean based scientific equipment for coastal monitoring, safety and navigation

[2] *IRENA Ocean Energy Report 2014*

[3] https://arena.gov.au/assets/2016/10/1605SG797-Etude-Seanergy-lowres.pdf

- Co-location with existing infrastructure (eg, ports/harbours, oil & gas platforms, etc.)

- **Affordability.** The traditional approach to evaluating ocean technology cost effectiveness is to examine the cost parameters of a single device operating in a test environment or demonstration project. This is usually measured as the Levelised Cost of Energy (LCOE). In this approach, the technology cost normally appears high and not competitive with other renewable technologies as the cost generally only reflects the isolated operating situation for a single demonstration device. We propose this misrepresents the actual cost competitiveness of ocean energy technologies.

  LCOE is considered a very simple measurement of the value of energy as it assumes the value is the same regardless of the time of generation. As demand fluctuates, generation that is available when there is low demand doesn't have the same value to the market as energy generated at times of high demand. Tidal energy generation is highly predictable, allowing for scheduling of the lowest cost energy source in advance, and wave energy will contribute during times of high demand when wind and / or solar is unavailable. ***When coupled with the specific market opportunities, ocean energy technologies will be cost competitive.***

- **Resilience of the National Electricity Grid.** Various Australian Energy Market Operator (AEMO) reports and several government-backed reviews, including the Finkel review, have highlighted technological and geographic diversity as a key component of a resilient and reliable electricity network. ***Ocean energy has the potential to greatly increase both these aspects of grid resilience, with the addition of new generation technologies and an increase in the geographical spread of generation assets.***

- **Carbon reduction.** ***Ocean energy is a significant means to address increased electrification while simultaneously reducing carbon production.***

  Electrification throughout the world and Australia is accelerating and will require substantial increase in the amount of electricity produced and supplied. Australia maintains the third largest Exclusive Economic Zone with over 80% being classified as offshore, beyond two nautical miles from the coast and subject to oceanic waves, tidal currents and wind. Renewable ocean energy can be captured and converted into electricity for both onshore and offshore use, as well as transformed into energy 'carriers' such as hydrogen, for storage or export.

- **Sustainable Food Production.**

  Australia hosts tropical, sub-tropical and temperate water environments that are all capable of supporting aquaculture coupled with offshore energy. Together, these resources underpin an unparalleled opportunity to develop industries that can drive significant economic growth in line with the $100 Billion annual revenue target set by Australia's National Marine Science Plan (2015 – 2025). In order for near-shore aquaculture systems to move offshore while maintaining economically viable operations, they will require reliable perpetual supply of electricity without an electricity cable from shore. ***Electricity produced from renewable ocean energy technologies is the key to a future success of offshore aquaculture operations.***

  As an active member of Australia's exciting new Blue Economy Cooperative Research Centre (BE-CRC), AOEG will be collaborating with other industry members, research community and the aquaculture sector to establish innovative, commercially viable offshore ocean energy/aquaculture systems. ***The Blue Economy CRC submission details additional benefits of renewable ocean energy/aquaculture operations.***

- **International Technology Standards for Australia.**

  As previously mentioned, Standards Australia recently established the AOEG-led application to form the new Australian marine energy standards committee *EL-066 Marine Energy – Wave, Tidal and other Water Current Converters*, which connects Australia as a working member of the International Electrotechnical Commission on Marine Energy Standards (IEC-TC114).

  In its member role, Australia will not only receive technical benefits from established and emerging global standards but will actively produce new marine energy standards to contribute to the international standards repository. ***These standards are critical inputs to an effective and robust technology roadmap. They will enable companies to accelerate development, reduce risks, improve compliance, bolster research collaboration, increase design consistency and increase synergies.***

  Australia's role in development of marine energy standards is expected to provide the following benefits relative to the Technology Roadmap and to Australia:

  - Strengthen confidence by the investment community leading to increased project financing.
  - Establish an effective supply chain and end-users/markets who will so utilise the standards.
  - Reduce costs and improve efficiency resulting from standards supporting streamlined development of technology.

- **World-class science and engineering.**

  Australia is recognised world-wide for its expertise in ocean engineering and science as a result of its close association with industries, such as the oil & gas sector. This knowledge and expertise are applicable to ocean energy within the context of the Technology Investment Roadmap, thus providing Australia a competitive advantage. Not capitalising on this would be a missed opportunity to develop a world-class sector.

## Recommendations

For Australia to gain the benefits described above we recommend:

- **Support development of technologies throughout the entire sector**. A successful industry sector cannot be established on technology alone. The sector needs a dynamic market (demand), and a skilled supply chain (supply).
  Diverse and unique national and international customers were described in the Jobs and Economic section above. Aligning the right ocean energy technology and energy system with future markets will allow Australia to focus investment in the required technologies.
  ***We recommend Government include ocean energy as an emerging "electricity generation/supply" technology with the potential to reduce costs and scale to the needs of a unique variety of end-users/markets in Australia and internationally***.
  ***Strong Government support for enabling research and education is also recommended.***
  *See Attachment B for additional comments from Bombora Wave Power.*

- **Position OE technologies within the roadmap as part of integrated energy microgrid system.**
  As mentioned, technologies alone will not deliver the benefits Government seeks, nor the energy solutions that markets require.

Consequently, ***we recommend government incorporate ocean energy technologies in its Technology Roadmap as a source of "electricity generation/supply" within the context of integrated energy solutions (e.g., integrated with battery storage and other sources of renewable energy).***

Coupling ocean energy technologies with other renewable sources, including battery storage, provides innovative energy solutions and improves potential to meet market demand. This combination reduces single-device energy production costs and reduces supply risk.

- **Streamlined and Consistency of Permits.**

  One of the most significant barriers to ocean energy development (deploying technologies) is the lack of consistency of regulatory bodies.

  To validate energy performance and operational capabilities, ocean energy technology developers need to install devices in conditions similar to a commercial project. This requires securing permits from multiple regulatory bodies within a given ocean-based physical geography.

  Ocean energy technology demonstration projects are relatively new in Australia. Therefore, regulatory bodies unfamiliar with ocean energy technologies do not have consistent, efficient permit approval processes. This causes extensive delays and is a barrier to ocean energy investment. ***We recommend Government facilitate permit consistency and streamlining for local, state, and federal regulatory authorities.*** To achieve even greater technological benefits, ***we recommend Government establish a permit roadmap alongside the technology roadmap for all emerging energy-generating technologies.***

Thank you for accepting our submission. Please do not hesitate to contact us should you require any clarification.

Yours sincerely

Stephanie Thornton

AUSTRALIAN OCEAN ENERGY GROUP

**Stephanie Thornton,**
**Cluster Manager**

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**Enclosed/ Attachment A** – AOEG Consortium Members as of 01 June 2020

**Enclosed/Attachment B** – Comments from Bombora Wave Power

**Enclosed/Attachment C** – Links to additional facts and information about ocean energy

## ATTACHMENT A

# AUSTRALIAN OCEAN ENERGY GROUP (AOEG) CONSORTIUM MEMBERS *as of 01 March 2020*

| Company | Consortium Member Name & Position | Company or Organisation Type |
|---|---|---|
| Aquatera | Gareth Davies, Managing Director & Ian Hutchison, Chief Operating Officer | Environmental services and products specialising in the ocean energy sector |
| Atratus Renewable Consulting | Simon Troman, Principal | Consulting Firm |
| BMT Commercial Australia Pty Ltd | Chris Shearer, Senior Mechanical Engineer *[Primary representative]* David Rissik, Head of Business Development & Climate Change Adaptation | International design, engineering, science and risk management consultancy. |
| Bombora Wave Energy | Sam Leighton, CEO | Australian wave energy technology developer |
| Carnegie Clean Energy | Jonathan Fievez, CEO & Brighid Jay, Business Development Manager | Wave energy technology developer |
| Climate-KIC Australia | Chris Lee, CEO | Climate change knowledge innovation community (NGO) |
| Hargreaves International | Kylie Hargreaves, Principal | Consultant - government and policy specialist. |
| Individual | Forbes Peter | Former naval electrical engineering officer providing support for Australia's fleet of Submarines |
| INGINE Inc. | Fanny Sauvignon, Program Manager | Wave energy technology developer |
| MAKO Tidal Turbines | Douglas Hunt, Managing Director | Tidal technology development company |
| National Energy Resources Australia (NERA) | Francis Norman | Commonwealth Growth Centre |

| Company | Consortium Member Name & Position | Company or Organisation Type |
|---|---|---|
| Renewable Capital Pty | Karl Schutte, Principal | M&A, Investment and Capital Services Firm |
| SABELLA SAS | Jean Christophe ALLO, Commercial Director and Marlene Moutel, Business Development Engineer | Tidal technology developer |
| Wave Energy Research Centre (WERC) | Wiebke Ebeling, Manager | State-supported ocean energy technology research centre |
| Wave Swell Energy | Tom Denniss, CEO | Wave energy technology developer |
| Wolfe and Co Solutions | Mike Straughton, Director | Consultant |
| University of Adelaide, School of Mechanical Engineering | Ben Cazzolato, Professor | University |
| University of New South Wales (UNSW), Water Research Laboratory | Francois Flocard, Principal Engineer | University |
| University of Queensland, School of Civil Engineering | Remo Cossu, Senior Lecturer | University |
| University of Tasmania, Australian Maritime College | Jean-Roch Nader, Lecturer/Research Fellow | University |
| University of Western Australia, Offshore Foundation Systems | Christophe Gaudin, Professor and Deputy Director | University |

**ATTACHMENT B**

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UNDEB EWROPEAIDD EUROPEAN UNION
Llywodraeth Cymru Welsh Government
Cronfa Datblygu Rhanbarthol Ewrop
European Regional Development Fund

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Sydney
NSW 2000

Friday, 19 June 2020

REF: **Response to Australian Technology Investment Roadmap Discussion Paper**

Dear Stephanie Thornton,

Bombora welcome the opportunity to provide a response that highlights the importance of the ocean energy sector in the Australian Technology Investment Roadmap as a means to achieve decarbonisation targets, boost economic growth and meet Governments innovation objectives.

**Key Messages**

We support the key messages stated in the AOEG response:

- the significance of the ocean energy sector in Australia to deliver a sustainable energy supply and boost economic prosperity, through technological advancement, whilst supporting the transition to a zero-carbon economy
- the ability of the ocean energy industry to deliver benefits across Australia especially in supporting the development of peripheral economies with high quality jobs in maritime regions
- the importance of sustained investment in the industry to build on the progress already made
- the need for a simple and transparent framework which encourages technology innovation and development of the ocean energy industry

We would like to place emphasis on the following key message:

- with the right funding, the potential of the ocean energy industry to maximise opportunities offered within Australia, and globally.

Founded in Perth Australia in 2012, Bombora is an award-winning ocean energy company. In 2017 Bombora opened its European Head Office in Wales and is now at an advanced stage of the 1.5MW mWave Pembrokeshire Demonstration Project supported by a £10.3 million European Regional Development Fund through the Welsh Government. Bombora's innovative mWave™ wave energy converter product produces environmentally friendly,

consistent, and cost competitive energy for commercial scale energy needs in coastal locations throughout the world.
Bombora provides evidence below on the following areas of the discussion paper and in support of AOEG recommendations:

**Support development of technologies through the entire lifecycle**
Ocean energy has the potential to deliver 300 GW of wave and tidal energy worldwide by 2050, saving 500 million tonnes of CO2, and creating 680,000 direct jobs (OES International Vision Report). If Australia is to capitalise on its vast natural resource and enable the burgeoning ocean energy sector to realise its economic potential on the global stage, financial support mechanisms must be in place to nurture innovative technology through the development lifecycle to commercial maturity. Without early stage investment, start-up technology companies will struggle to develop and create technical and commercial confidence, to attract new private investment.
Bombora has benefited from the Welsh Government focus on supporting emerging ocean energy technologies and expansion of the sector to deliver economic regeneration and prosperity to Wales.

**Jobs/economic growth**
Bombora's £17 million Pembrokeshire Demonstration project has a >85% UK supply chain content with significant contracts being awarded to companies in Pembrokeshire offering real diversification opportunities and offsetting impacts of the decline in the petroleum sector in the region.

Similar to the UK, Australia has abundant natural wave resource. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) states that wave energy could contribute up to 11 per cent of Australia's energy by 2050, making it a strong contender in Australia's renewable energy mix. Ocean renewable energy presents an opportunity for Australia to keep its own renewable energy technology value locally and export the knowledge, skills and expertise globally. With the right support ocean energy can continue to create highly skilled, innovative jobs in peripheral economies and provide supply chain diversification and resilience. Bombora is developing a pipeline of global wave energy projects, progressing opportunities in Australia, Japan, Spanish Canary Islands, and Ireland.

Support mechanisms would provide a clear pathway to attract further private investment and progress projects in Australia. As an example, the Offshore Renewable Energy Catapult (OREC) published a new evidence-based assessment demonstrating ROI. It shows the UK's marine energy industry has provided value for money with every £1 of public money invested in major UK marine energy businesses leveraging £7 of private investment, and more than 77% of this investment has been spent in the UK supply chain.

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European Regional Development Fund

**Resilience of the National Electricity Grid**

If Australia is to achieve carbon emission targets, it is imperative that a variety of complimentary zero carbon technologies contribute to the energy mix. Particularly, focus should be given to those technologies that work together by balancing grid transmission requirements. Marine renewable energy technologies are looking at combining offshore wind and wave energy generation. Such co-location offers better utilisation of the seabed and smooths power to the grid. The immediate market opportunity here alone is vast, floating wind is forecast to scale up to 12GW of capacity globally by 2030, becoming a market estimated to be worth £32 billion.

I would like to take the opportunity to thank AOEG for co-ordinating a response from across the membership. If we can be of any further assistance, please do not hesitate to contact me at sam@bomborawave.com.

Yours faithfully,

Sam Leighton
Managing Director

# ATTACHMENT C

## Links for Additional Facts and Information About Ocean Energy

- **Australian Ocean Energy video:** see video on home page; https://oceanenergygroup.org.au/
- **What is ocean energy?** https://www.oceanenergy-europe.eu/ocean-energy/
- **Additional Government submissions associated with Australia's ocean energy industry (below) can be found on AOEG's website:** https://oceanenergygroup.org.au/nera-submission-and-response-to-offshore-clean-energy-infrastructure-regulatory-framework-2158/
    - Pre-budget submission by National Energy Resources Australia (NERA) to the Department of Treasure
    - Submission by AOEG to the Department of Agriculture, Water and the Environment regarding the Offshore Clean Energy Infrastructure Regulatory Framework.
- **International Ocean Energy:**
    - Australia is a member country of the International Energy Agency (IEA), **Ocean Energy Systems:** https://www.ocean-energy-systems.org/. The OES Vision for International Deployment of Ocean Energy estimated a global potential to develop 748 GW of ocean energy by 2050. Deployment of ocean energy can provide significant benefits in terms of jobs and investments. The global carbon savings achieved through the deployment of ocean energy could also be substantial. By 2050 this level of ocean energy deployment could save up to 5.2 billion tonnes of CO2.
    - European Marine Energy Test Centre – global demonstration centre for ocean energy technologies: http://www.emec.org.uk/