Offshore Future Energy Forum – 25/26 November 2021

Below is a summary of the responses from presenters to unanswered questions asked through the Slido platform during the forum. Please contact each respondent directly for any clarification or to ask further questions.

Session 1 – International overview and offshore wind

Chris Jewell – Co-Chair, Aotearoa Circle	
International ships on domestic voyages - NZ only has a fleet of seven or so ships registered for coastal trading. That constitutes a very low emissions output, should this be an area of focus?	I think it's worth doing a study on how we move our goods around NZ and what is the most cost and carbon efficient approach (trains, trucks, ships). We need to think about this as a network, have a vision of what we are aiming to achieve, and then look at what the roadblocks are to achieving it.
Are you sure that community energy is 'part of our DNA'? We don't have a favourable policy and regulatory environment for decentralised energy.	Distributed energy production (i.e. behind the grid) is not currently a large part of NZ's energy sector. With solar technology evolving, there are a number of merits of having a more distributed system for security, reliability and optimising the grid costs. Regulatory environments (consenting regimes, standardisation of distribution connection regimes) need to evolve to allow a cookie cutter approach to rolling out distributed energy production across different areas of NZ. The challenge is the same for an electricity retailer having to do a deal with every lines company to offer a national service – its inefficient, so the majority of the competition occurs in the large population centres.

Alastair Dutton – Chair, Global Wind Energy Council	
How will the world cope with decommissioning offshore wind parks in an environmentally safe way as they are replaced with new turbines?	All offshore wind projects need to have a decommissioning plan which includes an environmental impact assessment, see https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/916912/decommisioning-offshore-renewable-energy-installations-energy-act-2004-guidance-industry_1_.pdf The presumption is full removal e.g. with monopolies cut off 1m below the seabed. New turbines, being larger, will require new foundations.
Have there been collaboration with shipping esp. considering MASS ships in the future and navigating coastal waters with floating wind turbines?	Shipping is one of the key stakeholders in developing an offshore wind farm. The assessments will take into account all types of vessels, including MASS ships. The layout and spacing of the turbines takes this into account.

How do you convince market participants to set up local manufacture of foundations or nacelles?	The best way is for countries to set a long term (20+ years) vision for offshore wind and set targets towards that vision. If the volumes are large then the market comes to you e.g. Japan. Foundations are one of the first elements to be localised. Nacelles are more difficult to localise since turbine manufacturers have strict quality requirements and established sub-suppliers. Mandated local content requirements, e.g. as in Taiwan, substantially increase the cost of energy and has been shown in onshore wind to be unsuccessful in the long term.
How do the carbon payback and LCA metrics compare with land based systems?	The most recent analysis I know of says "7.4 months energy payback time", see more on LCA at https://www.siemensgamesa.com/-/media/siemensgamesa/downloads/en/sustainability/environment/siemens-gamesa-environmental-product-declaration-epd-sg-8-0-167.pdf
As kaitiaki Moana what scientific research is being undertaken for the preservation of our marine taonga?	There is lots of research going on about ocean conservation and sustainability e.g. https://oceanconservancy.org/climate/confronting-climate-change/offshore-wind/ , https://www.energy.gov/articles/doe-announces-135-million-sustainable-development-offshore-wind Each offshore wind farm will also require an Environmental and Social Impact Assessment before it can apply for its consent.

Katharine York – Operations and Maintenance Centre of Excellence Manager, Catapult UK	
Climbing ladders onto moving structures has been done for years in pilotage. What new technology or best practice is being used in offshore wind?	Best practice is addressed in this industry document https://www.gplusoffshorewind.com/newsletter/2020-october/g-launches-its-latest-good-practice-guideline New technology is: - Walk to work platforms like those provided by Ampelmann https://www.ampelmann.nl/ - Get Up Safe from PICT http://www.pictoffshore.com/ a heave compensated system for lifting personnel. Hornsea 2 Offshore Wind is the first wind farm to be constructed without access ladders - Windgrip from Windcat Workboats for greater stability https://www.fwol.de/fileadmin/user_upload/fwol.de/schiffe/fwol-ship-specifications-windcat-43-v01.pdf
With so many different stakeholders and competing interests, how can a stable and consistent buildout of wind projects best be realized?	My preference would be for: - Development zones identified and assessed on behalf of government, large-scale EIAs looking at cumulative impacts, costs recouped from developers during leasing of sites & operations, shifting

	away from the UK piecemeal approach where developers take all the risk - Plan a pipeline and how manufacturing and construction needs can be met to get full usage of construction vessels - Build in requirements for local content when awarding contracts
With offshore infrastructure being orders of magnitude more complex and expensive than onshore. What are the key benefits over onshore if land is available?	Wind resource is higher and more reliable. Turbines can be larger and farms can be significantly larger. As an example Hornsea Project One, 1.5GW, was constructed on an area of 407km². Public opinion in UK has been less anti-offshore wind so government strategy and planning decisions have significantly favoured offshore proposals over onshore.
What are some of the challenges and success factors in recruiting wind technicians and then retaining them? Apart from greener grass, why do they then leave?	- Management issues - Shift patterns eg 7/7, 9/5, 14/14 - Pay structure including whether additional payments for being offshore (including failed sails), overtime, annualised hours impact on pay, how holidays are managed and whether careful holiday booking can result in overtime - Limited progression opportunities – pathway tends to be from a junior role, to a leader of a service team, to a troubleshooter and then into a much smaller number of senior technician roles (planning and back office support) and then into an even smaller number of managerial roles - Recruitment is always heavily over-subscribed but quality of applications is not always high. - Many companies require experience on a certain type of turbine rather than accepting that in a growing industry someone has to be taking on new people
What height swells can you work in to access offshore installations from a sea vessel?	The metric used by the industry for safe transfers from a CTV is usually 1.5m Hs as measured in the field. This is a blunt instrument. In reality, technicians rarely transfer above 1.2m and are often feeling too sick to transfer at lower wave heights, but very much depends on local conditions. Some vessels claim they can provide safe transfers in 2m or above but I've never seen it put to the test because no-one wants to send people out in a potentially unsafe situation to prove that they can climb a turbine, and then potentially be stranded in bad weather as they can't get back down.
I understand that painting turbines black markedly reduces the bird strike. Any comments?	I've heard of one study where a single blade was painted a different colour. The study was conducted at the Smøla onshore wind farm in Norway, owned by Statkraft. They had a particular problem where sea eagles were frequently attempting to fly through wind turbines. I haven't seen official results, but news headlines suggest a significant improvement at this site.
A just transition will only occur in our region if multi-nationals do choose to use local service providers. How do you encourage multi-nationals to go local?	In the UK the main regulatory way has been through the Offshore Wind Sector Deal and commitments made during the consenting process for the latest round for 60% UK content. https://www.gov.uk/government/publications/offshore-wind-sector-deal. In early rounds the focus was to get offshore wind going with no emphasis on local supply chain.

	In Grimsby, local councils and local businesses worked together closely in order to welcome and encourage multi-nationals into the area, setting up meet the buyer opportunities and networking to help companies and workforces establish in the area. Geography, local expertise and resources are important considerations in decisions about where manufacturing facilities will be based. Operations and maintenance teams tend to be local. Specialist workers for seasonal tasks are more mobile and may flip between hemispheres as their work is concentrated in low wind/summer months.

Pieterjan Vanbuggenhout – Senior Origination Officer, Parkwind EU	
What % of fuel in the CTVs is hydrogen? And is the hydrogen green?	The first vessel will be a hybrid with up to 50% hydrogen and 50% diesel. We are using fuel cell technology as opposed to dual-fuel combustion to eliminate also NOx emissions, and to potentially allow for 100% use of hydrogen in certain operating modes. Once we have gained enough comfort with the hybrid vessel, the next generation CTVs could be fully converted to hydrogen fuel (no more diesel). In an initial stage, this will be blue or green hydrogen, but once our 25 MW green hydrogen project is operational, we plan to fully switch to green hydrogen.
The floating installation vessel installing complete turbines. What sort of sea weather conditions can it operate in compared to jack up barges etc?	The floating installation method is designed to operate in the same weather conditions as the more traditional jack-up methodology. For this particular project (Arcadis Ost I) in Germany, we will be working with DEME Offshore's DP3 offshore installation vessel called "Orion" for the monopiles installation. The Orion is equipped with a motion compensated pile gripper system. For the WTG installation, we have been working very closely with Heerema Marine Contractors and Vestas to develop this floating installation method, in which the Rotor Nacelle Assembly (RNA) happens on a dummy tower on board of the installation vessel, after which the complete RNA will be lifted as one piece onto the WTG tower.
As a partner with ISHY workgroup, how are you working with Ports/landslide ops to develop the infrastructure to facilitate the hybridisation of ships.	We obtain a concession / lease from the port and are responsible for the full development, construction and exploitation of the refuelling station. The port provides us with the quayside location and berthing facilities, and electricity supply (needed for compression and cooling).

	Because this is a pilot project, the port (in this case Port of Ostend) is also a member of the project consortium and assists us with the permitting process as well.

Session 2 – Power to X – Leveraging offshore wind

Thom Cameron – Hydrogen and Chemicals Technology Director, Aurecon Australia	
We often hear the round trip efficiency losses with H2 are dramatic and undermine the case for hydrogen as a carrier, true/false? Does NH3 solve this?	Yes, this is true and the actual number depends on the technology used. For instance, you'll get a better return if you can use a fuel cell at the end rather than an engine. Does ammonia solve this problem, no not really and in some cases it will make it worse. Every time you step through a piece of equipment, plant or process you're almost guaranteed to lose some energy. So by moving from electrons to hydrogen then to ammonia simply adds another step. However, distribution needs to be considered, if you're putting it on a ship and sending overseas to a customer then then using ammonia as a energy carrier can actually be more efficient as other losses are limited. There are emerging technologies where you can potentially go straight from electrons to ammonia via a different electrolysis process which will help the cause.
No energy is fully clean -there is inherent carbon cost in construction and installation. How has this been accounted for in the Power to X story?	Of course, this is true and it's true of simply using electrons from a wind farm for example. That being said the total embodied carbon of the energy product is dwarfed when compared to traditional sources and as such when taken over a project lifecycle the renewable supply chain quickly recovers the ground it lost in having a need for more infrastructure.
Rio Tinto makes aluminium direct from electricity in NZ. Why introduce the losses of hydrogen in Australia?	I didn't have enough time to spend on this so perhaps I missed my point. Yes, the electrical energy Rio use at Tiwai Point is renewable and you can call that process green, just as you can in Tasmania and a variety of other smelters round the place. It's the step before that I was referring to where the industry uses large volumes of fossil fuels as fuel for process heat in the alumina refineries. This is to convert bauxite to alumina which is required then for the smelting process which takes place in NZ. Hydrogen could displace the process heat fuel
How do you see the role of carbon recycling (eg from a flue) versus direct air capture for carbon based e-fuels?	Recycling of carbon will of course be a good thing, but it's not really a finished solution as it's still giving the current emitters a licence to continue. Around the world there are plenty of people looking to do just that but it isn't going to be able to be called a green product by most peoples definition. If you can somehow trap the carbon you've captured in a product such that it won't be emitted, then that can work. Equally if you can convert the original fuel to bio, such that the carbon you capture from the flue was recently in the atmosphere (i.e. not dug up) then than can be carbon neutral. If you combine those two some will say it's carbon negative. As I mentioned the

	people looking at synthetic methane in Aus are looking at direct air capture as they want the product to be green gas, not 'less grey'
Can you please justify you comment that cables won't work? (not 100% sure of context so feel free to leave this one)	The problem with using massive cables as a means to export renewable energy are many. The logistics of fabricating and construction the cable are significant, particularly over the potential distances required. The cable will experience the same utilisation issues as electrolysers in that you are reliant upon a specific generation profile. This system will also experience significant energy losses although perhaps less than the chemical system. They also come with a significant risk, in that you've tied your output to a single customer location, rather than being de-linked from a customer and open to a global market as with chemical carriers. In terms of scale, it is difficult to see how the countries wanting to import the energy would be feasibly able to do it all via cables certainly given current and foreseen technology. That being said I'm no expert in this area.

Session 3 – Regulatory Regime and infrastructure

Thom Cameron – Hydrogen and Chemicals Technology Director, Aurecon Australia	
How will Transpower help enable potentially large connections like offshore wind could generate? Will REZs be the mechanism?	As part of our planning process Transpower is looking at areas where the total generation resource within a region may exceed any one proponent's development plans and how transmission infrastructure is developed. One of these options is the use of Renewable Energy Zones (REZs). We are presently working through a REZ case study with some proponents and distribution companies on the implications both technically and financially on these scheme developments.

Panel session - Day one

Responses from: Brett Rogers – Director, Elemental Group + Ross Dingle – Head of Commercial, Port Taranaki	
Maui was underpinned by government support. Can a new offshore-based energy industry be successful without government support?	Ross: Government support is vital. Developers require a clear regulatory framework to reduce consenting risk. The industry has significant potential to provide valuable trade revenue over a long period of time. Understanding the benefits to the New Zealand economy could facilitate government incentives in this space.
Which country leads in terms of an energy strategy that is optimised? In the balance of net zero + added energy economy. Will NZ get there?	Brett: Norway is the leader in taking a fossil fueled and hydropower-based economy and transforming it into a renewables power.

How can the next generation have their say in discussions around future energy and energy transition?	Brett: They already are (Greta Thunberg) and do so through their consumer choices as they have high free cash capacity. Ross: Talk to your MP's, get involved in school projects supporting a renewable energy economy, think about educational choices that create pathways towards meaningful employment opportunities in this sector.
The energy industry is currently not diverse. When only adapting existing talent to renewables, diversity won't change. How can we attract diversity here?	Brett: The energy industry is very diverse as it employs people from many races and religions however females remain underrepresented. The way to improve this is by having strong female role models (which we have) and offering these sorts of careers to early teenagers in their year 9 and 10 experiences. Ross: There is plenty of scope for new entrants into this new industry. Traditional energy extraction and production still has some way to run. The industry must position itself as an equal opportunity employer and celebrate diversity.
With developers competing for the same seabed for offshore projects, how does the govt choose which to approve? Do we need licensing rounds like oil and gas?	Brett: This is the announcement by Megan Woods to start a regulatory review for offshore wind in second half 2022. We expect it will follow other international jurisdictions in this regard (ie UK, Europe, Japan, South Korea, Australia). Ross: The establishment of a comprehensive regulatory regime will be key to addressing this matter. There is an opportunity to build off the success and failures of those countries that have gone before us globally.
Is there an opportunity for iwi to partner with developers and invest in offshore wind opportunities, so we can benifit from Maori knowledge from outset?	Ross: I see this as a critical part of making the industry a success for New Zealand Inc. Team New Zealand and this includes Iwi must be able to invest in renewables. Developers must partner with Iwi and respect cultural values. Iwi will be here forever, and certainly long after the developers have gone.
We seem to be fixated on energy export - should we not be focusing first and foremost on NZ Net Zero?	Brett: We have to do both to support New Zealand energy markets and to share our energy wealth as good global citizens to reduce global carbon emissions. Ross: New Zealand net zero has significant impact on export industries that create thousands of jobs and sustain economic development across New Zealand. Think about Oil and Gas as a sunset industry, think about reduced farming intensity. This will impact jobs and GDP. I don't think you can talk about NZ Net Zero without also talking about new export industries to replace what will likely be lost.

Session 4 – Wave and tidal

Dr Craig Stevens – Principal Scientist, Marine Physics, NIWA	
What is the generation potential of cook strait?	Vennell et al 2020 suggest an option for a single farm is 90 MW and that the total possible potential is 15 GW. Stevens et al 2012 claimed an initial starting point would be a 40 MW farm. References: - Vennell, R., Major, R., Zyngfogel, R., Beamsley, B., Smeaton, M., Scheel, M. and Unwin, H., 2020. Rapid initial assessment of the number of turbines required for large-scale power generation by tidal currents. Renewable Energy, 162, pp.1890-1905. - Stevens, C.L., Smith, M.J., Grant, B., Stewart, C.L. and Divett, T., 2012. Tidal energy resource complexity in a large strait: The Karori Rip, Cook Strait. Continental Shelf Research, 33, pp.100-109.

Armin Howard – Project Operations Manager, Azura Ocean Technology	
Do you have plans to build a 1MW version. What is the limit of output?	Absolutely we have plans to build larger i.e. 1MW scale units. Our focus at present is on the early adopter markets where levelized cost of energy (LCOE) is not a determining factor. As we build scale driving down production costs, leading to reduced LCOE we see the technology moving into utility scale applications, such as offshore wind infill requiring larger output devices. Higher output will require larger devices, float width being the determining factor.
When considering desalination, have you looked into the rest of the process beyond power generation? – i.e, how the fresh water will be transported to shore	We have in conjunction with reverse osmosis (RO) desalination equipment manufacturers, considered a number of options for transporting the water ashore: - Pumping high pressure sea water into a shore-based RO facility - On board desalination pumping fresh water directly ashore - On board desalination pumping fresh water into a nearby moored barge for transportation to shore The best method will need to be assessed on a case-by-case basis considering sea conditions, proximity to shore and economic factors.

Panel session - Day two

Responses from: Millan Ruka – Ruka Energy + Craig Stevens – Principal Scientist, Marine Physics, NIWA + Martin Knoche – Co-Chair, Aotearoa Wave & Tidal Energy Association + Stephanie Thornton – Cluster Manager, Australian Ocean Energy Group	
Components and equipment is currently manufactured using fossil fuel processes or unsustainable resources (eg steel). Has the whole supply chain been considered? This is accurate for all technologies, wind H2, etc as complexity adds more carbon.	**Craig:** In our recent paper on hybrid approaches of wave energy we did consider wider supply chain issues although with a good deal of speculation as we were dealing with hypothetical technology - but this allowed us to look broadly across materials. https://www.frontiersin.org/articles/10.3389/fmars.2021.628148/full **Martin:** Proper Life Cycle Assessments (LCA) like cradle-to-cradle approach and Environmental Product Declaration (EPD)'s are required moving forward. For selected international ME projects this work has been done (Check out SIMEC Atlantis). From my understanding I haven't seen any LCA done for a NZ marine energy project, yet."
What level of Govt Support in Australia do Ocean Energy Group members receive for their projects, if any?	Stephanie: While there are no overarching government support programs for ocean energy projects (industry-wide), there is potential government grant support via the Australian Renewable Energy Agency (ARENA). For example, ARENA is contributing support for Wave Swell's King Island project. Additionally, grant support may be possible through state government programs under the umbrella of regional development, technology and/or manufacturing, and others.
What are your views on the recent legislation that was passed in Australia, and how 'fit for purpose' it is across all technologies?	**Stephanie:** The Offshore Electricity Infrastructure Bill is a strong step forward in support of ocean energy development in Commonwealth waters. While the drivers behind the Bill were predominantly the emerging offshore wind projects, this Bill provides good support for ocean energy development as well. There are 3 license streams in this framework: 1) commercial, 2) research and demonstration and 3) transmission and infrastructure. License stream #2, Research and Demonstration, is intended for small-scale projects to undertake research and/or to test and demonstrate emerging technologies (eg, ocean energy). Of note, is that research and demonstration licences can overlap with other license areas (eg, commercial). This could provide opportunities for collaborative offshore wind/wave projects.
Does Three Waters initiative impact the success of river based energy generation?	**Millan:** It will totally depend on the operational mode of the power generation device. The Ruka Marine Turbine is slow moving, soft edged, and a surface mode floating turbine, non-polluting, fish friendly, no dams and other criteria that is not at all confrontational to the "Three Waters" initiative.