



ETIPOCEAN

European Technology & Innovation Platform for Ocean Energy

Deliverable 8.5 (part 1):

Report from the first stakeholder engagement workshop



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Contents

1) Executive summary	3
2) Workshop 1 - 26 October 2017.....	9
Discussion table 1: Metrics and stage-gate development programmes.....	11
Discussion table 2: Control and Systems for improved yield, reliability and survivability	14
Discussion table 3: Environmental impacts & consenting	19
Discussion table 4: Power Take Off- have we cracked it?	25
Discussion table 5: Socio-economic impact and acceptance.....	29



1) Executive summary

ETIP Ocean project started on 1 December 2016. By 31 November 2017 it organised 7 webinars transmitted live through webinar software. Each webinar addressed a specific priority area identified in deliverable 2.1, "Report on an integrated framework of ocean energy sector challenges".

The priority areas identified in deliverable 2.1 were classified as belonging to one of three categories: Technology, Financial or Environment & Socio-economics. The webinars followed, therefore, the same classification.

After each webinar, a report was drafted listing:

- the topics presented,
- findings of the discussions including recommendations, and
- questions for discussion during the annual workshop.

The results from 5 webinars (Technology and Environment & Socio-economics topics) were summarised at the first annual workshop on 26 October 2017. The workshop brought together a broad variety of participants in a single venue to review and build upon the results of the preceding webinars.

The event generated actions from key questions posed during the webinars. The webinars act as a knowledge sharing platform discussing fourteen identified priority barriers that need to be overcome for ocean energy to reach commercialisation. The goal is to define a common vision for the accelerated development of the ocean energy sector and then disseminate knowledge through public engagement.

The workshops were designed to elicit two key pieces of information - define the key actions and determine the key stakeholders to perform them.

The main findings of the workshop can be found in the summary tables.



Table 1: Summary of workshop results on Metrics and stage gate development programmes

Barrier to ocean energy deployment	Actions	Responsible stakeholders
Metrics need to be comprehensive and objective; assessing right characteristics, for diverse technology types, right strength, for entire system development pathway, etc.	<p>Complete development of a set of metrics for ocean energy technology development, with validation.</p> <p>Support demonstration projects to allow validation of the metrics.</p>	<p>International bodies, such as IEA and IEC, International organisations, such as ETIP, OEE and EERA, Technology/Project Developers, Private/Public funders</p>
Lack of tools and processes to support evaluation of metrics	<p>Develop tools and processes to facilitate metric evaluations for sub-system, devices and arrays.</p>	<p>International organisations, such as OEE and EERA, Technology/Project Developers, Private/Public funders</p>
Lack of investor confidence	<p>Gain cross-sector approval and acceptance of metrics. Deliver appropriate standardisation and dissemination of the metrics.</p> <p>Support demonstration projects to allow validation of the metrics.</p>	<p>International bodies, such as IEA and IEC, International organisations, such as OEE and EERA, Technology/Project Developers</p> <p>National funding authorities and European Commission.</p>



Table 2: Summary of workshop results on Control systems.

Barrier to ocean energy deployment	Actions	Responsible stakeholders
Lack of clear transfer of lessons learned and coordination between academic and private industry work	Continued funding of knowledge sharing webinars, conferences/exhibitions.	EU projects, such as ETIP Ocean, R&D organisations and Control Developers
Lack of technical comparison of different control system approaches	Advocate and construct blueprints for control system design best practices.	Industry, Academia, R&D organisations and technology developers
Existence of diverse range of testing controls simulation platforms and tools	Further development and maintenance of a limited number of advanced tools, open development up to other researchers.	R&D organisations and Academia
Critical aspects are overlooked in the control system development	More emphasis on investigating alternative benefits of control systems, such as survivability, reliability, improvements to cost of energy.	Trade associations, technology developers and EU projects, such as ETIP Ocean
Lack of proper testing, validation and optimisation of control models at different scales	Develop/make available 'Hardware in the Loop' test facilities for realistic testing of control systems at different scales. Support demonstration projects on the basis of deploy and monitor.	Developers and EU project, such as MARINET. Member States funding authorities and European Commission.
Control solutions are not integrated into overall systems at an early stage	Ensure that there is early integration of control systems into subsystems that might be otherwise developed in isolation.	Developers and funding bodies
Control system development can seem to be reserved for experts	Keep controls knowledge sharing events understandable to wider audiences by thinning down complicated mathematics.	Trade associations, EU projects, such as ETIP Ocean



Table 3: Summary of workshop results on Environmental impacts

Barrier to ocean energy deployment	Action to overcome barrier	Responsible stakeholder
Burden of proof <ul style="list-style-type: none"> - Inadequate policy - Lack of guidance 	Adopt risk based approach to consenting Common scoping framework and national guidance Support demonstration projects on the basis of deploy and monitor.	Member States' consenting authorities based on RiCORE. Member States' consenting authorities facilitated through EU. Member States funding authorities and European Commission.
Monitoring data collection and analysis	Develop Direct Impact Analysis and Power Analysis tools	Academia and industry funded via Horizon2020
Long timelines for consent challenges	National guidance, scoping framework, sound assessments	National consenting authorities and industry.



Table 4: Summary of workshop results on Power Take Off

Barrier to ocean energy deployment	Actions	Responsible stakeholders
Challenging technical requirements and diverse range WEC driving inputs	Requirements for the PTO sub system design to be capable of high performance AND reliability during testing and operations. Implement an iterative design process for PTO development scaling.	European Union Member States, Equipment buyers
Lack of common, recognised and open access dry testing facilities	Build open access, dry test facilities open to all Developers with PTO programmes. FORESEA or MARINET2 projects allowing facility access (funding) across the EU could form a vehicle for common access permissions.	EU level test/lab facility, Cross sector facilities and providers
Lack of technology transfer and engaged supply chain	Diversification Outreach. Policy change to introduce tax relief for R&D PTO or other sub system developments. Forecasting and incorporate Utility Scale opportunities into commercialization pathways.	Cross sector industry, EU, national and regional diversification projects
Lack of recognised PTO (and other sub component) validation and certification systems and poor utilization of existing certification processes by some EU Member States	Create and support a system of appropriate target level metric criteria at various TRL development levels.	Public/Private funders, Cross sector standards bodies, such as DNV-GL, Bureau Veritas, NORSOK, ISO or ICE International organisations, such as OEE and EERA, Technology/Project Developers, Private/Public funders



Table 5: Summary of workshop results on Socio-economic impact and acceptance.

Barrier to ocean energy deployment	Action to overcome barrier	Responsible stakeholder
Finding/identification of stakeholders	Developing good practise guidelines	Coordinated by EU
Understanding of OE benefits for local communities; community ownership programmes	Studies on the benefits of ocean energy to local economy	Coordinated by EU, Carried out by National development agencies
	Ocean energy community ownership studies	Coordinated by EU, Carried out by National development agencies
	Better dissemination of information, including from deployed demonstration projects.	Specialised media, industry associations, project developers, ETIP Ocean.
Lack of integration of OE in regionally specific activity on aiding development	Reviewing regional programmes for growth	National governments, EU
	Creating centrally located register of regional support programmes	Coordinated by EU/National development agencies, Operated by ETIP or industry association
Understanding of OE added value to other activities/infrastructure	Study of the “integration” of ocean energy with other existing/planned activities	Coordinated by EU
EU procurement rules and procedures	Updating EU procurement rules by giving more weight to non-financial factors, such as a wider benefit to local communities	EU Institutions, Ocean Energy Europe



2) Workshop 1 - 26 October 2017

The first stakeholder workshop was organised alongside the Ocean Energy Europe Conference & Exhibition in Nantes, France. Co-locating the events gave ETIP Ocean the possibility to access a range of ocean energy stakeholders that may not, otherwise, have travelled to a standalone ETIP Ocean workshop.

Topics

Seven webinars and a seminar transmitted live through webinar software were organised by ETIP Ocean in the period preceding the workshop.

Table 6: ETIP Ocean webinars and seminar organised between 6 April and 25 October 2017

Date	Webinar title	Priority challenge addressed	Classification
06/04/2017	Metrics and stage-gate development programmes	Defining and enforcing standards for stage progression through scale testing	Technology
25/04/2017	Warranties, guarantees and insurance	Providing warranties and performance guaranties	Financial
23/05/2017	Enhancing social impact and acceptance	Enhancing social impact and acceptance	Environment & Socio-economics
27/06/2017	Control systems for improved yield, reliability and survivability	Increasing device reliability and survivability	Technology
29/08/2017	Minimising negative environmental impacts	Minimising negative environmental impacts	Environment & Socio-economics
05/10/2017	Funding Ocean Energy Technology Development Using Pre-Commercial Procurement and Stage-Gate Development Processes	Linking stage-gate development processes to funding decisions	Financial
25/10/2017	Wave power take-off: have we cracked it?	Developing novel concepts for improved power take-offs (PTOs)	Technology

Of the seven priority challenges addressed during the webinars and seminar, it was decided to not discuss the two financial priority challenges during the workshop. At the same time as the ETIP Ocean workshop, a session on financing ocean energy demonstration projects was in progress at the Ocean Energy Europe 2017 conference and exhibition.



To ensure participation of the largest possible number of stakeholders and experts, it was decided to discuss all the financial challenges during the second stakeholder workshop in 2018.

Format

The workshop was introduced by the secretariat that presented the main findings and results of the webinars under the two classifications on the agenda: Technology and Environment & Socio-economics. Questions were posed to take discussions under each topic forward during the workshop.

Participants were split into five different tables, each addressing a specific webinar topic and, thus, an identified priority area. The experts that presented during the webinars were invited to moderate the discussions at their respective tables. Participants were tasked with suggesting actions to address identified challenges in their topic and determine which stakeholder category should be responsible to carry out the actions.

The secretariat distributed printed copies of the presentations made during the webinars and reports on the main findings at each discussion table.

At the end of the discussion, a spokesperson from each table presented the challenges, actions and identified responsible stakeholders to all participants.

Attendance

Thirty-three people signed the attendance list.



Discussion table 1: Metrics and stage-gate development programmes

Objectives

The “Metrics and stage gate development programmes” webinar was held on the 6th of April 2017. Stage-gate procedures and the metrics that underpin them have proven their worth in a range of emerging technology sectors in recent years. Developing new technologies is inherently risky, with many failing to ever reach commercial viability. The main findings from this webinar, the presentations and the video recording can be found on etipocean.eu website.

Workshop results

Participants at the discussion table followed up on the results from the webinar and listed the common main barriers to progress in ocean energy development linked to metrics and stage gate development. Actions to overcome these barriers and the responsible stakeholders were discussed and identified.

Barriers

1.) Comprehensive Metrics

The roundtable discussion provided a list of requirements for the metrics:

- Metrics should be developed to serve an internationally recognised set of topic areas such that they assess the right technology characteristics.
- Metrics need to be made applicable to all wave and tidal energy devices and technology types.
- Metrics must reward the right strengths of a technology to avoid inappropriate guiding of technology development.
- Metrics need to cover the entire system development pathway, across all TRLs. They, therefore, require the appropriate detail for the various TRLs.
- Subjectivity should be removed where appropriate. Some subjectivity is likely to remain in more qualitative topic areas and where flexibility is required to assess true novelty.
- The hierarchy of individual and combined metrics needs to incorporate appreciation of uncertainty of input data.
- Ongoing refinement of the metrics is required.

2.) Evaluation

The discussion mentioned that there are tools and processes required to support evaluation of the developed metrics.

3.) Lack of Investor Confidence



Cross-sector approval of metrics is required to encourage investor confidence and allow cross-funder comparisons.

Actions

1.) Complete development of a set of metrics for ocean energy technology development

The development should include the following:

- Stakeholder consultation on metrics selection to build trust and acceptance.
- Learning from previous due diligence activity in ocean energy and from other sectors.
- Incorporation of uncertainty methods to better understand the range and probability of metric results.

2.) Develop evaluation tools and processes

Carry out validation activity to give confidence and confirm the appropriateness of the metrics to all ocean energy technology types and TRLs. Develop tools and processes to facilitate metric evaluations for sub-system, devices and arrays.

3.) Obtain Cross-sector approval, appropriate standardisation and dissemination

Gain cross-sector approval and acceptance of the metrics including the method of integrating metrics into a prioritised hierarchy. Deliver appropriate standardisation and dissemination of the metrics to provide transparency of metric design and implementation, allowing investors to readily observe why and how technologies have been either successful or failed at that particular gate stage.

Assess how standards bodies such as the IEA/IEC could drive standardisation of ocean energy metrics application.

Demonstration projects will provide the ocean energy sector with the opportunity to validate metrics through deployment and testing.

Stakeholders

International bodies such as the IEA and IEC can potentially become active driving forces behind international coordination and adoption of metrics.

International organisations such as OEE, EERA and the ETIP network provide a capable networking and knowledge sharing vehicle to support metric development and collaboration inside the European ocean energy industry.

Technology developers, private/public funders, project developers and international coordination bodies should engage with metrics validation and acceptance.



Table 7: Summary of workshop results on Metrics and stage gate development programmes

Barrier to ocean energy deployment	Actions	Responsible stakeholders
Metrics need to be comprehensive and objective; assessing right characteristics, for diverse technology types, right strength, for entire system development pathway, etc.	<p>Complete development of a set of metrics for ocean energy technology development, with validation.</p> <p>Support demonstration projects to allow validation of the metrics.</p>	<p>International bodies, such as IEA and IEC, International organisations, such as ETIP, OEE and EERA, Technology/Project Developers, Private/Public funders</p>
Lack of tools and processes to support evaluation of metrics	Develop tools and processes to facilitate metric evaluations for sub-system, devices and arrays.	<p>International organisations, such as OEE and EERA, Technology/Project Developers, Private/Public funders</p>
Lack of investor confidence	<p>Gain cross-sector approval and acceptance of metrics. Deliver appropriate standardisation and dissemination of the metrics.</p> <p>Support demonstration projects to allow validation of the metrics.</p>	<p>International bodies, such as IEA and IEC, International organisations, such as OEE and EERA, Technology/Project Developers</p> <p>National funding authorities and European Commission.</p>



Discussion table 2: Control and Systems for improved yield, reliability and survivability

Objectives

Control systems for wave and tidal energy converters act to optimise power production and reduce stress and fatigue on components by allowing devices to adapt to changing ocean conditions. The webinar provided a brief introduction to the theory of control systems, including a look at their use in other sectors, before investigating how such systems can be applied to the ocean energy sector. The webinar was held on the 27th of June 2017. The main findings from this webinar, the presentations and the video recording can be found on etiocean.eu website.

Workshop results

Participants at the discussion table followed up on the results from the webinar. They identified the control and optimisation systems development progression barriers, divided into technical and common area barriers. Then they highlighted necessary actions to overcome them, and finally listed stakeholders who should take the main driving responsibility.

Barriers

1) Technical Area

1.) Lack of technical comparison

Establish common control systems specifications and realistic drivetrain examples to allow technical comparisons between different system control system approaches.

2.) Existence of diverse range of testing controls simulation platforms and tools

There exists a diverse range of testing controls simulation platforms and tools. There is a lack of post-release maintenance and upgrading of these open-source tools.

3.) Lack of proper testing

Hardware in the Loop (HIL) 'real world dynamic/sensors/drivetrain' testing equipment and procedures are critical and over looked aspects of control system development. Such equipment and procedures are vital for calibrating, testing, validating and comparing solutions. In addition, control models are not properly tested, validated and optimised at each scale.

2) Common Area Barriers

1.) Lack of transfer of lessons learned



There needs to be a clear transfer of lessons learned from the implementation of control solutions between groups working within the ocean energy sector and from other sectors.

Historically, groups will default to what they know to tackle problems. There is a need to combine the development efforts on different device components to tackle problems. The overlap of academic and private industry work on controls system research needs to be better coordinated, with feedback from both sides on their needs and progress. R&D academic researchers and private industry developers have overlapping controls requirements, which needs to be better, coordinated, with feedback from both sides on their needs and progress.

2.) Critical aspects are overlooked

Control systems often focus on optimizing power production instead of the other requirements of a control system, such as survivability, reliability, robustness, condition monitoring, etc.. Optimisation does not include relevant cost functions

3.) Integration of control solutions

Control solutions are not integrated into overall systems at an early stage.

4.) Control system development can seem to be reserved for experts

The area of control system development needs to be presented in a more accessible way, there is a risk that the area may seem reserved for expert mathematicians when it needs to be accepted by the whole industry.

Actions

1. Technical barriers

1.) Construct control design blueprints

Advocate and construct blueprints for control system design best practices, similar to the detail level found in EMEC ocean energy guidelines. These blueprints should not be too specific otherwise they will not be applicable, given the wide range of controls designs currently being developed.

2.) Development of a limited number of advanced tools

Further development of a limited number of advanced tools, such as WECSIM software. Open development up to other researchers. Build similar software for tidal development. Funding needs to be made available to administer the maintenance and upgrading of developed tools.

3.) Develop/make available 'Hardware in the Loop' test facilities

Develop HIL systems for industry use. HIL testing procedures could be fed into a common database for testing guidelines to be generated and applied. Feedback loops and continual improvement of these guidelines would aid all developers in designing and testing controls systems to a common standard. Including guidance on device upscaling effects needs to be considered.



Demonstration projects allow for validation and optimisation of testing guidelines. This can be achieved through a variety of projects for validation at different scales.

2. Common area barriers

1.) Funding of knowledge sharing

Continued funding/project management of knowledge sharing webinars and open access workshop discussions. Although competitive secrecy will always exist, a knowledge exchange mechanism remains key to creating a more overt sharing environment. Integrated Ocean energy and outside the sector case studies knowledge sharing examples.

Technical specific controls conferences/exhibitions between relevant R&D organizations and controls developers would enhance knowledge sharing and feedback loops.

2.) Understandable knowledge sharing activities

Keep controls knowledge sharing events understandable to wider audiences by thinning down complicated mathematics.

3.) Investigate alternative benefits

More emphasis should be placed on investigating the alternative benefits of control systems e.g. survivability, reliability, improvements to cost of energy etc.

4.) Early integration of control systems

Developers and funding bodies need to ensure that there is early integration of control systems into subsystems that might be otherwise developed in isolation. For example, if a project is developing a PTO for a larger system, the influence of the controller on the PTO and larger system should be considered from the outset.

Stakeholders

1) Technical barriers

Creating a common set of controls guidelines could originate as a product from the WES controls development landscaping and stage one project selection. Similarly, this could originate from industry, although vested interests and competitive market positions may limit the flow of technical input to a private sector developed guideline.

R&D organizations/academia maybe best placed to develop WECSIM software and to develop a similar tool for tidal energy arrays.

'Hardware in the Loop' rigs could be made available through programmes similar to MARINET.



2) Common area barriers

EU supported projects like ETIP Ocean are key to continued knowledge sharing and sharing lessons learned.

Increased involvement of trade associations, academic and developer joint projects and improved knowledge sharing avenues could provide a better link between the developer's real-sea control needs and the R&D organisation's research subjects and topics.

Table 8: Summary of workshop results on Control systems.

Barrier to ocean energy deployment	Actions	Responsible stakeholders
Lack of clear transfer of lessons learned and coordination between academic and private industry work	Continued funding of knowledge sharing webinars, conferences/exhibitions.	EU projects, such as ETIP Ocean, R&D organisations and Control Developers
Lack of technical comparison of different control system approaches	Advocate and construct blueprints for control system design best practices.	Industry, Academia, R&D organisations and technology developers
Existence of diverse range of testing controls simulation platforms and tools	Further development and maintenance of a limited number of advanced tools, open development up to other researchers.	R&D organisations and Academia
Critical aspects are overlooked in the control system development	More emphasis on investigating alternative benefits of control systems, such as survivability, reliability, improvements to cost of energy.	Trade associations, technology developers and EU projects, such as ETIP Ocean
Lack of proper testing, validation and optimisation of control models at different scales	Develop/make available 'Hardware in the Loop' test facilities for realistic testing of control systems at different scales. Support demonstration projects on the basis of deploy and monitor.	Developers and EU project, such as MARINET. Member States funding authorities and European Commission.
Control solutions are not integrated into overall systems at an early stage	Ensure that there is early integration of control systems into subsystems that might be	Developers and funding bodies



	otherwise developed in isolation.	
Control system development can seem to be reserved for experts	Keep controls knowledge sharing events understandable to wider audiences by thinning down complicated mathematics.	Trade associations, EU projects, such as ETIP Ocean



Discussion table 3: Environmental impacts & consenting

Objectives

The webinar “Minimising negative environmental impacts” was held on 29 August 2017. The webinar addressed the Strategic Research Agenda priority category “Minimise environmental impacts” and attempted to build on Action 4 of the Ocean Energy Forum Strategic Roadmap “De-risking environmental consenting through an integrated programme of measures”. The main findings from this webinar, the presentations and the video recording can be found on etipocean.eu website.

Workshop results

Participants in the discussion table follow-up on the results from the webinar and listed three main barriers to progress in ocean energy development linked to environmental impacts. Actions to overcome the barriers and responsible stakeholders were discussed and identified.

Barriers

1) Burden of proof

Ocean energy is a relatively new sector with little environmental data available from full-scale deployed projects. Authorities and other stakeholders often require, therefore, that developers prove the lack of impact on a range of issues before deployment in a strict application of the precautionary principle. Lack of experience and available empirical data means that the absence of impact may not be proven or only proven through thorough assessments and modelling that place an unreasonable burden on the project developer.

This reversal of the burden of proof, furthermore, can lead to consenting authorities developing policies that are inadequate and do not allow for a proper assessment of potential impacts associated with ocean energy projects. It is important that consenting authorities adopt a risk-based consenting process that allows for appropriate assessment of impacts. The burden of proof placed on developers is exacerbated by the lack of appropriate guidance to developers on what needs to be assessed to obtain environmental permits and the best practical measures for monitoring the project is deployed.

2) Environmental monitoring is data heavy

Performing exhaustive Environmental Impact Assessments and conducting monitoring campaigns requires collecting and treating a very large amount of data. Moreover, it is not always clear what level of granularity of data is required for each aspect being analysed nor what sample size is required to detect a relevant effect with a given degree of certainty.



Collecting and treating all this data is expensive and burdensome, particularly for relatively small projects. Furthermore, it comes with the risk that significant resources are put into collecting or treating data that is not relevant. Developers often do not have the financial resources to collect and treat all the required data.

3) Challenges to awarded permits can have long lead-times

Obtaining all the permits required to build an ocean energy project can be time consuming. However, many administrations have established processes with predetermined lead times. Whereas these can always be improved or made more fit-for-purpose, they give project developers a path to follow and timeline, albeit approximate.

Once obtained, however, permits can be challenged, through both administrative appeals and/or legal appeal processes. In this latter case, beyond the cost and the resources that need to be allocated to the process, lead-times for a judgement are uncertain.

This uncertainty over the timing of the judgement and its consequences for a project come at a significant financial impact to the developer, reduce investors' appetite to support the project, or push investors to require a higher return due to perceived risk, pushing up project costs.

Actions and responsible stakeholders

1) Adopt a risk-based approach to consenting

The Ocean Energy Forum's Strategic Roadmap suggests adopting a risk-based approach to environmental analysis and monitoring in consenting procedures. A risk-based approach focuses on likely environmental impacts providing guidance for determining project baseline characterisation requirements and developing project environmental management plans that are proportionate to the level of risk posed by a proposed ocean energy project.

It requires an on-going review of environmental impacts associated with the technology's increased deployment to ensure that up-to-date information and data on potential impacts of ocean energy projects are available and considered in determining the likely significant impacts for future deployments.

The EU-funded RiCORE project¹ developed a risk-based approach to ocean energy and offshore wind energy consenting. The project develops an approach to optimise management of uncertainties associated with environmental impacts in a cost-effective way.

¹ <http://ricore-project.eu/>



ETIP Ocean proposes that Member States appropriately translate into national consenting processes the recommendations of the RiCORE project. The European Commission could facilitate this process by setting up a working group or platform for relevant national consenting authorities to exchange best practices and lessons learnt.

2) *Develop and open-source software that collects data from existing databases to develop direct impact analysis.*

Environmental monitoring activities around ocean energy sites collect significant amount of data and feed them into various databases. There is, therefore, little need for more databases to be created but rather a requirement to ensure databases are synchronised and that data can easily be translated between databases. In addition, it is essential that project developers understand how the data can be used in a meaningful way.

ETIP Ocean recommends developing a readily accessible, open source software, designed to carry-out direct impact analyses based on a set of parameters. The software would be fed by existing databases and monitoring campaigns and help developers identify and assess the significance of environmental impacts associated with such a project. The software would help determine both direct and indirect impacts as well as determining suitable mitigation and monitoring techniques.

- *Develop methodology for what data is needed: Power Analysis*

To better inform authorities and stakeholders of what environmental data is needed to conduct an Environmental Impact Assessment and post-deployment monitoring activities, it is recommended that Power Analyses are run. Power Analyses allow a developer to estimate the number of observations of a given phenomenon needed to detect to any degree of certainty the impact they are looking for.

The main issue that the methodology needs to address is the sample size of data required to positively determine the statistical significance of a potential impact pathway.

Whereas Power Analyses are data-specific, however a guidance document outlining the methodology for conducting them would facilitate the process. The latter should inform on the granularity of data required for each aspect that requires assessing or monitoring. Developing such a methodology would focus data collection and analysis and reduce the quantity of unnecessary data collected.

Power Analyses allow a developer to estimate the number of observations of a given phenomenon needed to detect to any degree of certainty the impact they are looking for has the potential to occur.

The development of such tools is typically an activity that should be facilitated by a Horizon2020 project, involving a consortium of several organisations in different European countries.



3) *Develop common approach to scoping and guidance for developers*

EU

Environmental impacts of ocean energy projects are inherently site-specific. It is, therefore, not possible to develop one-size-fits-all guidance on what needs to be assessed or monitored.

However, ETIP Ocean suggests developing common guidance on scoping and assessment technique requirements. National consenting authorities should cooperate in the development of such a common framework, addressing common licensing issues and building on case studies and lessons learnt. The European Commission should impulse and facilitate this activity that could be linked to the working group or platform suggested in point 1 above.

- Develop guidance for developers

On the basis of this common scoping and assessment requirement framework, national consenting authorities should issue specific guidance to ocean energy developers on appropriate assessment and monitoring requirements and the national permitting process. This would streamline permitting related work for developers and provide a clear pathway to obtaining the necessary permits.

Clear guidance and sound assessments de-risk consenting

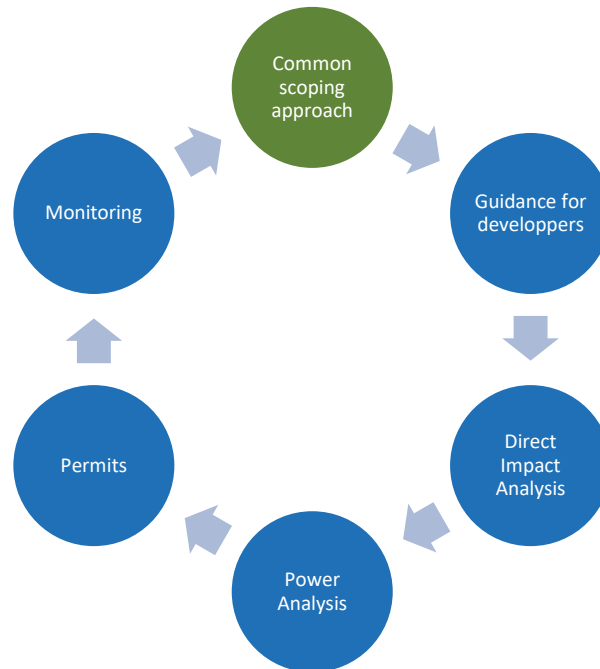
The coherent roll-out of this integrated programme of measures will create a virtuous cycle where better-informed assessment and monitoring improves consenting policy allowing authorities to issue ever sounder guidance to ocean energy developers.

Such a process should continually increase certainty in environmental assessments and increasingly facilitate the process of obtaining consent and permits for developers.

Moreover, whereas, permits can always be subject to legal challenges, clear procedures backed by ever sounder science should also better inform legal proceedings.



Figure 1 – Cycle of an integrated programme of measures to improve environmental impact analyses and de-risk consenting procedures for ocean energy deployment



“Real-sea” testing

The results of the analyses within ETIP Ocean also highlight the importance of in-sea testing. Demonstration projects provide the sector with the opportunity to prove their technology in a real sea environment. The learning by doing allows industry and researchers to gather valuable insights to improve future policy and consenting processes.

Consequently, public support for early demonstration projects through a deploy and monitor approach will facilitate the gathering of better evidence, reducing future risks for both the environment and developers.

Table 9: Summary of workshop results on environmental impacts

Barrier to ocean energy deployment	Action to overcome barrier	Responsible stakeholder
Burden of proof <ul style="list-style-type: none"> - Inadequate policy - Lack of guidance 	Adopt risk based approach to consenting	Member States’ consenting authorities based on RiCORE.



	Common scoping framework and national guidance	Member States' consenting authorities facilitated through EU.
	Support demonstration projects on the basis of deploy and monitor.	Member States funding authorities and European Commission.
Monitoring data collection and analysis	Develop Direct Impact Analysis and Power Analysis tools	Academia and industry funded via Horizon2020
Long timelines for consent challenges	National guidance, scoping framework, sound assessments	National consenting authorities and industry.



Discussion table 4: Power Take Off- have we cracked it?

Objectives

The “Power Take Off – Have we cracked it?” webinar was held on the 25th of October 2017 and coordinated as a panel session at OEE2017 Conference and Exhibition.

“A deep dive into the technical aspects of PTOs. What progress has been made in the last 5 years? Which different concepts are available and how do they compare? Do we need to invest together to further one or two universal PTO solutions? A potentially contentious look at the key component of any ocean energy device.” The main findings from this webinar, the presentations and the video recording can be found on etipocean.eu website.

Workshop results

Participants at the discussion table followed up on the results from the webinar. At the beginning, they identified the PTO development progression barriers – divided in technical, infrastructure, technology/market, and qualification and standards barriers. Then they highlighted necessary actions to overcome the barriers, and finally stakeholders to take the main driving responsibility.

Barriers

1) Technical

Challenging technical requirements and diverse range WEC driving inputs

The PTO development is a technical challenging one with a wide-ranging list of topics to consider and tackle, including the following:

- Peak to Mean wave height conversion
- Diverse range of WEC driving inputs
- The reciprocal process of WEC to PTO feedback loop
- Unrealistic expectations being applied to the R&D process, i.e. no failures
- Low velocity but high forces wave type resources.

This also results in high percentage of OPEX compared to CAPEX spend for PTO's (LCOE equation).

2) Infrastructure

Lack of common, recognised and open access dry testing facilities

Technology agnostic, onshore, PTO input simulator testing facilities need to be recognised and available.

3) Technology/Market

Lack of technology transfer and engaged supply chain

There is a lack of technology transfer from established offshore industries into ocean energy. In addition, an undefined or not properly established supply chain with few “industries” and many SME or spin-off/start-ups.



4) Quality and Certification barriers

Lack of recognised sub component validation and certification systems

The lack of recognized PTO (and other sub component) validation and certification systems to attract investors and create a common target for Developers. In addition, there is a poor utilization of certification processes by some Member States during R&D funding.

Actions

1) Technical barriers

Iterative PTO design process

- Requirements for the PTO sub system design should be capable of high performance AND reliability during testing and operations.
- During PTO development scaling, there is a need to be iterative in design steps with the acceptance that it may fail due to optimisation towards a lower cost and higher energy output. An iterative R&D process provides vital learning for the development of a commercial product.

2) Infrastructure barriers

Testing facilities

- Build an open access, dry test facilities that are open to all Developers with PTO programmes. These should be designed to test performance levels, lifetime fatigue and efficiencies.
- FORESEA or MARINET2 projects allowing facility access across the EU could form a vehicle for common access permissions.

3) Technology/Market barriers

Increase technology transfer and engage supply chain

- Wave Energy Scotland's example of Pre-Commercial Procurement funding of innovate PTO's using public funding is an efficient way to support high potential technology developments at the early and mid-stages of development.
- Diversification Outreach to other industry sectors to support development pathways, and create a competitive market for PTO design and testing.
- Policy change to introduce tax relief for R&D PTO or other sub system developments.
- At the R&D level, Utility Scale opportunities could be better forecast/defined and incorporated into commercialization pathways and roadmaps strategies to better inform early stage funders on potential outlooks and investor attractiveness.

4) Quality and Certification barriers

Development of metrics

Create and support a system of appropriate target level metric criteria for PTO technologies to achieve, at various TRL development levels. Make these metric criteria a condition for future development funding calls. Agree upon a common terminology for



testing and certification of different system components, perhaps using IEC defined efficiencies as an example.

Stakeholders

1) Technical barriers

To ensure PTO design and testing meets investor requirements, knowledgeable and conscientious equipment buyers will seek to ensure relevant and appropriate PTO design and testing steps, and performance

The EU could take on responsibility for ensuring that sub systems such as PTO's conform to minimum design standards, perhaps in a similar way to the US DoE Wave Energy Prize for innovative WEC designs, or via the support and construction of performance and reliability standards.

2) Infrastructure barriers:

An EU level test/lab facility, with similar FORESEA/MARINET2 open access agreements could be a solution.

Cross sector facilities and providers, e.g. oil and gas sector maybe willing through diversification to offer on a fee paying basis PTO, and other testing facilities.

3) Technology/Market barriers

This would include all levels of funding and support, from the EU level through focused diversification projects such as project NeSSIE, to national and regional diversification projects such as those supported by the ORE Catapult, Scottish Enterprise and Highlands & Islands Enterprise.

Public funding calls, specifically, could include or be targeted at cross sector technology transfers. In addition, COSME and SME support through cluster to cluster collaboration should be made available.

4) Quality and Certification barriers

Funding and support for certification systems can come from any potential funders, public or private, EU or regional, intra or inter renewables or even from established cross sector standards bodies such as DNV-GL, Bureau Veritas, NORSOK, ISO or ICE.

Table 10: Summary of workshop results on Power Take Off

Barrier to ocean energy deployment	Actions	Responsible stakeholders
Challenging technical requirements and diverse range WEC driving inputs	Requirements for the PTO sub system design to be capable of high performance AND reliability during testing and operations.	European Union Member States, Equipment buyers



	Implement an iterative design process for PTO development scaling.	
Lack of common, recognised and open access dry testing facilities	Build open access, dry test facilities open to all Developers with PTO programmes. FORESEA or MARINET2 projects allowing facility access (funding) across the EU could form a vehicle for common access permissions.	EU level test/lab facility, Cross sector facilities and providers
Lack of technology transfer and engaged supply chain	Diversification Outreach. Policy change to introduce tax relief for R&D PTO or other sub system developments. Forecasting and incorporate Utility Scale opportunities into commercialization pathways.	Cross sector industry, EU, national and regional diversification projects
Lack of recognised PTO (and other sub component) validation and certification systems and poor utilization of existing certification processes by some EU Member States	Create and support a system of appropriate target level metric criteria at various TRL development levels.	Public/Private funders, Cross sector standards bodies, such as DNV-GL, Bureau Veritas, NORSOK, ISO or ICE International organisations, such as OEE and EERA, Technology/Project Developers, Private/Public funders



Discussion table 5: Socio-economic impact and acceptance

Objectives

The webinar “Enhancing Social impact and acceptance” was held on 23 May 2017. The webinar addressed builds on Action 4 of the Ocean Energy Forum Strategic Roadmap “De-risking environmental consenting through an integrated programme of measures”. Especially on the challenge – “need for the identification of socio-economic benefit potential for communities, regions and Member States hosting development, and the EU, to maintain political support and public backing”. The main findings from this webinar, the presentations and the video recording can be found on etipocean.eu website.

Workshop results

Following up on the findings from the webinar, participants at the discussion table listed four main barriers to progress in ocean energy development linked to socio-economic impacts and acceptance. Actions to overcome the barriers and responsible stakeholders were discussed and identified.

Barriers

1) Finding/identifying stakeholders.

Identifying the right stakeholders at the early stage of project development is crucial for successful project delivery. Without common guidance, ocean energy project developers rely on their personal expertise and on the “trial and error” method. This leads to a lot of re-inventing the wheel. Guidelines on how to engage with stakeholders would streamline the process and help avoid costly mistakes.

2) Defining local content/benefits/community ownership,

There is a lack of understanding over what positive (or negative) impacts ocean energy development could have on the local economy. Without this knowledge, public opinion can be easily influenced by misinterpreted facts and rumours. Increased knowledge and engagement from local community (through consultations and co-ownership) would reduce the risks of the projects. This ultimately will lead to the lower costs. Dissemination of the results of such studies should be improved.

3) Regionally specific activity on aiding development (not centralised)

There are many regional growth support programmes. Unfortunately, in many of them ocean energy technologies are not specifically considered; nor are the potential benefits to local supply chains and the local economy well understood. Lack of alignment between different programmes and duplications is another problem that could be solved through better coordination. This lack of alignment can occur because different support programmes are developed in isolation – access for local and regional groups looking to



implement create or amend support schemes to a forum on the web site might foster better alignment and engagement.

4) Procurement: how do you maximise the benefits?

The EU has very rigid procurement rules. Participation in the EU-led programmes can expose developers to a significant administrative burden.

Following official procurement procedures, and once a minimum level of capability is established the main factor for choosing a supplier is price. The wider benefits to the local community and the social acceptability of an ocean energy project are not considered or have a smaller relative weight; smaller local companies can also be hampered – even where they can compete on price, due to the challenges they face providing credible guarantees or performance bonds.

It may be the case that a company that has historically sourced certain products or services from local suppliers has to switch supplier after joining an EU-financed project. Procurement rules may favour a more geographically distant supplier on the sole basis of lower price for the given product or service.

From a purely financial perspective, cheaper services or products are better use of public money. However, the overall benefit to a local community in terms of other EU policy objectives, including blue growth and regional development, or benefits to the project as whole, such as improved social-acceptance leading to fewer permit-challenges and associated costs, are not duly considered.

Actions and responsible stakeholders

1) Good practise guidelines

ETIP Ocean recommends developing good practise guidelines for ocean energy stakeholder engagement. Common stakeholder engagement guidance is useful for project developers, funders and for local communities. Project developers should be able to access a comprehensive checklist to follow during ocean energy project development.

Demonstrating that a project developer is following established guidance, will help project funders and local communities to gain confidence in the process, guaranteeing that all stakeholders are involved and that stakeholder engagement steps are followed. A facility for communities and for agencies developing support schemes to be introduced to one another and discuss projects and support mechanisms might also assist

ETIP Ocean recommends that the European Commission should take the lead in coordinating this process, as the guidelines and principles are common across all EU Member States.



2) Benefits of ocean energy to local economy

Due to the relative youth of the ocean energy industry, there is little conclusive data on the impact ocean energy development can have on regional economic growth. Research on this topic will increase the understanding of how increased deployment of ocean energy projects and the growth of the industry affects local economies. Demonstrated positive economic impacts will also increase local communities' acceptance of new ocean energy projects.

ETIP Ocean recommends that regional governments, national or locally based economic developing agencies or cluster organisations lead research in this topic. The European Commission could facilitate this process through Horizon2020 non-technological research projects or through Interreg.

Specialised media, ocean energy industry associations or/and ETIP Ocean could help disseminating results of such studies. An online repository of the studies should be available to industry and interested communities. Here ETIP Ocean could continue using its platform as a "knowledge hub".

Ultimately, local communities and local stakeholders will gain a concrete understanding of the benefits of ocean energy through the deployment of projects in their area. Consequently ocean energy demonstration projects should receive public support, ensuring that "real-life" impacts and benefits on local communities can be assessed and measured, paving the way for a harmonious integration of future commercial projects.

3) Ocean energy community ownership studies.

Increased participation of local communities through community ownership programmes would achieve a number of positive results – companies will reduce possible risks and costly delays, projects will attract additional source of financing. As financial partners, local communities will have a better way of influencing the execution of the projects' and will have general co-ownership feeling.

The EU or national authorities can take a lead on coordinating such research. An appropriate starting point would be EU sponsored WISE Power project (<http://wisepower-project.eu/>) on community ownership in the wind energy sector.

4) Reviewing regional programmes for growth: how can ocean energy add to these programmes?

Many EU regions have targeted support programmes for growth. It is important for national/regional governments and development agencies to align them to avoid duplication and to improve synergies. Regional development programmes should



consider what role ocean energy development can play in the future energy mix, and how it will affect local industry and supply chains.

The EU and national authorities are in the best position to organise and coordinate such actions. These actions could be part of a broader project as discussed under point 2 above. Some form of centrally located register of such schemes sponsored by EU grant and operated by ETIP and/or Ocean Energy Europe might assist.

5) A study about an “integration” of ocean energy with other activities/infrastructure – adding value to existing activities (tidal bridges, etc.)

Studies on the added value of ocean energy installations on existing or planned infrastructure can provide a better understanding of the wider economic impact/costs of ocean energy development.

For instance, tidal turbines can be integrated in bridges with a minimal extra financial cost. Similarly, near-shore wave power devices can be integrated in seashore defences or port breakwaters.

An analysis of how ocean energy development can bring added value to other planned infrastructure developments could pave the way smarter infrastructure development in the future.

ETIP Ocean recommends that the European Commission take the lead in carrying out such an analysis, actively consulting ocean energy developers, concerned marine construction industries and other appropriate stakeholders. The analysis should determine and quantify the benefits of combined development of infrastructure and ocean energy.

6) Review of the EU procurement rules

ETIP Ocean acknowledges that EU public procurement rules and procedures in some cases can put too much emphasis on the lowest price.

By their nature ocean energy projects are delivered in the local environment. As local marine businesses have unique knowledge of the environment in which they work, their expertise will be called upon by ocean energy project developers.

Indeed, it is likely that large supply chain businesses that do win contracts will subcontract the work to local businesses to some extent. By favouring price over other factors procurement rules inadvertently introducing unnecessary hazards into a project.

In addition, ocean energy is one of the few sectors that is predisposed to delivering most of the economic activity in some of the remoter areas of Europe. Therefore, it can bring



an economic boost to ports and seafaring communities. EU public procurement rules should take this into account.

ETIP Ocean recommends that the European Commission reviews public procurement rules and procedures, placing a bigger emphasis on non-financial factors such as broader social and economic benefits for local communities.

Table 11: Summary of workshop results on socio-economic impact and acceptance.

Barrier to ocean energy deployment	Action to overcome barrier	Responsible stakeholder
Finding/identification of stakeholders	Developing good practise guidelines	Coordinated by EU
Understanding of OE benefits for local communities; community ownership programmes	Studies on the benefits of ocean energy to local economy	Coordinated by EU, Carried out by National development agencies
	Ocean energy community ownership studies	Coordinated by EU, Carried out by National development agencies
	Better dissemination of information, including from deployed demonstration projects.	Specialised media, industry associations, project developers, ETIP Ocean.
Lack of integration of OE in regionally specific activity on aiding development	Reviewing regional programmes for growth	National governments, EU
	Creating centrally located register of regional support programmes	Coordinated by EU/National development agencies, Operated by ETIP or industry association
Understanding of OE added value to other activities/infrastructure	Study of the "integration" of ocean energy with other existing/planned activities	Coordinated by EU
EU procurement rules and procedures	Updating EU procurement rules by giving more weight to non-financial factors, such as a wider benefit to local communities	EU Institutions, Ocean Energy Europa

Purpose

The socio-economic roundtable specified three purposes for above mentioned actions:

- 1) To make ocean energy forefront of economic development.
- 2) To better understand stakeholder needs and maximise positive benefits.
- 3) To find new financial development models for community benefit.