



# LiftWEC

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DEVELOPMENT OF A NEW CLASS OF WAVE ENERGY  
CONVERTER BASED ON HYDRODYNAMIC LIFT FORCES

## **Deliverable D9.3**

Scoping report of the social acceptance of the LiftWEC technology

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## 1 EXECUTIVE SUMMARY

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This document constitutes Deliverable ‘D9.3 Scoping report of the social acceptance of the LiftWEC technology’ of the LiftWEC project. LiftWEC is a collaborative research project funded by the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement No 851885. It is the intention of the project consortium that the LiftWEC project culminates in the development of one or more promising configurations of a Wave Energy Converter operating through the use of one or more rotating hydrofoils that generate lift as the primary interaction with the incident waves. In this Deliverable, a scoping report of the potential social acceptance of the LiftWEC technology is presented. As the only Deliverable on this project that assesses social acceptance issues, it is the intention of this report to present useful and carefully considered guidelines on how the LiftWEC project should prepare for, and manage, the planning, investment, and consultation processes. The research findings presented in this report are informed by a review of current literature on social acceptance, an analysis of previous research studies that have investigated similar issues, and the results of several semi-structured interviews that were conducted with relevant actors. Valuable learning lessons are presented in the discussion section of this report, which suggest how the LiftWEC project can maximise its potential socio-political, market and community acceptance.

Broken down thematically, the findings presented in this report help to accommodate for gaps of knowledge in current literature and reflect important perspectives that the LiftWEC project can learn from. A key finding regards the manner in which planning processes engage with emerging Marine Renewable Energy (MRE) technologies, such as the LiftWEC concept. It is revealed that there are multiple non-technological barriers that can prevent emerging projects from developing relationships with planning actors, including communication and knowledge exchange constraints. Additionally, insight on the value of emerging projects facilitating early engagement with stakeholders is illustrated. It is found that, although early engagement can be significantly beneficial for the acceptance of a MRE proposal, there are numerous challenges that must be considered. These challenges, which include providing technological certainty and building trust amongst stakeholders, are assessed in this report and potential solutions are proposed. Important findings regarding the need for change to marine planning procedures are also presented. These findings are complimented by the presentation of interviewees’ forecasts on the potential future of MRE technologies. Learning from the collected findings, this Deliverable report proposes three learning lessons on how the LiftWEC project can gain high, and sustainable, levels of social acceptance.

The structure of this Deliverable report is described briefly as follows. Firstly, an introduction to the report is provided. This includes a discussion of the wider LiftWEC project and the purpose of this scoping report. Secondly, a literature review on the topic of social acceptance is presented. This review illustrates how academic literature has traditionally framed the concept of social acceptance, outlining gaps of knowledge and exemplifying the need for greater research on the social acceptance of wave energy technology. Thirdly, the methodology of this study is explained and justified. Fourthly, the research findings are presented. The findings are discussed in a thematic manner, with key points including the nature of the planning process, the facilitation of public participation, market opportunities and barriers, and the forecasted future of MRE. Fifthly, three recommended learning lessons are put forward. These are designed to inform the LiftWEC project on how it can maximise its potential socio-political, market and community acceptance. This report then concludes by reiterating



the key arguments, research findings and recommendations that are outlined in this report. It is hoped that this report can help to inform the evolvement of the LiftWEC project and, in particular, can guide the manner in which it engages with the planning process, investors and local communities.



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## 2 INTRODUCTION

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This document constitutes Deliverable ‘D9.3 Scoping report of the social acceptance of the LiftWEC technology’ of the LiftWEC project. Informed by a review of academic literature and interviews with a range of actors in the Marine Renewable Energy (MRE) field, this scoping report presents recommendations on how the LiftWEC project can maximise its socio-political, market and community acceptance. This document represents the main social scientific output of the LiftWEC project and contributes important information that can help to guide the development of the technology.

### 2.1 PROJECT OUTLINE

LiftWEC is a collaborative research project funded by the European Union’s Horizon 2020 Research and Innovation Programme under Grant Agreement No 851885. The LiftWEC project focuses on the development of a novel type of Wave Energy Converter (WEC), called LiftWEC, which is intended to utilise hydrodynamic lift forces to incite device motion and extract wave energy using a rotating hydrofoil, as opposed to the more traditional approach of exploiting buoyancy and diffraction force regimes. This radically different approach to the design of wave energy converters offers the opportunity of making a step-change in the potential of wave energy, and thus lead the way for its commercialisation, where no commercially viable wave energy system currently exists.

### 2.2 PURPOSE OF THE DELIVERABLE

The purpose of this Deliverable is to create a scoping report of the potential social acceptance or resistance of the LiftWEC technology. Although assessments of the socio-economic impact of LiftWEC have been conducted, a comprehensive examination of the social acceptability of the concept is also required. Social acceptance is conceptualised as consisting of three main elements: socio-political acceptance, market acceptance, and community acceptance. The purpose of this Deliverable is to present an assessment of the social acceptability of the LiftWEC technology from these three perspectives. The Deliverable highlights potential issues relating to all three spheres and presents a range of learning lessons that can help to guide the future implementation of the technology.

### 2.3 RESEARCH OBJECTIVES

The research aim of this study is to explore the social acceptability of the LiftWEC concept. To fully understand how the three core perspectives of social acceptability – socio-political acceptance, market acceptance, and community acceptance – relate to the LiftWEC technology, three corresponding research objectives have been created. Each focusing on one of the social acceptance perspectives, these objectives have been examined in a sequential manner. All research objectives are informed by a literature review of academic publications and marine planning policy documents, an evaluation of the findings of previous research studies that have investigated similar issues, and the findings of semi-structured interviews conducted with selected interviewees. The three research objectives are clarified below:

- 1.** To understand the potential socio-political impact that the technology may create by examining how planning process manage the implementation of MRE technologies and how planning actors interpret the LiftWEC concept.



- 2.** To evaluate the market acceptability of the technology by exploring both how it is interpreted by investors and developers, and their perceptions of the opportunities and barriers that may emerge in the MRE market.
- 3.** To consider the potential community acceptance of the technology by assessing how the implementation of similar devices have been received by local maritime communities and how lessons can be learnt from previous experiences.

## 2.4 STRUCTURE OF THE DOCUMENT

The structure of this document is as follows. Firstly, a literature review is presented. This involves a review and critical evaluation of the concept of social acceptance, as it is interpreted in academic literature. This section is divided into three segments, beginning with an introduction to the need to consider social acceptance in the realm of MRE. This is followed by a debate on the conceptualisation of social acceptance and the manner in which it has been framed by socio-political, market and community perspectives. Subsequently, an assessment of the major research gaps and knowledge limitations in the field is presented.

Secondly, the methodology of this research is explained and justified. This involves a discussion of the research design that was used to frame this study, as well a clarification of the data collection and analysis methods that were employed.

Thirdly, the research findings of this study are presented. This section has been thematically divided, with each sub-section discussing a specific finding that has emerged from the collected data. These findings include important information on the manner in which planning processes engage with novel and emerging marine renewable technologies, as well as insight from professionals and practitioners regarding the future of MRE.

Fourth, a critical discussion on the meaning and value of these research findings is provided. This discussion section includes the presentation of three learning lessons that are framed as recommendations for the LiftWEC project to follow moving forward.

Finally, the report is concluded with a summary of the key findings and several closing remarks regarding the opportunities and challenges that the LiftWEC technology may face.

A full bibliography of the material referenced throughout this report is included at the end of the document.



## 3 SOCIAL ACCEPTANCE

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This section of the report presents a literature review of the concept of social acceptance in relation to MRE. This review creates a framework that informs the research design and methodology of this study. The core arguments of the review are also used to assess the meaning and relevance of this study's research findings, ensuring that the results relate to current academic thought and can be of practical use for the LiftWEC project. The following section is divided into three segments. Firstly, an introduction to the need to consider social acceptance in the realm of MRE is outlined. Secondly, a review of the conceptualisation of social acceptance is presented. This involves an evaluation of how the concept of social acceptance has been interpreted in academic literature and, in particular, how it has become a key issue in relation to MRE. This is complimented by three further sub-sections, which assess the most commonly referenced framing of social acceptance. This framing considers social acceptance upon socio-political, market and community acceptance perspectives. Finally, this review section concludes with a discussion on the evident gaps of knowledge that exist within research. Largely, these gaps relate to a lack of examination of social acceptance in relation to wave energy production, an issue that this scoping report attempts to correct for.

### 3.1 INTRODUCTION

MRE, specifically in regard to tidal and wave technology, has a significant capacity to become a major contributor to global energy needs (IEA, 2007). Since the beginning of the 2010s, when sea space began to be allocated for commercial deployment, device prototypes have been tested and implemented across the globe. A combination of political support, significant resources and technical expertise have contributed to this emerging situation (Kerr et al., 2014). Scotland, as an example, has been positioned at the front of this new industry. Activity in Scotland is focussed on the archipelago of Orkney, where the European Marine Energy Centre, the first full-scale grid connected test facility in the world, operates. Orkney, as with many other maritime communities that have a strong association with MRE, has begun to plan for the future and has prioritised the need for both research and planning practice to understand the social, economic, and environmental change that will accompany this new industry.

It is important to recognise that MRE is more than a technically challenging extension of onshore renewable energy development (Kerr et al., 2014). The policy environment, governance, patterns of resource use, conservation values, and distribution of ownership rights are all substantively different from the situation onshore. This difference has been made evident in the Marine Spatial Planning (MSP) framework, which recognises that approaches adopted on land may not be appropriate at sea (Jay, 2010; Kidd and Ellis, 2012). Furthermore, marine energy development may play an important role in the redistribution of ownership rights in the marine environment. Increasingly, society looks to the sea to meet its growing resource needs and to stimulate economic growth. The European Union's 'Blue Growth' agenda typifies this aspiration (Rickels et al., 2019).

Innovative and new technology presents the opportunity to improve access to resources, as well as the ability to exercise control over marine space. This underpins an ongoing process whereby public rights and freedoms are supplanted by private rights, firstly by the creation of sovereign rights, such as Exclusive Economic Zones, then by the creation of private rights, including sea bed leases and planning permission (Kerr et al., 2014). Wave energy development is at the forefront of this evolving picture (Johnson et al., 2012). MRE developers require access to significant areas of sea and this will





impact on the rights and privileges of other users of the marine environment. Largely, research into MRE has focused on resource assessment, device design, and environmental impact (Borthwick, 2016). Environmental research has often been concentrated on cetaceans and birds (Willsteed et al., 2017), as well as benthic communities (Ceccarelli, 2007; Witman et al., 2004) and physical-chemical parameters, such as water quality (Gholizadeh et al., 2016; Gorde and Jadhav, 2013; Orouji et al., 2013). This is, largely, a consequence of statutory responsibilities and lobby groups promoting environmental issues. Consequently, social science research into marine energy has been given low priority. The current balance of research effort does not reflect the role of society in the development of MRE or its potential impact on coastal communities (Kerr et al., 2014). Even if technical challenges are overcome and environmental impacts minimised, the development process may still be compromised by a failure to understand social issues. Thus, the need to consider the potential social acceptance, or reluctance, of emerging MRE concepts, prior to implementation, is crucial to their success. The purpose of this scoping report is to consider this issue and to provide useful recommendations for the LiftWEC project. To comprehensively understand what the concept of social acceptance means, the following sub-section assesses how it is interpreted in literature.

### 3.2 CONCEPTUALISING SOCIAL ACCEPTANCE

Social acceptability is a pertinent issue in the context of MRE. Support for offshore renewables has been found to exceed that for onshore renewables (Bailey et al., 2011). Offshore renewable energy, viewed as less contentious than onshore, is, therefore, regarded a simpler route to wider public acceptance of renewables development (Bailey et al., 2011; Bates and Firestone, 2015). Nevertheless, some proposals for offshore developments have been met with strong opposition, with concerns over aesthetics, place attachment, presumed lack of tangible benefits, and impacts on other marine industries (Devine-Wright, 2009; McLachlan, 2009; Haggett, 2011; Bonar et al., 2015).

Studies of social acceptance of energy technology are frequently based on a three dimensional conceptual framework incorporating market acceptance (based on costs and revenue), socio-political acceptance (founded on attitudes towards the technology in principle) and community acceptance (opinions and impacts at the local level) (Rosso-Cerón and Kafarov, 2015; Bolwig et al., 2020; Devine-Wright and Wiersma, 2020). The majority of studies in the social acceptance of MRE literature reviewed are from the community perspective, incorporating the views of local stakeholders, such as fishermen, and residents. This reflects the view that community acceptance is considered to be the main social challenge in marine energy development (Firestone et al., 2018).

There is a clear difference between acceptance of renewable development in principle and acceptance of specific renewable energy development projects (Firestone et al., 2009; Heras-Saizarbitoria et al., 2013; Klain et al., 2017). Various survey results have shown general attitudes towards renewables are highly supportive, but local acceptance differs among coastal communities (Bates and Firestone, 2015; Devine-Wright and Wiersma, 2020). In the past, it may have been suggested that such lack of social acceptance of MRE in coastal communities was connected to NIMBYism (Not In My Back Yard protest). Analysis of social acceptance studies, however, suggests that NIMBYism is too reductive, and inaccurate as an explanation for low social acceptance of marine renewable projects (Haggett, 2011; Wiersma and Devine-Wright, 2014). Some studies have even found evidence of inverse NIMBYism, in which familiarity through living close to energy projects leads to increased general support for them (Roddis et al., 2019).



Social attitudes to MRE developments instead appear to have their roots in the complex and often emotional relationship between people and marine areas (Bailey et al., 2011), reflecting how different communities use and perceive the ocean. Beliefs and underlying values are both directly and indirectly associated with expectations and support for offshore developments (Bidwell, 2017), and this can account for the significant variation found in studies, such as those by Firestone et al. (2009), Bates and Firestone (2015) and Devine-Wright and Wiersma (2020) in which divergence in attitudes is observed between communities even in cases where they are geographically very close.

Higher acceptability or support for MRE projects has been connected to higher levels of perceived benefits and lower levels of acceptability or opposition connected to higher levels of perceived risks (Dreyer et al., 2017). This may explain why, in studies of acceptability of MRE developments in the United States, Dreyer et al. (2017) and Firestone et al. (2018) found that levels of acceptability were higher among coastal residents than non-coastal residents. Furthermore, Johansen (2019) found in a study in Denmark that locally resident property owners were generally more positive towards a proposed nearshore renewable energy development than second home owners. Demographic variables, with the exception of age, have been found to have very little effect on social acceptability (Hooper et al., 2020).

Studies have been conducted to better understand the underlying reasons for local variation in acceptance. Counter effects to climate change and potential for local benefits have been cited as main factors in community support (Bailey et al., 2011). In particular, collective benefits for communities have been associated with higher social acceptance than focusing on individual benefits (Walker et al., 2014). Conflicts, however, can result from giving one interpretation of the marine environment preference over others (Bidwell, 2017). Acceptance can also be impeded where benefits are perceived as temporally distant, intangible, or the preserve of others, while negative impacts are viewed as immediate, tangible, and affecting locals most strongly (Haggett, 2011).

The relationship between people, place and landscapes has a significant bearing on attitudes towards offshore developments, depending on whether MRE infrastructures are considered place-disruptive or place-affirming or -enhancing (Firestone et al., 2018; Devine-Wright and Wiersma, 2020). In a study of social attitudes towards MRE in island communities in the UK, de Groot and Bailey (2016) found that where development proposals complement place values, acceptance was more likely and, conversely, conflict was often the result of contradiction of these values. Understanding the unique relationships between communities and the ocean, and the underlying beliefs and place-based values influencing people's opinions towards offshore renewable energy development is therefore essential to fostering wider public acceptance in communities where MRE development is proposed.

Trust in the developer is also of importance (Haggett, 2011). Bates and Firestone (2015) argue that trust in the developers and planning process, and perceived fairness through equitable distribution of the benefits among communities, may be more important than matters relating to the support for the technology itself. Similarly, it has been found that social acceptance is closely related to the level of stakeholder involvement in the planning process, potentially more so than matters directly concerning projects themselves (Haggett, 2011; Bonar et al., 2015). Deliberative planning processes that incorporate community values and ensure community benefits from marine energy projects are associated with increased acceptance (Klain et al., 2017). Early engagement is also important (Klain et al., 2017) and as the public are not a homogeneous group, it is necessary to engage with a diverse range of people and groups (Haggett, 2011). A fair and transparent decision-making process and the extent to which stakeholders, including communities, are engaged (Firestone et al., 2020) can



significantly drive project acceptance or support. To fully comprehend the concept of social acceptance, and how it must be considered by the LiftWEC project, the following sub-sections critically consider the differing dimensions of the concept.

### 3.2.1 Socio-political acceptance

Socio-political acceptance is social acceptance in the broadest, most general level. Both policies and technologies can be subject to societal acceptance (or lack thereof). Traditionally, a range of different indicators, including public opinion polls, have been used to inform policy-makers on the potential public acceptance for renewable energy technologies and policies (Wustenhagen et al., 2007). Scholars have evidenced how these methods often demonstrate a positive overall picture for renewable energy that is not truly reflective of local communities (Gross, 2007; Soma and Haggett, 2015). This, in the past, has ‘mised’ policy makers to believe that social acceptance is not an issue to consider (Fast, 2013). Whereas implementation rates are, ultimately, an aggregate of the number of successful cases, there are huge differences in rates among countries that cannot be explained by the differences in wind, wave, or tidal resources (Toke et al., 2008). Scholars suggest that many of the non-technological barriers for achieving successful projects at the implementation level can be considered as a manifestation of lack of social acceptance (Wustenhagen et al., 2007; Heras-Saizarbitoria et al., 2013). At the general level of socio-political acceptance, this also concerns the acceptance by key stakeholders and policy actors of effective policies. Those policies require the institutionalisation of frameworks that effectively foster and enhance market and community acceptance. For example, the establishment of reliable financial procurement systems that create options for new investors, and spatial planning systems that stimulate collaborative decision making (Soma and Haggett, 2015). Ultimately, socio-political acceptance refers to general perceptions of a technology or innovation, and the potential of these to contribute toward important societal objectives and targets.

### 3.2.2 Market acceptance

As small-scale MRE devices continue to become more prevalent, another factor is important to consider. As explained by Wustenhagen et al. (2007: 2685), “social acceptance can also be interpreted as market acceptance, or the process of market adoption of an innovation”. In this perspective, it is possible to learn from literature on the diffusion of innovation, which explains the adoption of innovative products by consumers through a communication process between individual adopters and their environment (Wolsink, 2013). While energy technologies continue to be bound to infrastructures that make them inherently more complex for diffusion of innovation than other products, using the insights from this literature can be helpful to study market acceptance of novel and emerging technologies (Soma and Haggett, 2015). Scholars have outlined how there are two important factors to understand when assessing market acceptance. First, it is vital to acknowledge that the focus is not just on consumers, but also on investors. Second, there is a link with socio-political acceptance. As market actors are influential stakeholders in the development of energy policies, they can use their influence in political decisions about the design of financial procurement systems and the access to the grid for other investors (Gross, 2007). This relationship can, at times, render it difficult to distinguish between socio-political and market acceptances in practice. In the most general of terms, they often appear at the same time in the same places. For instance, local people do not only provide local knowledge about what would suit the community as a whole, but also involve local business interests urging market acceptance, and local claims for socio-political acceptance (Haggett, 2008).



### 3.2.3 Community acceptance

Community acceptance refers to the specific acceptance of siting decisions and renewable energy projects by local stakeholders, particularly residents and local authorities. This is the arena where the debate around NIMBYism unfolds. This is the argument that the difference between general acceptance and resistance to specific projects can be explained by the fact that people support renewable energy as long as it is not in their own backyard (Devine-Wright, 2012). Yet, others have found evidence for exactly the opposite effect, namely that opposition decreases, rather than increases, with the degree of being directly affected by a specific wind power project (Petrova, 2016). The development processes, the opportunities for engagement, trust, transparency, and perceptions of the engagement are all deemed as strongly affecting levels of community acceptance (Aitken et al., 2014). If people feel the process has been fair, they are much more likely to support the outcome, or to oppose the outcome of a process deemed to be faulty (Gross, 2007). A particular feature of community acceptance is that it has a time dimension. As Wolsink (2007) demonstrates, the typical pattern of local acceptance before, during, and after a project follows a 'U-curve'. This involves a transition from high acceptance to relatively low acceptance during the siting phase, before returning to a higher level of acceptance once a project has been implemented. Recent literature has argued the importance of shedding new light on factors influencing community acceptance. Scholars have highlighted the relative importance of factors related to distributional justice (Segreto et al., 2020), procedural justice (Wiersma and Devine-Wright, 2014), and community trust in the information and the intentions of the investors (Kerr et al., 2014). These are important questions to be considered by research that explores the potential impact of emerging MRE technologies on local marine communities.

## 3.3 CONCLUSIONS

This review has shown how social acceptance has become an important factor to consider in the development and implementation of MRE. It has also demonstrated how social acceptance has been conceptualised, what it means in both a practical and theoretical sense, and how it can be considered along socio-political, market and community perspectives. By reviewing these aspects, this section has helped to highlight how, over the last number of years, a shift toward including social indicators, such as job creation and social acceptance, and measures on the suitability of MRE to local communities, have become more common (Cuesta et al., 2020). Traditionally, this has been far from the case, with the techniques used to consider the impact of MRE developments not tending to utilise such indicators. Rather, previous approaches focused on selecting the best solution based on a specific economic objective function, the capital cost of instalment, technical factors, and environmental indicators (Cuesta et al., 2020; Soma and Haggett, 2015). This meant that fulfilling technical requirements became the guiding factor for MRE implementation. As this review has discussed, this is beginning to change, and social acceptance issues are becoming increasingly prominent in the field of MRE.

Despite the growing acknowledgement of social acceptance related issues in the field of MRE, there are gaps of knowledge and limitations to current research. Specifically, there remains a lack of research on the social acceptance of small-scale MRE devices, such as novel and emerging wave energy converters, and a limited array of solutions on how such devices can work to maximise community acceptance, whilst simultaneously facilitating high levels of market and socio-political acceptance. As outlined in the introductory section of this report, it is the intention of this study to correct these limitations and to construct recommendations that can help to guide how the LiftWEC



project manages its potential acceptance. This section has built a framework that informs the research design of this study, presented in the following section. It will also be used to apply relevance and value to the research findings of this report, which will be considered in relation to current academic thought and, in particular, the gaps of knowledge mentioned above. The need to consider the concept of social acceptance whilst designing and developing novel MRE technologies has become evident, and this report will help to further this trend by bringing the concept into new arenas of study.



## 4 METHODOLOGY

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This section provides detail on the methodological framework of this report. This includes a discussion of the research design that was constructed, as well as a justification of the data collection and analysis procedures that were followed. An acknowledgement of the methodological issues and ethical considerations that were encountered whilst preparing this study is also included. The methodology of this study, which is informed by the previous section's conceptualisation of social acceptance, is designed with the intention of creating a framework to answer the research objectives outlined in the introductory section.

### 4.1 RESEARCH DESIGN

Flyvberg (2006) outlines how good social science is problem driven and suggests that research on societal issues should utilise qualitative methods to comprehensively understand the topic under investigation, in this case the social acceptance of emerging MRE technologies. This encouraged the creation of a research design that could facilitate the use of qualitative interviews with practitioners and professionals within the MRE field, community members who have been impacted by previously implemented MRE devices, and additional contacts who are deemed to be of relevance to the LiftWEC project. The rationale for employing this approach stemmed from the notion that developing a general understanding of the social acceptance of emerging MRE devices could reveal specific issues of importance that require subsequent analysis to be able to provide conclusions and potential recommendations.

This study's qualitative approach is reflective of a methodological shift that has occurred in the realm of social science, whereby there has been a move away from statistical scholarship towards more ethnographical interpretative studies (Ivankova et al., 2006). This shift is evident within this study, where emphasis is placed on defining a subjectivist epistemology that can facilitate for a myriad of perspectives. Such an approach is important for research such as this, that examines the perceptions and opinions of a range of different actors. This is particularly important when, in the case of socio-political, market and community actors, conflicting interpretations and desires are common. It is crucial to investigate all of these possible perspectives and to consider what they reveal about the current social acceptance of emerging MRE technologies, and what that may tell us about the future opportunities and challenges that may arise. The main strength of a study that employs qualitative methods is that it can enable an in-depth understanding of complex systems, much like the social acceptance of emerging MRE.

### 4.2 DATA COLLECTION

The rationale of this study is not simply to understand stakeholder opinion, per se, but to gauge the implications of that opinion in relation to the potential success of emerging and novel MRE technologies. Thus, a data collection approach that can facilitate this style of examination was necessary. As highlighted above, the collection of qualitative data was deemed as having the highest potential to comprehensively respond to the questions of this study and to provide information that could be translated into learning lessons for the LiftWEC project. The specific qualitative method that this study employed is semi-structured interviews. The following sub-sections will provide detail on the selection of interview participants, what the interviews consisted of, and how they were conducted.





#### 4.2.1 Selection of interviewees

Ten semi-structured interviews were conducted with relevant actors between September and November of 2020. A snowball sampling approach was used for the selection of actors to be interviewed (Noy, 2008). Beginning with a small population of socio-political actors, this study developed a larger sample by learning from initial participants and identifying others who were relevant to the study. Interviewees were drawn up through a process of mapping, ensuring that a variety of actors holding different roles and located in different European nations engaged with the study and provided insight. Participants were then selected based upon the likelihood of having a detailed understanding of the emerging problems confronting MRE. Having met and identified actors from snowballing efforts, a subtle rapport was established between researcher and interviewee, facilitating open discussions. Table 3.1 (below) highlights the profiles of the selected interviewees. Informed by literature, it was decided to categorise actors within three distinct profiles; (i) socio-political actors, (ii) market actors, and (iii) community actors. Although there were more socio-political actors interviewed than market or community actors, all data was analysed in a partial manner and equal weighting was attached to all interviewees.

*Table 3.1 – Profile of interviewees*

<b>PROFILE OF INTERVIEWEES</b>	<b>No.</b>
<b><i>Socio-political actors</i></b> (Marine planners, practitioners, academics)	6
<b><i>Market actors</i></b> (Investors and support organisations, developers)	2
<b><i>Community actors</i></b> (Fishing organisations, Non-Governmental Organisations)	2

#### 4.2.2 Interview structure

The interviews were designed from the outset to allow for the analysis of debate regarding the social acceptance of novel and emerging MRE. Interviewees were prompted to discuss their perceptions of the current challenges and opportunities facing MRE technologies and their experience of how social acceptance issues are managed, and provide recommendations for the future. To support the free development and uptake of individual opinions from a variety of stakeholders, interviews were conducted on a one-to-one basis. In comparison to group formats to study acceptance, this has the advantage that people's perceptions do not influence each other. Additionally, interviews made it easier to integrate people who are less familiar or knowledgeable about the topic under study as they do not need to elaborate on their thoughts in front of others who they might perceive as experts.

A semi-structured interview guideline was developed to gather data regarding the specific research objectives of the study (see Appendix 1 for an example of an interview structure for socio-political actors). The interview guidelines helped to ensure comparability across interviews, especially across different countries and contexts. The questions that are part of the guideline are open questions, i.e. interview partners did not have fixed options for answering them. This provided interviewees with the possibility of freely choosing which aspect they wanted to put an emphasis on or which aspects they wanted to mention. Furthermore, semi-structured interviews enabled the interviewer to

spontaneously rephrase or add questions if the answers provided by the interviewee left too much room for interpretation or were not fully clear.

Each interview began with an introduction, where general information about the objective and structure of the LiftWEC project, and of Work Package 9 in particular, was discussed. This was followed by an introduction to the purpose of the interview and by ensuring informed consent through explaining procedures of data collection (recording the interviews), data documentation (transcripts), access to this data (restricted to researchers working on this task) and presentation of results (anonymised publication of findings). This also supported the rights of the interviewees, whose participation was voluntary, to skip questions or stop the interview at any time. The interviews ended by allowing time for final comments and thanking interview partners for their time. Arranging interviews was achieved by way of contacting potential interviewees by e-mail. This enabled the interviewer to inform the potential interviewee on the objective of the study and on the interview's components (duration, conducted online, confidentiality). If needed, potential interviewees were reminded by email up to two times. If this did not lead to a response, the researchers looked for a replacement where possible.

### 4.3 DATA ANALYSIS

An inductive form of thematic analysis was used to analyse the collected interviews. This involved identifying common themes, topics, and patterns of meaning that came up repeatedly (Javadi and Zarea, 2016). The most common themes regarding the social acceptance of MRE were analysed to reveal commonalities amongst interviewees. As an inductive approach was taken to the analysis of the interviews, the data determined the themes that emerged. This enabled theoretical aspects to develop from the data and to remain grounded in empirical observation. A key advantage of this approach to qualitative analysis is its flexibility and capacity to provide a complex account of a detailed set of data. NVIVO software was used to conduct thematic analysis of interview transcripts. This enabled the examination of relatively large bodies of text and multiple, iterative queries within the data. It also made cross-referencing and comparisons possible.

### 4.4 METHODOLOGICAL ISSUES

Although great levels of consideration and care were taken into account in the construction of this research design, inevitably, a few issues arose. Due to COVID-19, all interviews were conducted in a virtual manner. This involved the use of Microsoft Teams and Zoom platforms to hold online meetings with interviewees. Conducting interviews online can make open discussions more difficult, as interviewees feel less of a personal connection with the researcher. However, there are also benefits to holding meetings online. Principally, no travel is required to arrange interviews with actors and a greater audience can be reached. This enabled a wide range of actors situated in various European countries to be involved in this study. Additionally, plans to hold an online focus group with several relevant market actors were unable to be realised due to time constraints. Although a focus group would have added a further methodological tool to this research and produced potentially interesting feedback, its absence was not seen as detrimental to this report's development and had no significant impact in regards to the quality of the research.





## 4.5 ETHICAL CONSIDERATIONS

This study was conducted in line with the guidelines and standards set by the Queen's University of Belfast's Code of Conduct and Integrity in Research and its Policy and Principles on the Ethical Approval of Research. Free and informed consent was obtained from all participants prior to the collection of data from online interviews. All interviewees were provided with a project information sheet and a consent form prior to meeting, and participants were fully briefed on what the research involves. It was also explained how anonymity and confidentiality will be achieved. Permission was also sought for the audio of the meetings to be recorded and participants were made aware of their right to withdraw within one month of data gathering without penalty. Consent was also obtained for the data to be used for research purposes and for future publication.

As required by all universities and research institutions, it was imperative that ethical approval was sought for this study. This ensured that the research was designed and conducted in such a way that it met ethical principles and was subject to proper and institutional oversight in terms of research governance. While this study was not deemed as examining an ethically sensitive topic, it remained important to take the necessary steps to ensure that all participants were aware of the study that they were engaging with, how their views would be analysed and who would have access to the study material. Confidentiality, a hugely important consideration in research, was ensured at all times during the course of the research. Additionally, the data from the interviews were safeguarded throughout, with only the research team having access. A copy of this study's information sheets (Appendix 2) and consent forms (Appendix 3) are included at the end of this report.



## 5 RESEARCH FINDINGS

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This section of the report presents the research findings of this study. When critically analysing the transcripts of interviews, a range of themes began to emerge from the data. These themes represent similar interpretations and opinions put forward by interviewees regarding the social acceptance of novel and emerging MRE technologies. The themes, which are presented and evidenced below, present valuable information on how planning processes engage with emerging MRE technologies (section 4.1), the need for change to planning procedures (sub-section 4.2), the benefits and challenges of early engagement between MRE proposals and local communities (sub-section 4.3), and forecasts on the potential future of MRE technologies (sub-section 4.4). Collectively, these findings reveal important insight on the current opportunities and challenges facing emerging MRE technologies, from socio-political, market and community acceptance perspectives.

### 5.1 HOW PLANNING ENGAGES WITH NOVEL AND EMERGING MARINE TECHNOLOGIES

An important topic of debate amongst interviewees, especially socio-political and market actors, was the manner in which planning processes engage with emerging MRE technologies. It was revealed that, unlike more established technologies, such as wind power, planners are commonly unaware of emerging technologies. Interviewees spoke of how *“planning authorities are not always all that well interacted with by those involved with novel or emerging renewable concepts ... the opportunities that I've had to find out about them have been through other projects or by attending conferences and things like that”* (Socio-political actor, #1). This suggests that the prospects for planners to learn about new technologies, and the potential value that they might offer, can be limited. As an interviewee expanded, *“I have counterparts who work for local planning authorities in more remote areas, and they wouldn't regularly attend events or conferences where new devices are presented because of the time and the expense that it involves”* (Socio-political actor, #1). This is an opinion shared by other socio-political actors, who discuss how, *“the key reason that I attend tech conferences is to make connections for future funded projects. I do appreciate that that isn't a possibility for all planners, due to logistics and funding, but it [learning about emerging technologies at conferences] is such a good way to get to know what is out there and learn what might be a possible project for us to work together on”* (Socio-political actor, #3). There are barriers, therefore, that can prevent planners from engaging with emerging technologies, suggesting the need for alternative communication pathways between projects and planning authorities.

Limited exposure at an early stage can be damaging for both the technology and the planners. Particularly for projects that remain in the early stages of development, *“sharing ideas on the potential value of a new or alternative technology can help to get the ball rolling. As planners, we can start to think of how this might match our [planning authority] plans, or wider government objectives, and how it might suit the conditions of our coastline and work with other activities here”* (Socio-political actor, #2). When discussing the LiftWEC technology, one socio-political actor asserted that, *“the more emergent technologies, like this one that you're highlighting, probably don't have a very easy or direct route to planners and to stakeholders. Certainly not in comparison to the more established renewable energy concepts”* (Socio-political actor, #1). This comment emphasises how emerging technologies face different challenges to those that 'more established' technologies are forced to contend with. An unequal footing exists between novel technologies and their more traditional counterparts, in regards to how planning processes engage with proposed MRE developments. To overcome this issue, communication and the sharing of ideas is an important factor to consider for emerging technologies.



Finding opportunities to do this in settings other than conferences or events is a commonly referenced point in the interviews. One market actor clarified this by stating that, *“from experience, a big thing is getting the device into the thinking of planners. Let them know what it is and how it can offer benefit to the specific communities you’re looking into ... [there are] no guaranteed ways of gaining interest or facilitating healthy relationships with planning authorities, but early and open and sustainable communication has always been a big thing for me”* (Market actor, #2). There is, therefore, an apparent expectation for emerging technologies to spend time and resources on constructing linkages and relationships with planning authorities. Interviewees proceed to discuss the importance of engaging with planning authorities, specifically in relation to how the potential social acceptance of a technology can be enhanced, rather than individual stakeholders or sectors. Whilst a more targeted approach can offer some benefit to projects, *“whether that trickles through to a wider array of stakeholders on the ground is unlikely”* (Market actor, #2). It is clear that attempting to establish relationships with planning authorities at an early stage can offer emerging technologies the greatest opportunity to share information about the concept amongst a wide range of relevant stakeholders.

A further challenge that emerging MRE technologies are faced with stems from a lack of technological and operational certainty. Interviewees suggest that planners can struggle to comprehend the true value of concepts that are based upon a technology that is yet to be finalised. As one socio-political actor argued, *“unless it’s going to be something that’s genuinely realised as a technology within the near future, some colleagues can find it hard to justify engaging with it”* (Socio-political actor, #1). There is a need, it appears, to enhance the certainty and reliability of the technology that underpins emerging projects, particularly if a high level of socio-political acceptance is to be obtained. The same can be said for market acceptance, with market actors emphasising the need for concepts to be *“technologically sound and ready to go”* (Market actor, #1) for investor confidence to be developed. It is important, therefore, that emerging MRE projects are proposing technologies that are fully operational and prepared for implementation. A lack of certainty in the technology of projects can discourage both socio-political and market actors from engaging with them. Missed opportunities to engage with the planning process due to perceived uncertainties or concerns in the technology, as one interviewee asserted, can be *“damaging to the reputation and long-term prospects”* (Socio-political actor, #4) of an emerging concept.

## 5.2 OPPORTUNITIES FOR CHANGE TO PLANNING PROCESSES

A further theme that emerged from the collected data related to calls for change to planning processes. Largely, these calls stem from concerns about the manner in which planning processes are truly integrated, inclusive, and sustainable, and how these factors are determining the successful deployment of emerging MRE technologies. Interviewees, particularly market and community actors, are keen to emphasise both the limitations of planning processes and to share ideas on how change could be orchestrated. One of the most commonly mentioned concerns held by interviewees regards the framing and implementation of consultation procedures. Dialogue with stakeholders is an essential component of planning practice and, when conducted effectively, consultation can help to reduce socio-economic and socio-political risk for MRE projects. However, interviewees revealed significant fears regarding consultation processes. As one respondent argued, *“current models of consultation are just not working how they could and should be. They are failing to properly engage communities or to communicate the potential impact of developments to us”* (Community actor, #2). This perspective is supported by claims that consultation procedures should have the capacity *“to initiate debate and stimulate critical feedback amongst stakeholders ... yet there are less and less*



*opportunities provided for this” (Community actor, #1). Others mention instances of “exclusion and unequal balances of power” (Socio-political actor, #1), which suggests that the perspectives of some actors can be more valued than others. There is a need, therefore, to reconsider what counts as consultation and to explore how it can be reorganised by planning authorities. Some interviewees suggested solutions involving innovative approaches to consultation, including the use of new technology: “Real-time interactive mapping has been used to identify conflicts among sea users in some contexts and I think that is exactly what we need more of” (Socio-political actor, #5). Consultation is a key component of marine planning practice that can provide emerging MRE technologies with social legitimacy and credibility. As illustrated, however, there is a need to reframe how consultation is conducted, to support more inclusive approaches, and to examine how innovative technologies can be utilised.*

Two further issues of concern regarding planning processes were noted in the interviews. First, a lack of integration within marine planning systems. Facilitating integration – whether it’s between institutional levels, terrestrial and marine planning, or old and new marine activities – is a vital component of a sustainable and just planning system. However, there are growing concerns regarding the capacity of marine planning processes to act in truly integrative ways. A lack of integration, as one interviewee discussed, *“can increase risks for developers and often creates conflicts between the different priorities of planning systems” (Market actor, #2). To correct these failings, planning should seek to “identify common grounds and to increase trust and communication amongst stakeholders” (Socio-political actor, #3). When facilitating genuine integration between planning objectives and supporting more collective engagement of stakeholders, emerging MRE technologies will have a much greater chance of gaining social acceptance.*

A final issue of concern regards the failure of planning processes to conduct impact assessments on issues other than environmental or economic matters. Interviewees argued that *“impact assessments on the potential social impact of developments would be a good addition to planning and would lessen the burden on the projects to showcase how they can benefit communities” (Socio-political actor, #6). Social acceptance has, evidently, become a more recognised concept in recent years, and interviewees were keen to demonstrate that, “although it remains less prioritised in planning processes than Environmental Impact Assessments, in reality, it is just as important and should be considered as so. Creating some form of social impact assessment framework could be a useful solution” (Socio-political actor, #4). Collectively, these findings reveal an apparent need for marine planning to transform into more democratic and integrated processes, where social impacts are considered on par with environmental and economic matters. It is evident that the interviewees considered these changes as being crucial for the future success of emerging MRE technologies. As one actor concluded, “there is a new energy landscape beginning to develop and small-scale and novel energy developments are going to be central to it. I’m not alone in thinking that planning must do more to ensure an efficient progression through this transition, and collaborative and inclusive planning processes will undoubtedly have a big role to play in this” (Socio-political actor, #1).*

### 5.3 BENEFITS AND CHALLENGES OF EARLY ENGAGEMENT WITH COMMUNITIES

A number of interviewees debated the value of emerging projects seeking to engage with local communities at an early stage of their development. The term ‘upstream’, which is defined as attempts to bring stakeholders together in dialogue about emerging technologies prior to the establishment of research and development trajectories, was commonly referenced in these discussions. Some interviewees discussed how a lack of early engagement *“can put projects on the*



*back foot from the start*” (Community actor, #1). Upstreaming can *“help to inform siting decisions, build trust amongst stakeholders and, a number of cases, can help to build consensus about proposed developments”* (Socio-political actor, #3). Moreover, it was felt by some interviewees that upstream engagement can be an effective means of dispelling unfounded concerns about emerging technologies that some stakeholders hold. Early engagement with stakeholders, as one community actor mentioned, can remove the risk of stakeholders *“finding out about projects too late in the day to have any kind of meaningful involvement in decision-making procedures or even the way in which uncertainties over the potential impacts of new technologies are navigated”* (Community actor, #1). These assertions suggest that upstream engagement is important for the potential social acceptance of emerging technologies, yet there are opposing opinions to this view.

Some interviewees were keen to demonstrate the challenges that can arise from attempts to facilitate early engagement with stakeholders and how it can hinder attempts to develop community acceptance. A community actor, when discussing their experience of engaging with a wind farm proposal, spoke of how *“developers were unsure about some project details during its early stages and were wary about sharing potentially inaccurate information ... This didn’t help their cause and actually led to suspicion about what the development would involve and how it would impact us”* (Community actor, #2). Uncertainty can be especially high for novel and innovative MRE technologies, so it is crucial that no details are withheld or hidden from stakeholders. This can restrict the development of trust between projects and local actors. It can also *“encourage misinformation and rumours”* (Community actor, #2) to emerge, which can be damaging to the reputation of the technology.

Other interviewees, when considering how upstream engagement was facilitated by other projects that they have engaged with, discussed how *“hidden barriers to participation can become clear ... [these include] hierarchical management structures that can actively exclude stakeholders that hold conflicting opinions to what they want to hear”* (Socio-political actor, #1). Seasonality and the scheduling of early engagement events was mentioned as another challenge: *“Winter meetings are inaccessible to seasonal residents, who deserve to have their say. In my mind, it signals that those behind some projects are just unwilling to engage with the full spectrum of the community”* (Community actor, #2). Additionally, the format of early engagement events, particularly when there is uncertainty regarding the technology, was a topic of debate amongst interviewees. As one respondent argued, *“public meetings do not always produce constructive interactions. I’m aware that some people don’t feel comfortable expressing their views in front of large audiences, especially when they have uncertainty about what the potential of the development will be”* (Socio-political actor, #2). Ultimately, the findings of this study illustrate how there are conflicting interpretations of the value of early engagement for emerging technologies. Whilst it can be a useful means of building consensus and trust amongst stakeholders, it must be implemented and managed in an inclusive and well-informed manner.

## 5.4 FORECASTING THE FUTURE OF MARINE RENEWABLE ENERGY

A final theme that emerged from the data revolved around the notion of forecasting the future of MRE. There was an acknowledgement amongst several respondents that, due to the increasing need to transition away from non-renewable energy sources, there will be a push from governments to explore the development of more novel and innovative MRE devices. Interviewees suggested that emerging projects, such as LiftWEC, are likely to receive greater attention from developers and planning practitioners in the coming years. As a socio-political actor noted, *“the potential for investment and the likelihood of projects being approved for implementation will greatly increase over*





*the course of the next 10 years ... governments will begin to realise the need for both small and large-scale development to meet net-zero targets, and there is certainly going to be a realisation of the unique value to these novel technologies can provide” (Market actor, #2). This forecast of the future suggests that emerging technologies will be presented with significant opportunities in the near future. To ensure that these opportunities can be realised, several interviewees emphasised the importance of “considering social acceptance issues right from the beginning of the research and design phase” (Socio-political actor, #2) and recommended that projects “continuously work on ways to enhance their societal relevance” (Socio-political actor, #6).*

A number of interviewees also recommended the need for emerging technologies, in preparation for future opportunities, to learn from the mistakes of previous projects, specifically those that fell short in their attempts to gain social acceptance. As one market actor asserted, *“engagement matters in this game. There’s a need to give people a space to express themselves, to have open and transparent debates, where they are comfortable to learn, and to build relationships ... and much of these issues can be learnt from previous projects. There’s so much that can be taken from both successful and unsuccessful projects. I can’t stress that enough, learning from where projects went wrong and lost support, and where they went right and gained it” (Market actor, #1). Other interviewees, when considering the future landscape for emerging MRE technologies, discussed how developers and authorities must work to build trust between each other. This trust, in turn, can help to establish confidence in the technology amongst communities. Whilst building trust is far from an easy task, as “disagreement is an intrinsic part of engagement” (Socio-political actor, #4), when managed in a transparent manner, it “can facilitate empowerment and help to challenge misinformed assumptions or rumours about the potential impact of the project” (Socio-political actor, #4). This suggests that the test facing projects, when considering how to successfully engage with communities, is to find ways to manage conflict that reduce long-term harm to the communities involved. These recommendations are complimented by a community actor who discusses how “transparent goalsetting and information-sharing are good ways to manage expectations ... and the use of local leaders as coordinators can be a really helpful means of countering negative perceptions about who controls projects” (Community actor, #1). This hints at the notion of providing local communities with the possibility to become involved in co-creating activities with project leaders and developers. This participatory approach is a particularly inclusive idea of how emerging MRE technologies, as they progress into a future that will prioritise renewable energy projects, can maximise their potential social acceptance.*

## 5.5 CONCLUSIONS

The findings of this study reveal important information regarding the potential social acceptance of emerging MRE technologies. There are evident barriers to how novel technologies, such as LiftWEC, can engage with the planning process. In particular, many interviewees highlight the need for greater communication between projects and planning authorities. There is also an apparent requirement for projects to enhance the certainty of their device’s technology, with a lack of technological assurance commonly deemed as a barrier for emerging projects. However, the findings also reveal a number of opportunities that can be interpreted as learning lessons for the LiftWEC project. It is evident that the socio-political acceptance of small-scale, emerging technologies will enhance in the common decades. To take advantage of this opportunity, interviewees stress the importance of both considering social acceptance issues, and of factoring market and community perspectives into the early stages of project development.



## 6 DISCUSSION

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The research findings of this report reveal a diverse range of perspectives that interviewees consider to be important when debating the potential social acceptance of emerging MRE technologies. The findings include critical insight on the significant barriers that emerging technologies can face whilst attempting to navigate the planning process and how, to be more successful, greater levels of communication and knowledge exchange between projects and planning authorities is vital. Moreover, many interviewees were adamant in their belief that planning processes themselves are in need of change, specifically in regard to how integrated and inclusive they are. Although this is a finding that relates directly to planning practitioners, it is a useful revelation that emerging technologies can learn from. By understanding the limitations of current planning processes, projects can prepare strategies that may help them to overcome barriers that arise throughout their application process. For instance, projects could consider strategies on how to engage with stakeholders beyond the planning consultation process and how to actively respond to community perceptions from an early stage.

Important insight is also uncovered regarding the potential future of MRE technologies, with interviewees noting the value of embedding social acceptance issues within the design phase of emerging technologies. Collectively, these findings are of direct relevance to the LiftWEC project and, in this discussion section, they will be framed as learning lessons that can help to guide the evolution of the project. For the LiftWEC project to successfully gain high levels of acceptance across socio-political, market and community perspectives, there is a need to: **(i)** establish strong communication networks with planning authorities, **(ii)** increase investor confidence by defining technological specifications, and **(iii)** actively respond to community perceptions. The following sub-sections consider these learning lessons in greater detail and discuss how they can be utilised by the LiftWEC project.

### 6.1 LEARNING LESSON #1: ENGAGING WITH THE PLANNING PROCESS

To establish a high degree of socio-political acceptance for an emerging MRE technology, it is vital that strong lines of communication are established between projects and planning authorities. The findings of this study demonstrate how novel technologies are often faced with significant challenges when attempting to breakthrough in energy markets dominated by fossil fuel technologies, as well as well-established renewable concepts, that reap the benefits from economies of scale, long periods of technological learning and socio-institutional embedding. To overcome this challenge, projects should attempt to share information about their technology, and the potential value of their device for local communities, at an early stage of project development. Currently, opportunity for engagement is commonly restricted to conferences or research events, which can be inaccessible to some planning authorities. Interviewees suggest that emerging technologies should go beyond these traditional arenas for knowledge share and encourage projects to engage directly with planning authorities. This can enable, according to some interviewees, the development of communication networks between planners and projects. Establishing communication networks can help planning authorities to understand how emerging technologies may align with policy objectives and goals, an important issue when considering the movement toward net-zero. Early engagement can also provide planners with the opportunity to assess how new devices could coexist with existing MRE devices – and how they could learn from previous implementation processes in order to avoid duplication of time and effort – as well as considering how emerging technologies could potentially impact maritime sectors and



local communities. In a practical sense, interviewees suggest that projects should create briefing documents and presentations, to be shared with planning authorities, that can explain their technology and showcase its potential to offer an alternative approach to MRE. Ultimately, early stage engagement with the planning process could help to establish coordinated funding mechanisms and fiscal measures, as well as helping emerging projects to benefit from more efficient consenting processes.

## 6.2 LEARNING LESSON #2: INCREASING INVESTOR CONFIDENCE

Reliability is an important factor of success for all emerging technologies. In marine energy, obtaining high levels of market acceptance is dependent upon the establishment of confidence in the technology of novel devices. Interviewees make clear the importance of clarifying the technological dimensions of emerging projects as a prerequisite for confidence to be created amongst potential investors. It is noted that investors have a clear preference for more mature, proven technologies and, subsequently, emerging concepts that are based upon unproven technological designs can face a greater range of challenges when attempting to establish confidence. In particular, interviewees reveal how the level of risk and uncertainty of future revenues can discourage potential investment in a new MRE technology. In order to de-risk the technology and to accelerate the commercialisation process, technology maturation is outlined as a key factor. Finding solutions to these problems is challenging, yet interviewees propose some valuable options. First, creating a track record of continuous device operation, perhaps for a period of at least 6 -12 months, is suggested as a means of helping to encourage further engagements between emerging projects and investors. Second, to achieve a satisfactory technology reliability record, interviewees recommend more focus on reliability in system design and the introduction of reliability modelling. In the course of the design and deployment of emerging MRE devices, regular system functionality checks, focussing on the final operation in open sea, grid-connected, multidevice arrays, are recommended. Third, some socio-political actors called for a greater knowledge share and collaboration between current and proposed MRE projects. Fourth, as a way of providing transparency to investors, the importance of design for installation and maintenance purposes was emphasised by market actors. A final recommendation, which stemmed from discussion on how emerging MRE projects can adapt to a continuously changing socio-technical environment, suggests the importance of evolutionary steering mechanisms and systemic thinking. The strategy that underpins emerging technologies must be flexible and re-adjustable to new trends and priorities.

## 6.3 LEARNING LESSON #3: MANAGING COMMUNITY PERCEPTIONS

A final learning lesson, which directly links to the topic of community acceptance, regards the management of stakeholder perceptions and attitudes. Research into public perception and acceptance of MRE has become more common in recent decades, with emerging projects urged to factor the perspectives of their potential hosting communities into their thinking. Communities, such as fisheries-dependent communities in rural coastal regions, maintain unique cultural activities and traditions. They have often built resilience to cope with and adapt to developments and changes at the coast over generations. Actively managing and responding to community perceptions is, therefore, vital to facilitating or hindering the implementation of MRE technologies. Interviewees highlight how public consultation should not be restricted to planning processes and, instead, should be a process instigated by projects themselves. In the research findings, it is evident that community actors feel there is a need to engage with the perceptions, expectations and concerns of potential





host communities from an early phase. This can be done through the hosting of workshops and focus groups with community organisations and local stakeholders, as well as by facilitating forums where feedback can be received. Responding to this feedback early in the development process can help to maximise the potential community acceptance of emerging technologies. Evidently, it is a challenge to manage community concerns whilst also considering the needs of policy and industry. However, interviewees make clear the importance of gaining community acceptance should projects reach the implementation stage. In interviews with community actors, examples are provided that illustrate how proposed developments have failed to be realised due to community opposition and protest. Such opposition is largely seen to stem from a lack of active engagement between projects and community members, and a subsequent lack of trust in the proposed MRE development. Being prepared to understand the nature of potential hosting communities and to react to the claims of different interests is imperative for emerging MRE technologies going forward.



## 7 CONCLUSIONS

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As the only Deliverable on this project that assesses social acceptance issues, this report has presented a range of critically considered guidelines on how the LiftWEC project should prepare for, and manage, the planning, investment, and consultation processes. The key value of the findings is the degree to which they reveal key information on the social acceptance of emerging and novel MRE technologies. Broken down thematically, the presented findings help to accommodate for gaps of knowledge in current literature and reflect important insight that the LiftWEC project can learn from. The report has demonstrated how planning processes engage with emerging technologies, such as the LiftWEC concept, and where there are opportunities for greater engagement and communication between planning actors and projects. Additionally, insight on the value of emerging projects facilitating early engagement with stakeholders is illustrated. It is found that, although early engagement can be significantly beneficial for the acceptance of a MRE proposal, there are numerous challenges that must be considered. These challenges, which include providing technological certainty and building trust amongst stakeholders, are assessed in this report and the potential solutions that are proposed are designed to inform the LiftWEC project on how to manage such issues.

Important findings regarding the need for change to marine planning procedures are also presented, which are reflective of current academic thought on the barriers that emerging and novel MRE technologies are faced with. These barriers, as argued in the discussion section, can also act as learning lessons that can contribute to the transformation of marine planning processes. These findings are complimented by the presentation of interviewee's forecasts on the potential future of MRE technologies, which hint at what the future may hold for emerging technologies and how opportunities to enhance social acceptance should be realised. The previous section concludes this Deliverable by proposing three learning lessons that can guide the LiftWEC project on how to gain high, and sustainable, levels of social acceptance as it progresses into the development phase. These lessons present both conceptual and practical guidance, and they have the capacity to play a significant role in how the LiftWEC project obtains technological certainty and trust from potential investors and planning authorities. Throughout this report, it has been made clear that social acceptance is a vital concept for all emerging and novel MRE technologies to not only consider, but to embed within their thinking. It is only through high levels of social acceptance that technologies, such as LiftWEC, will be facilitated with the opportunity to become a key device in the future field of MRE.



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## APPENDIX 1: INTERVIEW STRUCTURE (SOCIO-POLITICAL ACTORS)

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### **Overview of LiftWEC project**

LiftWEC focuses on the development of a novel wave energy converter whose primary coupling with the waves is through hydrodynamic lift forces. The overall objective of the project is to determine the potential of this concept to produce renewable energy at a commercially competitive price whilst ensuring a minimal environmental/social impact. This will be achieved by a combination of numerical/physical modelling and desk-based studies of the structural design, the operational and maintenance requirements and the social acceptance of the technology. Although a preliminary assessment of the socio-economic impacts is ongoing, a deeper examination is required to fully understand the social acceptability of the LiftWEC concept. The task that this interview will contribute to involves the creation of a scoping report of the social acceptance of the final LiftWEC technology. This impact assessment will be the main output of the social science research element of the project.

Although a preliminary, desk-top assessment of the socio-economic impacts is being conducted as part of other tasks in the project, a deeper examination is required to fully understand the social acceptance or resistance to the LiftWEC concept. Social acceptance is conceptualised as consisting of three main elements: socio-political acceptance, market acceptance, and community acceptance. The preliminary report will cover the social acceptability of the technology from these three perspectives and will highlight potential issues relating to all three spheres. To achieve this, the first act is to learn from the insight of marine planners, policy experts and researchers who have expert experience of managing the implementation of marine renewable energy technologies. This interview poses questions regarding the general planning procedure that is followed to deal with new/emerging technologies, as well as exploring the how processes of public engagement, licensing, environmental assessments, and evaluations are conducted. The insight gained through this interview will significantly strengthen the quality and reflectiveness of this research. The questions of the interview have been divided into four themes:

### **Theme 1 – New and emerging technologies**

- Q1)** Can you describe how planners discover and engage with emerging marine renewable energy technologies?
- Q2)** How can engagement be simplified before technologies reach the deployment stage?
- Q3)** What are the main planning opportunities and challenges that face new technologies?

### **Theme 2 – Planning process**

- Q1)** From your experience of engaging with the planning process related to the deployment of new marine renewable technologies, how is public engagement/consultation conducted?
- Q2)** What other assessments, besides Environmental Impact Assessments, should be conducted?



**Q3)** Do you know of any post-deployment evaluations of technologies conducted in the years following implementation?

**Q4)** Are there areas where the planning process for emerging technologies improve?

### **Theme 3 – Dealing with objections and challenges**

**Q1)** What are the major objections from communities/maritime sectors/other investors/government that arise when planning for new and emerging technologies?

**Q2)** How are these objections and challenges dealt with and responded to? Can learning from them help to prevent similar challenges emerging in the future?

### **Theme 4 – Planning for the future**

**Q1)** In general terms, what are your expectations for the future of renewable technologies in the marine environment? How are planners planning for the emergence of future technology?

**Q2)** What changes to current planning processes will need to be made to accommodate for the future?





## APPENDIX 2: INFORMATION SHEET FOR INTERVIEW PARTICIPANT

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**Title of Project:** Development of a novel wave energy converter based on hydrodynamic lift forces (LiftWEC)

**Name of Researcher:** Ben McAteer

**Chief investigator:** Dr. Wesley Flannery

### **What is the purpose of the project?**

LiftWEC focuses on the development of a novel wave energy converter whose primary coupling with the waves is through hydrodynamic lift forces. The overall objective of the project is to determine the potential of this concept to produce renewable energy at a commercially competitive price whilst ensuring a minimal environmental/social impact. This will be achieved by a combination of numerical/physical modelling and desk-based studies of the structural design, the operational & maintenance requirements and the social acceptance of the technology.

### **How will this interview contribute to the aim of project?**

Although a preliminary assessment of the socio-economic impacts has been conducted, a deeper examination is required to fully understand the social acceptance or resistance to the LiftWEC concept. To achieve this, this interview will ask for your insight and perceptions regarding the potential socio-political impact and market acceptance of the concept. Your responses will highlight potential issues relating to these topics and will inform the final conclusions of the project.

### **Why have you been chosen to take part?**

You have been chosen due to your expertise and experience of working within the realm of marine renewable energy. Learning from your insight and factoring in your opinions will be key for the successes of the LiftWEC project, hence your invitation to participate.

### **Do you have to give consent to take part?**

Yes, consent is needed for taking part in all aspects of the study, including:

- Participating in a semi-structured interview (online);
- For that interview to be recorded;
- For transcripts being typed up verbatim from the interview, with your identity and responses made not directly attributable to you.

A consent form has been drawn up with a series of tick boxes to be completed when agreeing to participate in all or part of the study.

### **What will you be asked to do?**

To take part in a semi-structured interview, discussing a range of themes linked to your work, interest and expertise.

### **What are the possible disadvantages to you taking part?**

The researcher does not anticipate that there are any disadvantages.

### **What are the possible benefits to you taking part?**



There may be potential benefits from participating in the research, as it is anticipated that the discussions used in the course of the research will inform the. Your responses may also contribute to the production of academic publications and presentations at workshops and conferences.

**Will your participation be kept confidential?**

Yes, all responses to the interviews will be kept anonymous. Any responses used in the publication of research will not be made directly attributable to you. For instance, quotes used from the transcriptions of interviews will be presented as: “a marine planner discussed”, “a policy expert stated”, “an industry figure explained”.

**What will happen to the results of the project?**

On-going work and project results will be disseminated via academic publications, public presentations, news briefs, the project website and portal, and project social media accounts.

**Who is funding the project?**

LiftWEC has received funding from the European Union’s Horizon 2020 Research and Innovation programme under grant agreement number 851885.

**Who has reviewed the study?**

The student has received ethical approval from The Engineering and Physical Science Faculty Ethics Committee.

**What if there is a problem?**

If there is a problem you can contact Dr. Wesley Flannery, the Chief Investigator, who may be contacted at: [w.flannery@qub.ac.uk](mailto:w.flannery@qub.ac.uk). Should you remain unhappy and wish to make a formal complaint, you can contact the Research Governance Team at Queen’s University Belfast at: [researchgovernance@qub.ac.uk](mailto:researchgovernance@qub.ac.uk).



## APPENDIX 3: CONSENT FORM FOR INTERVIEW PARTICIPANT

### CONSENT FORM FOR INTERVIEW PARTICIPANT

Participant Identification Number: \_\_\_\_\_

<b>Title of Project:</b>	Developing Innovative Strategies to Extract Ocean Wave Energy
<b>Chief Investigator:</b>	Dr. Wesley Flannery

**Please initial box**

1. I confirm that I have read, or had read to me, and understand the information sheet and I have had the opportunity to ask questions and these have been answered fully.
2. I understand that my participation is voluntary, and I am free to withdraw at any time, up to one month after the online workshop without giving any reason and without my legal rights being affected.
3. I understand the study is being conducted by researchers from Queen's University Belfast and that my personal information will be held securely on University premises and handled in accordance with the provisions of the General Data Protection Regulation (GDPR).
4. I understand that data collected as part of this study may be looked at by authorised individuals from Queen's University Belfast and regulatory authorities where it is relevant to my taking part in this research. I give permission for these individuals to have access to this information.
5. I agree to take part in the above study.
6. I understand that the information I provide may be published as a report or journal article. Confidentiality will be maintained, and it will not be possible to identify me from any publications.
7. I understand the interview will be digitally recorded and there is a possibility of direct quotation being used in publications.

\_\_\_\_\_  
Name of Participant (please print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Name of Person Taking Consent  
(please print)

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

