



Regulating wave and tidal energy: An industry perspective on the Scottish marine governance framework

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ARTICLE INFO

Article history:

Received 18 November 2015

Received in revised form

15 December 2015

Accepted 16 December 2015

Keywords:

Ocean energy

Marine governance

Environmental impact assessment

Resource management

Marine spatial planning

ABSTRACT

The emerging ocean energy industry, which seeks to utilise waves and tides to generate electricity, is developing in many jurisdictions. The UK, and Scotland in particular, is strongly interested in these technologies, and has made considerable efforts to reform its marine governance processes to better meet the needs of innovative new marine industries. This paper provides an industry perspective on this regulatory framework, reporting on the experiences of ocean energy project and technology developers. Semi-structured interviews with companies with practical experience with Scotland's regulatory framework provide evidence of a number of legal and regulatory challenges, as well as interesting insights into how developers are interacting with new marine governance systems. The paper details the findings of these interviews and offers some suggested directions for future research.

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1. Introduction

The pressing environmental imperative to decarbonise the energy system has driven unprecedented interest in renewable energy technologies, while the drive to exploit marine resources has precipitated what some have called an “industrial revolution” of the ocean [1–5]. At the confluence of these two trends lies the emerging ocean energy industry, seeking to utilise the waves and tides to generate electricity.¹

Ocean energy is highlighted as one of five sectors with high potential for sustainable “Blue Growth” in the European Union's (EU) Blue Growth strategy [6],² and there is now considerable interest and investment worldwide [7]. Interest has been particularly strong in the UK, especially Scotland, where ocean energy benefits from existing maritime expertise, considerable political

and financial support, and on-going legal and regulatory reforms [8,9].

Ocean energy technologies enter an increasingly crowded and contested marine environment. As a result, policymakers, developers, and researchers are interested in how rapidly evolving marine governance frameworks can support the sustainable development of such innovative new marine industries, while also protecting an increasingly fragile and industrialised ocean.

This paper considers the Scottish regulatory framework, reporting on the experiences of project and technology developers. The following section sets out a brief review of the literature regarding marine governance and ocean energy. Section 3 details the methodology of this study, primarily semi-structured interviews with project and technology developers with practical experience of Scotland's regulatory framework. Section 4 recounts these interviews, while Section 5 discusses the findings, highlighting some areas of interest. The final section offers some concluding thoughts and suggests some directions for future research.

2. Marine governance and ocean energy: literature review

As with other novel offshore activities, ocean energy is bringing its own unique challenges to marine governance frameworks [5,9]. Ocean energy is not simply a technically challenging extension of onshore renewable energy, rather the “policy environment, governance, patterns of resource use, conservation values, and

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¹ In this paper, “ocean energy” is used to refer primarily to wave and tidal stream energy technologies currently approaching commercialisation. Ocean energy technologies also include: tidal barrages, which resemble traditional large hydropower stations; Ocean Thermal Energy Conversion (OTEC), which exploits the temperature differential between deep and shallow waters; and salinity gradient technology, or osmotic energy, which exploits the difference in salinity between freshwater and seawater. Ocean energy could also be used for the production of freshwater through desalination, heating, generation of compressed air, e.g. for aquaculture, and production of hydrogen by electrolysis.

² The other four are: marine biotechnology; coastal and marine tourism; aquaculture; and seabed mining.

distribution of ownership rights are all substantively different from the situation onshore” [9].

These concerns are not new. The 1970s oil crisis catalysed rapid development of a range of renewable energy technologies, including ocean energy [10]. Legal research on ocean energy developed alongside these technological developments, largely focussing on the then-frontrunner technology (Ocean Thermal Energy Conversion, or OTEC), identifying the relevant legal frameworks and considering how they might be improved [11–15].

Many issues raised by this early scholarship remain relevant some 40 years later. For example, concern in 1976 regarding the “adverse effects of the late blooming jurisdictional and environmental impediments to implementation of new technologies” [11] is equally prescient today, as rapid technological advancements threaten to outstrip the evolution of the associated legal and regulatory frameworks.

Recent years have seen renewed development of ocean energy technologies, and the forecasted scale of this new industry has sparked considerable academic interest. This interest focused initially on the technology itself, but has expanded to cover issues such as: community acceptance [16–18]; attitudes of fishermen toward ocean energy development [19]; co-existence with fisheries [20]; and the economic impacts of industry development [21,22]. The International Network for Social Studies in Marine Energy (ISSMER) was convened in 2012³ and a research agenda for social studies focussed on offshore renewables was developed [9].

Legal and regulatory frameworks affect the development of new technologies and industries, and there are strong links between these issues and the issues highlighted by the social sciences research agenda.⁴ A range of scholarship has begun to emerge considering such issues, including discussion of: international law [23,24]; consenting issues [25–28]; environmental impact assessment [29,30]; and marine spatial planning [31–34].⁵

A legal research agenda for ocean energy has been developed [35], complementing the social sciences research agenda and setting out a guiding framework for exploration of legal and governance issues relating to ocean energy, as well as identifying some key questions for further research. This paper seeks to contribute to the advancement of this agenda by providing an industry perspective on some of the questions it poses.

3. Method

3.1. Research design and structure

This study uses qualitative data to highlight the marine governance issues facing ocean energy developers. The methodology of this study closely follows that of Leete et al. (2013), which similarly investigated opinions regarding ocean energy, albeit from an investor perspective [36].

The development of a new industry, and its interaction with evolving legal frameworks is a complex process. In seeking to create space for interdisciplinary marine and coastal research, Christie (2011) argues that “Qualitative social data which maintain the narrative of informants and complement general patterns with specific and, perhaps non-statistically significant, results are essential to a complete understanding of complex phenomena” [37].

³ See (<http://www.issmer-network.org/>).

⁴ The ISSMER agenda refers to broad marine governance issues, including “policy environment, governance, patterns of resource use, conservation values, and distribution of ownership rights”, though legal issues in the Agenda are ultimately confined to dealing with “uncertainty” and “planning processes”.

⁵ Also referred to as “maritime spatial planning”, notably by the European Commission.

Indeed, “The bias toward quantitative or modelled results, based on a tendency to view quantitative results as rigorous while qualitative results are dismissed as anecdotal and subjective, should be resisted on methodological, practical and educational grounds” [37].⁶

Given the exploratory nature of this research, and the desire to elicit new insights into the complex and varied factors exerting influence on this emerging industry, an inductive methodology was selected. Such an approach can enable research to identify relationships and develop hypotheses directly from the data collected [38]. This allows the richness of the qualitative data to be fully utilised in the development of the research findings.

The collection of the primary data took place over an 8-week period in July–August 2013, and consisted of two preliminary phases of exploration and stakeholder consultation, followed by one phase of detailed interviews with industry participants.

Phase 1: A thorough review of the existing literature was undertaken, highlighting a number of key themes.

Phase 2: Working groups were facilitated in four stakeholder workshops, forming part of both the Marine Scotland (MS) MSP consultation process⁷ and the MESMA project.⁸ The former focussed on MS’s draft MSP documents, while the latter addressed questions relating to consultation, ownership and rights, governance, and community benefit. Two public consultation sessions on ocean energy development were also attended. These are summarised in Annex 1. This provided further development of the key themes, as well as an insight into broader stakeholder perspectives regarding the development of an ocean energy industry.

Phase 3: Collection of the primary data took place, consisting of a series of in-depth, semi-structured interviews with participants in the UK’s ocean energy industry. Participants had specific experience with the Scottish regulatory framework. The interviews were primarily non-directive, in line with the inductive nature of the research. This approach enabled the interviewees to talk freely about the subject and so provided for expansive data collection.

In order to ensure some level of consistency of data to facilitate analysis, interviewees were given some general questions regarding the issues that arise in key areas of marine governance (see Table 1). The interviews nonetheless remained flexible in order to benefit from the insights of the participants, an approach that has been shown to be particularly suited to exploratory studies of this type [39].

3.2. Participants

Participants recruited for this study were specifically targeted for their experience in engaging with the regulatory frameworks for ocean energy in Scotland. One national-level representative body was also recruited to provide an industry-wide view, therefore adding further depth and clarity to the findings.

Participants were invited to take part via a short introductory email that briefly summarised the research aim, gave an overview of some questions that the research was seeking to investigate, and specifically cited their involvement in the ocean energy sector.

Twenty entities were invited to take part in Phase 3; a total of seven completed in-depth interviews. These participants

⁶ Citing [63,64].

⁷ See (<http://www.gov.scot/Topics/marine/science/MSInteractive/Themes/msp>).

⁸ “Monitoring and Evaluation of Spatially Managed Areas” was a European Union Framework Programme 7 project (2009–2013). See (<http://www.mesma.org>).

Table 1
Participants interviewed in this study.

Participant type	Number
Large energy company, developing ocean energy projects as part of a larger renewable energy portfolio	2
Large dedicated ocean energy project developer	1
Established technology developer	2
Emerging technology developer	1
National representative body	1

represent a broad cross-section of players from the industry, including both project and technology developers with small and large consents (i.e. ranging from small-scale testing projects to arrays of devices totalling more than 50 MW), as well as the national industry body previously mentioned.

Recruiting participants for qualitative research regarding the ocean energy industry is challenging for a number of reasons. Firstly, the small nature of the industry naturally limits the number of companies with practical experience engaging with the regulatory framework. Secondly, and perhaps most importantly for the present study, the close-knit nature of the industry means that actors are somewhat reluctant to comment on legal and regulatory issues as they do not wish to prejudice relations with the regulatory bodies with whom they must work in order to advance their projects.⁹

The ocean energy industry has quickly become the target of numerous research projects and consultations, and there is a growing feeling of “research fatigue” or “consultation fatigue”.¹⁰ Many actors, including ocean energy companies,¹¹ have limited resources available to engage with the many requests they receive.

It is also commonly known that cooperation and knowledge sharing within the industry is limited: there is a reluctance to share information as various actors are competing to be the “first past the post” in terms of technological development and deployment.¹²

Despite the small sample size, the specific experience of the interviewees and the depth of the interviews conducted, as well as the inclusion of a representative body, enabled a robust analysis. Indeed, a sample of this size proved fruitful in the previously mentioned study regarding investor preferences in ocean energy [36].

3.3. Interview structure

The majority of the Phase 3 interviews were performed face to face; two were conducted via telephone for practical reasons. The interviews were generally 1–2 h in length.

Table 2 details the themes for the semi-structured interviews. Each interview commenced with an overview of the research aims and methodology. Interviewees were then invited to speak freely about the core subject areas as they saw fit. Participants were also given the opportunity to add additional information that did not fit into the four identified subject areas. Where direction was given, interviewees were guided to the broad theme using open

language, and closed or narrow questions were avoided in an effort to avoid researcher bias [39].

3.4. Data recording and analysis

Comprehensive written notes were taken during the interview, recording the key points made by the participant. These notes were subsequently developed into a more complete written record immediately following the interview. Interviewees were given the opportunity to review the written record in order to ensure that it accurately represented their comments. This helps to alleviate concerns regarding legibility, imperfect memory, and the unintentional mixing of data [40].

The interviews were organised and analysed in three stages, following the recommendations in Strauss and Corbin (2008) [41] and the approach taken by Leete et al. (2013) [36].

Stage 1: The qualitative data was broken down into discrete units of conceptual information [39]. Structural coding was used to label each unit based on the guiding themes of the interviews, thereby facilitating subsequent analysis [42–44]. Once all units had been coded, the complete dataset was re-evaluated against the final list of labels, ensuring consistency and allowing data coded earlier in the process to be reassessed against labels identified at a later point in the process [44].

Stage 2: The data labels were organised into categories according to which of the four themes they fell under. Additional categories were also added to represent units outside the initially envisaged themes.

Stage 3: The unitised data were examined to identify common themes and similarities across the interviewees. This analysis is presented below.

4. Findings

The Stage 1 data analysis yielded 290 data points across 11 categories. A total of 82 unique labels were identified, representing common statements and opinions. These are summarised in Annex 3. Though the final coded data does not represent a quantitative analysis, it nonetheless highlights some interesting areas for discussion.

4.1. Rights and ownership

The oceans have historically been considered to be under common ownership, with few examples of complete ownership or exclusive rights in marine spaces [45]. However, new technological and social drivers are gradually supplanting public rights, and creating of new private rights in marine spaces [9,46]. Development of ocean energy technologies potentially challenges traditional conceptions of rights in the marine environment [9].

⁹ This concern was noted by a number of participants.

¹⁰ For example, Marine Scotland has noted that “Respondents at previous workshops have talked of “consultation fatigue” complaining of too many and similar consultations without visible effect” (<http://www.gov.scot/Publications/2013/12/6618/12>).

¹¹ Or, within larger companies, the particular team dealing with ocean energy.

¹² The programme for the 2nd Tidal Energy Summit (2008) is indicative of this mindset, stating, “There is a misconception within the industry that first past the post will be the technology which is selected and backed”.

Table 2
Interview themes.

Theme	Guiding questions/topics
Rights and ownership	Ownership of seabed Exclusion zones/de facto zoning User conflicts Stage at which tenure should be awarded Structure of seabed ownership in the UK Control: centralised or local?
Environmental impacts	Experiences with the current EIA process How EIA processes can be improved Balance: development/sustainability Strictness of EIA process Strategic Environmental Assessment (SEA) “Survey, deploy and monitor” (SDM)
Resource management/consenting	Permitting models Crown Estate leasing process Competitive vs. cooperative process UK’s one-stop shop (OSS) systems Merits of OSS Alternatives to OSS (e.g. parallel consenting procedures)
Managing ocean space	Experience with ongoing MSP processes Integration of ocean energy into MSP MSP and zoning Trade-offs between different activities Utility of MSP at the project level

4.1.1. Security of tenure and exclusive occupation

Participants highlighted that security of tenure is crucial, as it is the fundamental basis for investment in a project: a developer has to be absolutely certain that it can unreservedly exercise its option to develop when it is ready to do so. The particular legal form of the occupation is not as important as the content: participants emphasised the need to have a legally enforceable right to occupy that space for the purposes of developing the consented project. Participants noted that many devices will require exclusion zones in order to function safely.

4.1.2. Community benefit

Participants raised the issue of community benefit deriving from “rights” to the local marine environment. It was noted that the impacts of any ocean development will be localised and compensation should reflect this. Some participants argued that offshore projects are different from those onshore as there is less immediate visual impact, which should be reflected in the provision of compensation. Participants argued that there must be a transparent process in place to assess and distribute such compensation. In any case, all participants discussing this issue noted that no such mechanism should be considered until the technology is proven at scale and is generating a commercial income.

While willing to consider mechanisms for compensation and distribution of benefits, participants agreed that secondary benefits, such as local jobs, should be seen as the primary compensation for local communities, e.g. the opportunity to upskill workers, utilise the expertise and equipment of fishermen and local businesses, and develop supporting infrastructure.

4.1.3. Consultation

There was little discussion of the formal consulting requirements, though participants highlighted the need for the developer to “take stakeholders with them”, i.e. to consult widely and early on in the process, and to keep stakeholders informed at all stages. It was noted that this will be key to ensuring that any conflicts over rights are overcome effectively.

4.2. Environmental impacts

A range of potential environmental interactions of ocean energy devices has now been identified, though considerable knowledge gaps and uncertainties remain [47–52].¹³ Understanding the environmental risks and benefits of ocean energy is challenging given the novel nature of the technologies and the difficulty of studying the marine environment [53].

4.2.1. Environmental impact assessment

Environmental impact assessment (EIA) is one of the cornerstones of project consenting, but EIA processes have been criticised in the ocean energy context [29,54,55]. Participants in this study reported varied experiences with EIA, with the process being very much dependent upon the specific location and the particular officer(s) in charge of the individual process. Nonetheless, the clear narrative in the interviews was that regulators place too great a burden for disproving negative environmental impacts on the developer.

Participants expressed concern that the precautionary principle is restrictively implemented, often being rendered as “do nothing”, whereas environmental imperatives should be encouraging the development of renewable energy projects. It was felt that regulators need to account for the potential benefits of ocean energy installations and move toward risk-based and collaborative approaches.

A potentially useful distinction was made between focusing on stressors rather than impacts. That is, regulators currently require proof of low impact for every potential stressor, as opposed to realistically identifying the likely impacts and working with developers to manage them.

The requirements for the collection of baseline data were singled out as a particular concern. Participants noted that the regulator has generally required two years of baseline data,¹⁴ a

¹³ This is particularly true as the size of deployments grows, as much of the existing literature on environmental impacts studies individual devices. Further research will likely be needed into the specific interactions of arrays of devices.

¹⁴ Participants identified that this was in pursuit of compliance with the Habitats Directive, though the Directive itself does not specify such a period. The SDM Guidance states that 2 years would be the minimum for a high-risk proposal, while

requirement perceived as excessive, and that better coordination is needed to identify and build upon existing data. One developer recounted collecting a considerable amount of baseline data that was ultimately not needed, resulting in sunk costs and delays to the project.

It was felt that other organisations, such as government bodies and statutory consultees, should take some responsibility for the development of baseline data, as they also benefit from the results. To this end, a number of participants praised the Scottish authorities for their actions in following up on the Scottish Strategic Environmental Assessment process and taking positive actions to assist with baseline data via the Scottish Marine Renewables Research Group.¹⁵

Some participants argued that developers have an inbuilt incentive to reduce environmental impacts regardless of the legal regime in place, as any negative environmental impacts would almost certainly result in a backlash that would harm both their project and the industry as a whole. In this context, it was argued that developers do not want a “free pass” but rather a structured EIA process that takes into account these inbuilt incentives.¹⁶ On the other hand, some participants expressed understanding regarding EIA requirements. Indeed, one participant saw the potential for backlash as a reason to accept stringent EIA processes, as they both limit the potential for such an occurrence and provide something of a safety net for the industry as a whole. One participant specifically recognised that ocean energy projects are essentially large industrial installations/power stations, and are therefore understandably not exempt from stringent rules and regulations.

It was nonetheless felt that ocean energy is subject to a more stringent standard in many cases, particularly when contrasted with established industries, such as offshore oil and gas. Participants viewed this as a result of there being a “well-trodden path” for existing technologies and a concomitant wariness of new technologies. A number of participants highlighted the relatively benign nature of ocean energy technologies, noting that many existing activities, such as fishing and dredging, are far more damaging to marine biodiversity.

4.2.2. Survey, deploy and monitor

Participants noted that it is difficult for developers to alleviate the concerns of regulators without live testing and that they simply need to “get devices into the water” to advance the industry. Scotland’s Survey, Deploy and Monitor (SDM) policy¹⁷ was seen as a positive development, to the extent that it can facilitate initial deployment of devices. One participant postulated that such policies can encourage developers to consciously design benign technologies, seek deployment in less sensitive areas, and find the appropriate scale for initial deployment.

One participant expressed mixed feelings about SDM, noting that in practice it is simply a restatement of existing EIA processes and fails to actually introduce any element of risk. This participant nonetheless saw SDM as essential insofar as the regulator considers it to be an essential policy tool to reduce baseline requirements. It was also suggested that SDM as currently implemented

may be too prescriptive, requiring a blanket baseline monitoring approach and not adequately accounting for existing baseline data. It was argued that SDM may be unsuitable in certain environmental contexts, e.g. where particular species or ecosystems are especially sensitive to new environmental pressures.

Another participant stated that their project had been assessed under the SDM policy and that they had been advised that one year of baseline monitoring was required, but that this was subsequently renegotiated in any case. This potentially calls into question the stability and permanence of such a policy in the absence of binding legal foundations.

Participants perceived a certain tension in implementation of the policy: on the one hand, regulators are nervous because they do not want it to be perceived as simply a shortcut to circumvent environmental rules; on the other hand, developers are also concerned that the policy does not have a binding legal basis or that it may change at short notice. One participant expressed concern that MS may decide, after an initial deployment period, that it requires more evidence, and that they may have to remove devices.

4.2.3. Environmental designations

A major concern identified by participants was environmental designations, and particularly those made under EU environmental legislation. Developers perceived such designations to be somewhat arbitrary and subject to unforeseen and sudden modification. One participant recounted an issue with site selection where a potential site was being considered for the development of a project, but was then made the subject of a consultation for new environmental designation without warning. In particular the EU Habitats Directive¹⁸ was widely reported to have been transposed into UK law more strongly than in other States. One participant in particular noted that one of the company’s European partners was surprised by how stringently the Directive is applied.

4.2.4. Strategic Environmental Assessment

Strategic Environmental Assessment (SEA)¹⁹ was not seen as playing an important role in improving project-level governance or in reducing the burden on developers to gather environmental data. Participants rather saw SEA as playing an essential strategic role in the overall development of the industry, providing legitimacy and allowing leasing rounds to take place. Thus while SEA may be useful for the industry overall, it does not provide sufficient detail to assist developers on an individual basis.

One participant commented that SEA is more suited for established areas of activity, and would be of more practical value once the industry further developed, i.e. after the deployment of the first commercial-scale arrays of devices. Another commented that SEA has no impact on where developers site projects, does not inform decision making processes, and does not reduce the burden on developers to develop the baseline data and studies that will satisfy regulatory requirements.

4.3. Resource management and consenting

Increasing competition for limited marine resources calls for effective regulatory frameworks to decide who is granted access to the resource, and under what conditions. Consenting processes should provide a principled and streamlined regulatory path for projects [26]. The UK has made efforts to streamline the regulatory framework [26,56], notably through the establishment of one-stop shop (OSS)

(footnote continued)

for a medium-risk proposal “The initial presumption would be that 2 years of site characterisation data would be required”. Low-risk proposals would need only 1 year of baseline monitoring.

¹⁵ See (<http://www.gov.scot/Topics/marine/marine-environment/smrrg>).

¹⁶ Indeed, there is already evidence that ocean energy developers have, in certain circumstances, gone beyond the minimum standards for consultation required by in order to ensure that the local community is a partner of the project [65].

¹⁷ Marine Scotland. “Survey, Deploy and Monitor Licensing Policy Guidance,” 2012.

¹⁸ Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

¹⁹ See [66,67].

authorities for consenting [25,27].²⁰

4.3.1. Seabed leasing

There was a strong sense that control over tenure should be centralised, but that intervention should be minimal. In this regard, it was noted that The Crown Estate (TCE)²¹ is in a good position to develop the seabed on behalf of the UK, as being a mixture of government and commercial provides it with the right balance of incentives.

Participants expressed the need for a clear, simple and stable framework within which a developer can advance ocean energy projects. TCE was generally applauded for their efforts to provide a clear route for developers to obtain tenure and providing a competitive process that delivered concrete results.

Many nonetheless found the leasing process to be excessively onerous, bureaucratic, and time-consuming. TCE itself reportedly felt that the quality of applications was mixed. Participants were keen to point out that these issues were, at least to some extent, merely teething problems caused by being the first authority to undertake such an ambitious process. Overall participants found TCE's continuous engagement and transparency ensured confidence in the process. Participants noted that TCE had been helpful, receptive to feedback, and worked closely with industry to further develop their processes.

It was felt that the process had not been sufficiently customised for ocean energy and that it was too closely modelled on TCE's experience with offshore wind, thereby generating an unrealistic expectation. In this regard, aquaculture was cited as an example of an industry where regulation had grown up alongside the industry, providing a more scale-appropriate process.

The main problem in this regard is that TCE initially released restricted areas with a large proposed capacity, in a relatively underdeveloped area. This caused an initial backlash against "drawing lines on maps", and it was perceived that this resulted in regulators later being exceptionally cautious in their decision making process. On a related note, the leasing round happened within a short timeframe: there was little engagement with local communities, and developers were immediately felt that they were "on the back foot".

Participants were not in agreement on whether the rounds system, whereby tranches of seabed leases are offered in periodic competitive leasing rounds, are the best way forward. Some argued that these rounds have forced the industry to meet the standards of a commercial-scale industry, long before the industry has actually reached that scale. One participant however noted that TCE had to conduct such a comprehensive process in order to demonstrate that it had given fair access for all.

A major issue identified is that there is no clear line of sight to the next leasing round, which is problematic for developers as they need a route to market and to manage risk. One developer in particular noted that this had caused significant problems. The developer wanted to lease a small piece of seabed in order to test parts of its technology and develop baseline data, but was not able to apply for a lease until the next leasing round.

There was also a suggestion that the leasing rounds as conducted favoured large developers, who are comfortable with proposing large-scale projects, while technology developers would prefer a first-come first-served model in order to submit smaller-

scale proposals on a more regular basis. The small technology developer confirmed this, noting that it is very difficult for them to engage in the TCE process. Indeed, in September 2015 TCE commenced a new programme of leasing for small-scale wave and tidal current test and demonstration projects under 3 MW.²²

4.3.2. Consenting processes

It was generally agreed that seabed leasing and resource consenting processes should be separate. It was unanimously and emphatically agreed that OSS is the right mechanism for streamlining consents. One participant said that OSS is rightly lauded as the holy grail as the previous system was a "nightmare". Separate consents and processes were identified as a significant risk from an investment perspective: the key is to institutionalise the process and make it official, long-term, and secure.

Many participants however expressed frustration at the operation of the OSS approach in practice. Marine Scotland had set a 9-month time limit for consents, but this was largely being missed, participants believed, due to a lack of experience. One participant estimated that the time to consent was between 7–18 months. Another participant lamented having collected data on birds for 16 months at the request of MS, only to wait another 19 months for MS to review their application.

In terms of the content of a consent, developers are aiming for a "buildable consent": i.e. the consent with the fewest and best-defined conditions as possible. To this end, it was noted that consents awarded can sometimes be vague, requiring a methods statement to be agreed at a later date. This has resulted in an ad hoc process of negotiation taking place post-consent.

4.4. Managing ocean space

Evolving uses of marine space necessitate a paradigm shift in our modes of governance of marine spaces, and marine spatial planning (MSP), which is intended to help reconcile potential conflicts between different uses of ocean space, has emerged as the frontrunner concept for implementing such a shift [57].

4.4.1. Interaction with existing users

A clear theme here was the challenge ocean energy developers face in integrating into an already crowded space, and that there are likely to be significant conflicts in the future. Developers see a need for considerable compromises to be made between users of the marine environment.

As with EIA, one participant argued that developers inherently have incentives to prudently site projects for conflict reduction. Cognisant of their desire or need for exclusive occupation, developers expressed that they wish to work alongside fisherman and other marine users to reduce conflict, and that they will try to stay away from shipping lanes.

Some noted that certain natural barriers to co-existence exist by virtue of the resource exploited: e.g. fishermen are not likely to be using tidal areas. They argued that the onus should be on the developer to reach an agreement with other users prior to, and during, consent application: the burden should shift to the relevant regulatory authority only if an agreement cannot be reached. Conflicts are nonetheless inevitable, but it was felt that the capacity to manage this will develop over time as the industry and regulators gain practical experience.

4.4.2. Zoning

There is a discussion in planning circles as to what extent

²⁰ In Scotland this falls under the mandate of Marine Scotland, while in the rest of the UK such consents are administered by the Marine Management Organisation.

²¹ TCE is a semi-independent, incorporated public body, charged with the management of an extensive property portfolio. This portfolio includes virtually all of the UK's seabed within territorial waters and the continental shelf (excluding oil, gas and coal). See (<http://www.thecrownestate.co.uk/who-we-are/how-we-work/>).

²² (<http://www.thecrownestate.co.uk/news-and-media/news/2015/new-leasing-for-small-scale-wave-and-tidal-sites/>)

zoning (see [58]) is necessary and what role it plays in MSP [59,60]. No unified opinion on the merits of zoning versus policy-driven MSP emerged from the interviews, though participants acknowledged that the nature of their technologies and projects is such that exclusion of others is inevitable, even where zoning is not formally implemented. In any case, it was noted that it would be necessary to establish exclusion zones during construction.

One participant expressed concern that zoning did not work for offshore wind because it ends up “sterilising” whole areas, while another added that zoning cannot provide sufficient flexibility. However others stated that zoned areas for ocean energy would be preferable and that zoning could begin based on the TCE demonstration leasing process, though they doubted the political feasibility of this.

4.4.3. Marine spatial planning

MSP was generally seen as a positive development, particularly in that it sets an intention that can focus the attention of regulators and policymakers and guide policy development. MSP was considered by some as necessary as it fills the need for an independent plan that suits everyone, however some were concerned that MSP could be too restrictive.

A preliminary issue identified is that MSP is not yet sufficiently developed to be helpful to developers at the project level. Nonetheless, a number of participants suggested that MSP had been directly useful to them at least to some extent. One participant stated that they had used the existing MSP documents “a little”, while another said it had been very useful in identifying data and making it available.

While participants expressed a definite need for MSP to allow trade-offs to be made between competing uses, many were concerned that the lack of an overall objective or hierarchy of interests precludes this from happening efficiently or effectively in practice. To this end, one participant argued that the overall objective of MSP should be ensuring that we make the best use of the oceans, not just managing the interests of different users. In other words, MSP needs to know what it wants to achieve. One participant argued that some users should take priority in certain areas, stating that as tidal energy is of national significance it should take priority over fisheries, at least in certain cases.

Overall, participants were keen to make it clear that the industry is not making a plea for unrestricted development, but rather wishes to ensure that it is not removed from the equation altogether.

Participants suggested some additional developments that could improve the functioning and utility of MSP, such as a centralised GIS system that could support rational planning decisions, and option areas as a way of prioritising certain areas for particular types of development.

4.5. Additional issues raised

Participants offered a range of crosscutting insights that do not fit neatly within the established legal research agenda. These insights could nonetheless prove useful in furthering reform or advancing future research.

4.5.1. Coherent development of the regulatory framework

Participants commented on the need to take a much longer-term view, focusing on the development of appropriate legal and regulatory frameworks in advance of commercial-scale development, rather than on short-term speed. The need to view the regulatory framework as a whole was also highlighted: while certain layers of regulation may not be appear to be helpful when considered in isolation, taken together they provide an overall framework that ensures security for developers and sustainable development of the industry. On a related note, the processes and

content of legal and regulatory frameworks are not in themselves of concern for developers, so long as overall there is a clear framework that provides a stable investment environment and a line of sight for future projects.

4.5.2. Political will

A clear thread in many of the discussions was the crucial role that political will plays in developing both a rational regulatory framework and a viable ocean energy industry. MSP and other regulatory initiatives flow directly from the willingness of government to engage and promote development.

Participants frequently cited Scotland as a model example in this regard, noting that regulators and policymakers are engaged, proactive and cooperative. One participant posited that Scotland is some 5 years ahead of other jurisdictions. Ireland was cited as an example of a country where political will and regulatory development have lagged behind the aspirations of industry, while it was noted that France, while participating actively in the development of tidal technologies, had thus far not put the appropriate frameworks in place.

4.5.3. Complementary policy and financial support

Other issues raised included the need for revenue support, i.e. a supplementary payment for the energy generated, and grant capital support, in particular to support the development of the first arrays of devices. Grid access was also raised, with concerns that the development of the grid is currently behind plans for energy development in many areas.

4.5.4. Jurisdictional issues

One participant discussed the UK's unique jurisdictional situation at length. At one level, there is a tension between Scotland and the rest of the UK regarding governance of the marine environment, with the Scottish Government agitating for increasing devolved power to manage its affairs. A process is now ongoing to ultimately devolve TCE functions and revenues to the Scottish Government.²³

This tension is replicated within Scotland itself, where many local communities, particularly the Orkney Islands, the Shetland Islands and the Western Isles, have expressed their desire for local control of marine resources driven by a strong sense of “ownership”.²⁴ It now seems likely that the ongoing process to further devolve TCE functions to the Scottish Government will result in direct revenue flows to such communities, though it is not yet clear whether communities will gain any control over management.²⁵

²³ The Smith Commission recommended that management of TCE assets and their revenues in Scotland should be devolved to the Scottish Parliament. The Scotland Bill, which includes provisions for this transfer, is currently making its way through the UK Parliamentary process. A new framework for control and management of Crown Estate assets in Scotland will be developed once the legislative powers have been devolved; it is not yet clear what form this will take. See (<http://www.gov.scot/Topics/marine/seamanagement/TCE>)

²⁴ The respective councils of these islands convened the Our Islands Our Future Conference in 2014, ahead of the referendum on Scottish independence, stating their intention to seek “additional powers and resources to give us a greater ability to shape the destinies of [the islands]”. They suggested, inter alia, that control of the sea bed could be sought, along with “new fiscal arrangements to allow the islands to benefit more directly from the harvesting of local resources, including renewable energy”. See (<http://www.orkney.gov.uk/Council/C/our-islands-our-future.htm>).

²⁵ The Scottish Government has stated its intention that communities will benefit from further devolution from the UK and TCE, and has committed to providing coastal and island communities 100% of the net revenue from marine activities out to 12 nautical miles. See (<http://www.gov.scot/Topics/marine/seamanagement/TCE>)

5. Discussion

The findings confirm a number of issues previously considered, and identify some issues of importance for the future development of regulatory frameworks.

With regard to **rights and ownership**, it is clear that security of tenure is important for future development of ocean energy technologies. Regulatory frameworks must account for this in providing seabed leases and consents. The industry clearly feels that it is not yet ready to be the subject of compensation mechanisms, so any move towards such mechanisms should be carefully considered and planned in full consultation. In particular it would be advisable to not simply replicate processes developed in the offshore wind context. On the subject of consultation, these interviews suggest that the industry is keen to strongly engage with stakeholders and they will do this in the absence of regulatory compulsion.

The findings confirm that **environmental interactions** are a particularly difficult issue for future development of this industry. There is a clear need to assist developers in the production of data, and to demand only the data that is necessary and potentially useful. One way to do this is to focus on impacts, rather than stressors. Regulators could, for example, avoid time stipulations for monitoring, instead providing binary thresholds for developers to meet.²⁶ The SDM approach is evidently a positive step supported by industry, yet is based on unstable legal foundations. Further formalisation of such flexibility however potentially contravenes the precautionary principle. Policymakers will therefore need to carefully consider how such flexibility can be advanced within the confines of established laws and principles, as well as how flexibility can be balanced with certainty. There may be a need for jurisdictions to work together to better harmonise environmental laws and regulations across the EU.

In terms of **consenting**, it is clear that the seabed leasing and resource consenting processes should be kept separate. In this respect, the findings suggest that current processes provide a robust and credible foundational framework for consenting, with TCE providing a sufficiently objective leasing process and the relevant OSS authorities assessing the proposed projects under resource management and environmental legislation. The interviews provide strong evidence in support of the OSS approach, in spite of difficulties and teething problems in its implementation.

The interviews make it clear that the process must be tailored to the particular stage of industry development and that there should be a clear line of sight to the next opportunity to apply for a project. Leasing rounds are appropriate for large-scale commercial projects, while smaller and more regular processes are better for early small-scale and prototype installations. Likewise, initial rounds should be in areas identified specifically for the purpose of advancing industry development, rather than envisaging full-scale commercial projects. The authorities have already learned from this experience, and these considerations can now be taken into account by other jurisdictions seeking to support the development of an ocean energy industry.

The interviews illuminated the existing practice of varying consents after the formal process has been concluded. While this may be functional in the initial stages of industry development, policymakers should be aware of this practice and seek to ensure that consents are robust at the outset. In any case, the process to vary consents should be formalised so that all parties are certain of where they stand. They also highlight the need for increased

capacity for regulatory authorities to manage the consenting process: this is likely to become an ever more pressing issue as ocean energy and other new marine industries rapidly develop under current pro-development policy settings.

Regarding the **management of ocean space**, this study suggests that there is uncertainty within the industry about how best to integrate these new technologies into strategic planning processes. The findings nonetheless appear to confirm the need for MSP, both as a strategic level of governance and, after further development, as a mechanism for directly supporting projects.

Especially illuminating are comments regarding the potential for coexistence. Participants tended to see conflict as inevitable, and, while there is great interest in the possibility of coexistence,²⁷ it appears clear that ocean energy projects are likely to be incompatible with this goal in many cases. This suggests that policymakers may need to: (i) focus on the coexistence options most likely to be practically feasible, such as locating ocean energy projects together where possible or co-locating projects with protected areas or aquaculture; and (ii) consider zoning of ocean energy projects (whether formally or through policy-driven approaches).

The issue of prioritising uses is also likely to be evermore crucial in increasingly crowded ocean spaces. While MSP has to date been focused on pragmatic policies to make trade-offs between uses, policymakers may in future need to instead explicitly set priorities and goals for MSP processes.

Finally, a number of **strategic issues** emerge from these interviews. Firstly, and perhaps unsurprisingly, participants approached legal and regulatory issues from a commercial perspective, considering how any issues in the legal context will affect their ability to attract investment and meet project milestones. While obvious, it will be important for policymakers to bear in mind: certainty and stability are crucial for supporting investment. On the other hand, it will also be important for policymakers to balance these commercial drivers with broader policy goals, especially ensuring sustainability.

Further consideration of inbuilt incentives may also be useful. This is not to say that the industry should be self-regulated, rather that policymakers can ensure that limited resources are initially focussed on areas where oversight is likely to provide additional benefits. This would however involve a much more detailed investigation of developers decision-making processes, which may be difficult.

6. Future research

Research to support the development of appropriate legal frameworks may be usefully developed in a number of directions.

The present study could be replicated with participants with experience of the relevant processes in other jurisdictions. This would enable similar insights to be drawn from different countries and allow the industry and policymakers in different jurisdictions to learn lessons from each other. Similarly, interviewing companies with experience in numerous jurisdictions could be helpful in bringing to light differences between approaches. For example, consenting processes, which are amenable to direct comparison across jurisdictions, have been compared in a number of papers [25,27,61]. Such a comparative approach could be extended to other elements of regulatory frameworks in order to build a more complete picture of current status and good practices.

The present study was limited to illuminating the commercial perspective, however future research could consider the regulator

²⁶ E.g., Rather than requiring 2 years of comprehensively monitoring seal populations, the regulator could instead require monitoring to show that less than 1 in 200 seals interacts with the device.

²⁷ Especially in the context of offshore wind and fisheries [20,68–74].

perspective, and assess how the interests of regulators and developers can be better aligned. This research could recruit the relevant authorities at the national level to discuss the high-level policy thinking, as well as regulatory officers at the project level to discuss how the processes work in practice and how interactions with industry take place.

In order to assess how the frameworks are progressing and the extent to which policymakers are suitably adapting regulatory processes, follow up interviews could be conducted to discuss how the legal frameworks are developing over time. This may be especially useful in the near future as companies begin to deploy devices on a wide scale and the pressure on regulatory bodies increases.

No attempt was made in the current study to provide an overall assessment of the regulatory framework according to an objective benchmark. The elaboration of some objective criteria for evaluating the evolution of marine governance frameworks would undoubtedly be useful. Existing international coordination efforts could provide an appropriate forum for such an exercise, e.g. the International Renewable Energy Agency (IRENA) or the International Energy Agency Ocean Energy Systems agreement (IEA-OES).

7. Conclusion

This study provides in-depth insight into how ocean energy developers perceive and interact with developing marine governance frameworks in Scotland. The findings confirm some pre-existing issues and assumptions, however the rich interviews also highlighted some interesting topics for further consideration.

Scotland appears to be leading the world in terms of its legal and regulatory support for ocean energy, and emerging jurisdictions can undoubtedly learn from the experience to date. Lessons can also be learned regarding improvements that could be made.

Far more needs to be done to ensure that EIA frameworks are striking the right balance between usability and sustainability, that consenting processes are fair and equipped to promote development at all stages, and that new industries are sufficiently considered or prioritised in strategic planning processes.

Despite some setbacks [62], expectations for the ocean energy industry remain high, especially in the UK and the EU. Driven by renewable energy and blue economy policies, ocean energy technologies are set to become a fixture in our seas in the near future: legal and regulatory frameworks need to be prepared to integrate such novel uses of the ocean into an already crowded and contested environment.

While it is clear that considerable legal and regulatory challenges remain, Scotland is providing a leading model for the reform of marine governance frameworks for the advancement of ocean energy.

Acknowledgements

I gratefully acknowledge the participants in this study that gave up their valuable time to share their experiences and insights. I also wish to thank Sandy Kerr and Kate Johnson for the assistance and guidance provided during a one month visiting scholar position at the International Centre for Island Technology at the Orkney campus of Heriot-Watt University. Finally, I wish to thank Shona Turnbull of Highland Council for allowing me to participate in the Marine Scotland workshops.

Annex A

See Annex [Table A1–A3](#)

Table A1
Preliminary workshops and consultations attended.

Workshop	Location	Date	Role
Marine Scotland MESMA, “The Future of Our Seas” workshop	Kirkwall, Orkney Islands, Scotland	1 July 2013	Facilitator
MESMA, public consultation			Facilitator
Marine Scotland MESMA, “The Future of Our Seas” workshop	Thurso, Scotland	4 July 2013	Observer
MESMA, public consultation			Facilitator
			Facilitator
			Observer

Table A2
Preliminary workshops – themes.

Consultation	Does consultation process work? Do you feel included in the consultation process? Are there other ways to participate?
Ownership/Rights and Governance	Do people want devolved power? And Why? What is your understanding of rights or ownership of the marine resources? Should local authority have control?
Community Benefit	What are the benefits? What works? Should there be a direct revenue payment to community? Or/Should there be a economic benefit ie jobs? Or/Should there be a benefit to environment? Why should we expect this benefit (£) versus where we do not expect benefit from a golf course?

Table A3

Summary of data coding labels by category.

Theme/label	Large energy Co.	Large OE Dev.	Est. Tech. Dev.	Emerg. Tech. Dev.	National body	Total
CP – consenting processes	24	18	29	10	5	86
Capacity of regulator		1	1		1	3
Certainty/clear regulatory framework	1	4	4	1		10
Consenting processes		3	1			4
Consenting processes outside OSS			1	1		2
Content of consent	3					3
Cost of consent	2	3	2	2	2	11
Developer-led leasing process			1	1		2
Marine Scotland - positive comment	1		1			2
Offshore wind	1					1
One Stop Shop - in favour	1	1		1		3
Relative ease of regulatory processes for existing industries	1				1	2
Stringency of consenting process for ocean energy			1	1		2
Subsequent negotiation and variation of consents	1	1	1			3
Testing centres/test devices	1		2	1		4
The Crown Estate			2			2
The Crown Estate - benefit fund			1			1
The Crown Estate - demonstration leases		1	3		1	5
The Crown Estate - positive comment	2	1				3
The Crown Estate - process	8	2	6	2		18
The Crown Estate - scale of leases	2	1	2			5
EI – environmental interactions	21	7	37	5	6	76
EIA	1		2	1		4
EIA - baseline data	3	1	5	1		10
EIA - comparison with other industries			2			2
EIA - risk-based approach			2			2
Environmental benefit of renewables/low impact of ocean energy	1		3		1	5
Environmental designations	4		5			9
Funding for EI research			1			1
Marine Scotland - positive comment			1			1
Precaution/Precautionary principle	3		2			5
Rochdale envelope	1					1
Role of regulators in reducing EIA burden			1	1		2
SEA	1		1		1	3
SEA - strategic utility	2	2	2		1	7
SEA - utility at project-level	2	1	1		1	5
Stringency of EIA process for ocean energy	1	2	4	2	2	11
Survey, deploy and monitor	2	1	5			8
GR - grid	1		2			3
Grid issues	1		2			3
INV - investment	1	1	3			6
Investment	1	1	3			5
Delaying decisions				1		1
JUR - jurisdictions	1		3	2		6
Ireland			1			1
Scotland	1		2			3
Sweden				1		1
UK				1		1
OS – ocean space	14	11	13	2	17	57
Coexistence		1				1
Consultation			1			1
Difficulties for new industries in crowded space	1				1	2
Existing users	2	1	3		4	10
Flexibility	1		2			3
MSP	2	1				3
MSP - Overarching objective/prioritisation of marine activities	1	1	3		7	12
MSP - strategic utility	1	1	1			3
MSP - utility at project-level	2	1	1	1		5
Offshore wind		1				1
Trade-offs between users					1	1
User conflicts	1			1	3	5
Zoning	3	2	2		1	8
GIS		1				1
OTH - other			1			1
Aquaculture regulation			1			1
POL – policy support	1		2	1		4
Grant support			1			1
Political will	1			1		2
Revenue support			1			1
RG – regulation, general	6	3	8		1	18
Development of regulation	1		5			6
Layers of regulation		1	1		1	3
Learning by doing	1		1			2
Long-term view		1				1
Strategic location of projects	4	1	1			6

Table A3 (continued)

Theme/label	Large energy Co.	Large OE Dev.	Est. Tech. Dev.	Emerg. Tech. Dev.	National body	Total
RO – rights and ownership	11	6	8	2	3	30
Community benefit	5	1			2	8
Consultation	2		3			5
Exclusive occupation/exclusion zones	3	1	1	2	1	8
Local ownership			1			1
Offshore wind		1				1
Public rights		1	1			2
Security of tenure	1	1				2
Tenure control		1	2			3
User conflicts		1				1
TEC - technology	2		1			3
Technology	2		1			3
Total	82	46	107	23	32	290

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