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Socio-economic benefits assessment of the Celtic Seas Partnership co-existence guidelines

WWF

CELTIC SEAS PARTNERSHIP

Life

Socio-economic benefits assessment of the Celtic Seas Partnership co-existence guidelines

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NEF Consulting Limited

New Economics Foundation
10 Salamanca Place
London SE1 7HB
www.nefconsulting.com
Tel: 020 7820 6361

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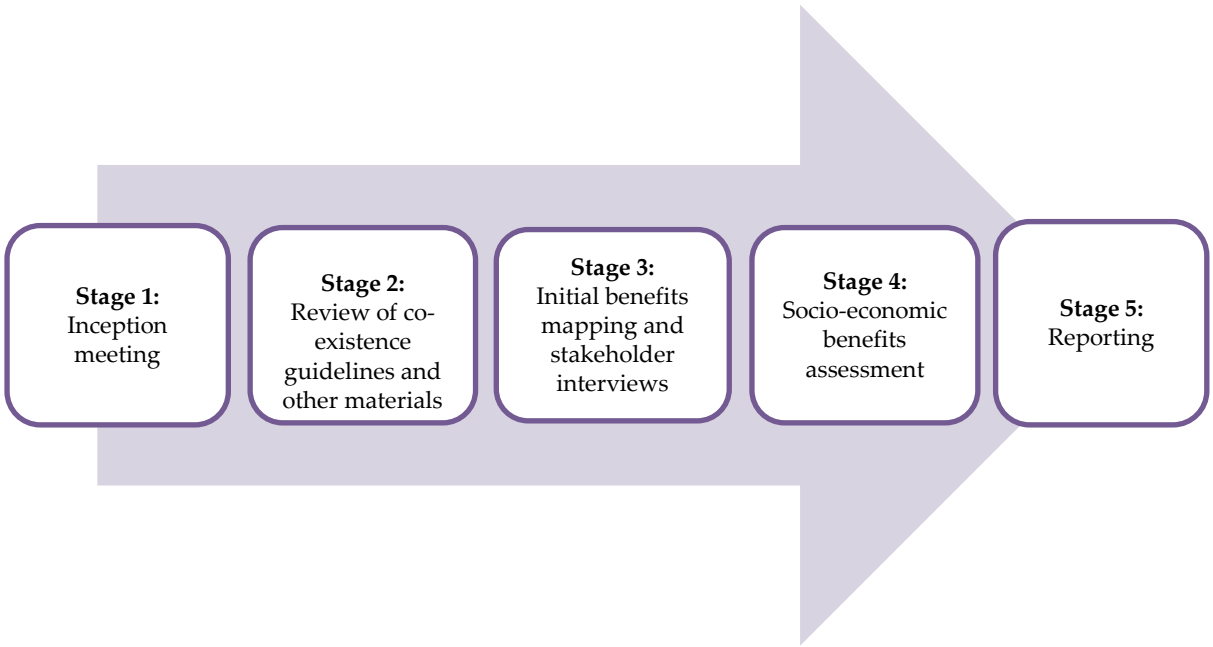
Executive Summary

The Celtic Seas Partnership has worked with stakeholders from across the Celtic Seas to produce a series of best practice guidelines to provide examples of possible approaches, tools, and mechanisms that could be used as solutions to environmental challenges facing the area. These guidelines are to help stakeholders work together to make progress towards the EU target of 'Good Environmental Status' under the Marine Strategy Framework Directive. Three sets of guidelines have been produced under the Celtic Seas Partnership; this study is focused on 'Encouraging harmonious co-existence of marine renewables with other marine uses and interests'.

To understand the potential impact of implementing these guidelines, WWF-UK commissioned NEF Consulting to conduct a socio-economic benefits assessment. The benefits assessment was conducted in a number of stages. The guidelines and related material were first reviewed to identify potential outcomes. This then fed into the initial outcomes map which was tested and refined through stakeholder interviews. Interview participants were also asked to provide estimates of impacts in their areas of expertise and these were then incorporated into the model. The benefits were modelled to give a range of potential values, and three different future trend scenarios[1] were assessed.



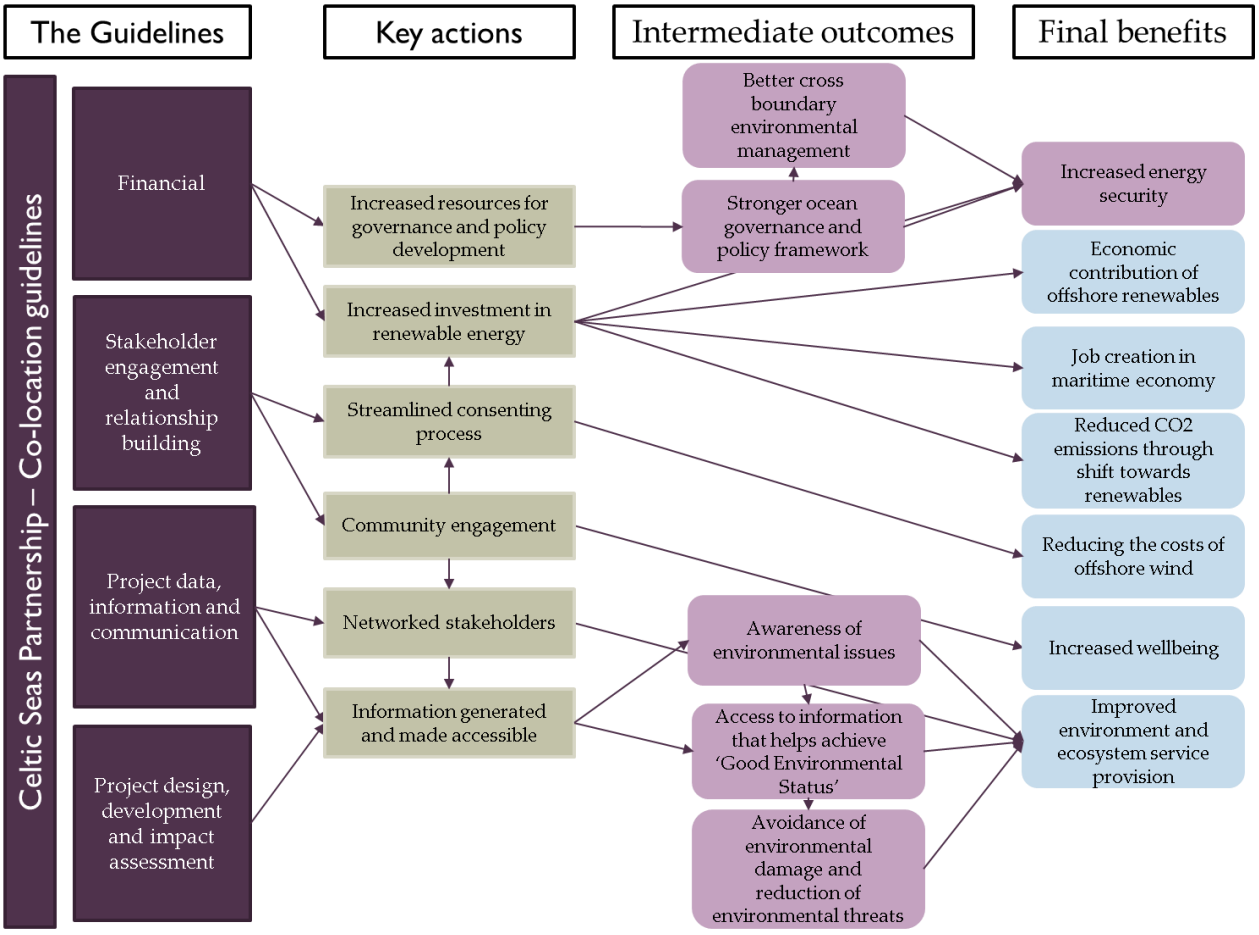
Of the benefits identified, six were modelled as these were considered to be the most material and realistic to measure:

- Value from economic contribution of marine renewables.
- Social value of job creation in maritime economy.

[1] The three scenarios are the Baseline, Nature at Work and Local Stewardship.

- Value from reduced CO_2 emissions through a shift towards renewables.
- Value from reducing the costs of offshore wind.
- Value from increased wellbeing.
- Value from improved environment and ecosystem services.

The figure below maps out the anticipated final benefits from implementation of the co-existence guidelines. It presents linkages from the recommendations in the guidelines through to key actions, the intermediate outcomes they deliver, and the final benefits that would be expected. The anticipated outcomes are displayed in both light purple and light blue. The outcomes in light blue are those benefits that were considered material and included in the model for assessment.



The results from the model are presented below and suggest an overall potential benefit from implementation of the co-existence guidelines of nearly £8 million over the five year assessment period (rising to over £36 million with upper bound assumptions, or £18 million as an alternative upper estimate with sensitivity testing). The results are presented with a lower estimate, referring to the benefits under more conservative, lower-bound assumptions, and an upper estimate, which makes use of more optimistic, upper-bound assumptions.

Table 1: Results of benefits assessment

Benefit	Range	Cumulative
Value from economic contribution of marine renewables	Lower estimate	£109,113
	Upper estimate	£654,679
Social value of job creation in maritime economy	Lower estimate	£4,658,926
	Upper estimate	£23,294,630
Value from reduced CO_2 emissions through shift towards renewables	Lower estimate	£367,402
	Upper estimate	£1,102,207
Value from reducing the costs of offshore wind	Lower estimate	£1,087,335
	Upper estimate	£3,262,004
Value from increased well-being	Lower estimate	£72,108
	Upper estimate	£84,126
Value of improved environment and ecosystem services provision	Lower estimate	£1,616,499
	Upper estimate	£8,082,496
Total	**Lower estimate**	**£7,911,383**
	Upper estimate	**£36,480,141**
	Alternate upper estimate	***£17,844,437***

While positive value is derived from all six modelled final benefits, it is clear that three of these are driving the majority of the overall value. These are the value from 1) reducing the cost of offshore renewables, 2) the value of improved environment and ecosystem services provision and, in particular, 3) the social value of job creation in the maritime economy. The alternate upper estimate applies the lower estimate for the social value of job creation to the upper estimate for the other benefits as a means of sensitivity testing the overall results to this one value.

Two additional future trends scenarios were also modelled. These drew on the Nature at Work (the environment takes centre stage) and Local Stewardship (society seeks greater local self-sufficiency) scenarios in the Celtic Seas Partnership Future Trends website[2] and report.[3] We interpreted the impacts these scenarios would have on the modelled benefits and adjusted the key variables accordingly to provide a range of values forecasting the potential impact of the guidelines under these alternative trend scenarios.

Under the Nature at Work scenario, both the lower and upper estimates have increased from our base case scenario. The results for this scenario suggest a total lower estimate of

[2] Celtic Seas Partnership. (n.d.). What does the future hold for the Celtic Seas? Available at: http://futuretrends.celticseaspartnership.eu/

[3] Celtic Seas Partnership. (2016). Future Trends in the Celtic Seas Scenarios Report. Available at: http://futuretrends.celticseaspartnership.eu/downloads/R2584d%20Future%20Trends_Final%20Scenarios%20Report_5Aug2016_High_res.pdf

nearly £11 million over the five year assessment period, and just over £47 million for the total upper estimate (falling to £28 million as the alternative upper estimate with sensitivity testing to adjust the value applied for the social value of job creation). Under the Local Stewardship scenario, both the lower and upper estimates increase relative to our base case scenario. The results for this scenario suggest a total lower estimate of over £10 million over the five year assessment period, and just under £48 million for the total upper estimate, in line with the Nature at Work scenario (falling to under £22 million as the alternate upper estimate with sensitivity testing to adjust the value applied for the social value of job creation).

The results from the model indicate that there is considerable potential benefit from implementing the recommendations set out in the co-existence guidelines. However, this study has largely been based on a hypothetical situation where these recommendations have been effectively implemented, a situation that is not necessarily certain in the real world. For the outcomes to be realised, the guidelines need to lead to concrete action; all stakeholders strongly agreed on this point. To progress the project further additional action will be needed to:

- Ensure that the guidelines are agreed and taken beyond their current voluntary status.
- Ensure that resources are made available for those who are tasked with regulation, monitoring and enforcement.
- Ensure compatibility and stability with the wider policy environment.

Furthermore, focus could be placed on specific actions which enable the guideline recommendations to be realised as actual benefits. The specific actions following from the guideline recommendations which are believed to most directly lead to beneficial outcomes are as follows:

- Increased resources for governance and policy development
- Increased investment in renewable energy
- Streamlined consenting process
- Community engagement
- Networked stakeholders
- Information generated and made accessible

As such, it would make sense to focus resources towards building on activities which contribute to these actions. In particular, much of the potential overall benefit identified in the model derived from either increased investment in offshore renewables or increased stakeholder engagement. This is perhaps unsurprising but nonetheless highlights that policy

and activities that increase or remove barriers to these actions will increase the likelihood of realising wider benefits in the Celtic Seas.

Introduction

The Celtic Seas is an area of the Atlantic Ocean west of Ireland and Scotland (see Figure 1) which supports a diverse array of wildlife. Marine wildlife living in the Celtic Seas include dolphins, porpoises, whales, sharks, and seals, as well as maerl beds, cold-water corals, and horse mussel reefs. The area also contains a variety of species that humans depend on for food, with many people depending on them to support their livelihoods and wellbeing.

Figure 1: The Celtic Seas

In the context of increasing threats to the world's oceans due to over-exploitation of resources, pollution, and climate change, the Celtic Seas Partnership project[4] was formed. The Celtic Seas Partnership is a multi-national[5] project, funded in part by LIFE+, the EU financial instrument which supports environmental, nature conservation, and climate action projects across the EU. It seeks to bring together a variety of stakeholders to collaborate on innovative approaches to management of the marine environment in the Celtic Seas and to create more harmonious ways of working between marine authorities, users, and other interest groups from across different sectors and countries.

As part of the project, the Celtic Seas Partnership worked with stakeholders from across the Celtic Seas to produce a series of best practice guidelines to provide examples of possible approaches, tools, and mechanisms that could be used as solutions to the challenges, and thus help stakeholders work together to make progress towards the EU target of 'Good

[4] The project is coordinated and facilitated by WWF-UK, SeaWeb Europe, University of Liverpool, Eastern & Midland Regional Assembly, and the National Environment Research Council.
[5] Including the UK, Ireland, and France.

Environmental Status' under the Marine Strategy Framework Directive. Three sets of guidelines have been produced under the Celtic Seas Partnership:

- Encouraging effective marine management and decision making across borders.
- Encouraging harmonious co-existence of marine renewables with other marine uses and interests.
- Encouraging positive interaction and preventing conflicts between marine stakeholders.

To understand the potential impact of implementing these, WWF-UK commissioned NEF Consulting to conduct a socio-economic benefits assessment, focusing on the guidelines on co-existence of marine renewable energy projects with other marine users and interests (the co-existence guidelines). The co-existence guidelines were chosen as the focus of this study as the other elements would be practically difficult to assess as many components have only recently been implemented and identifying impacts at this early stage may be problematic.

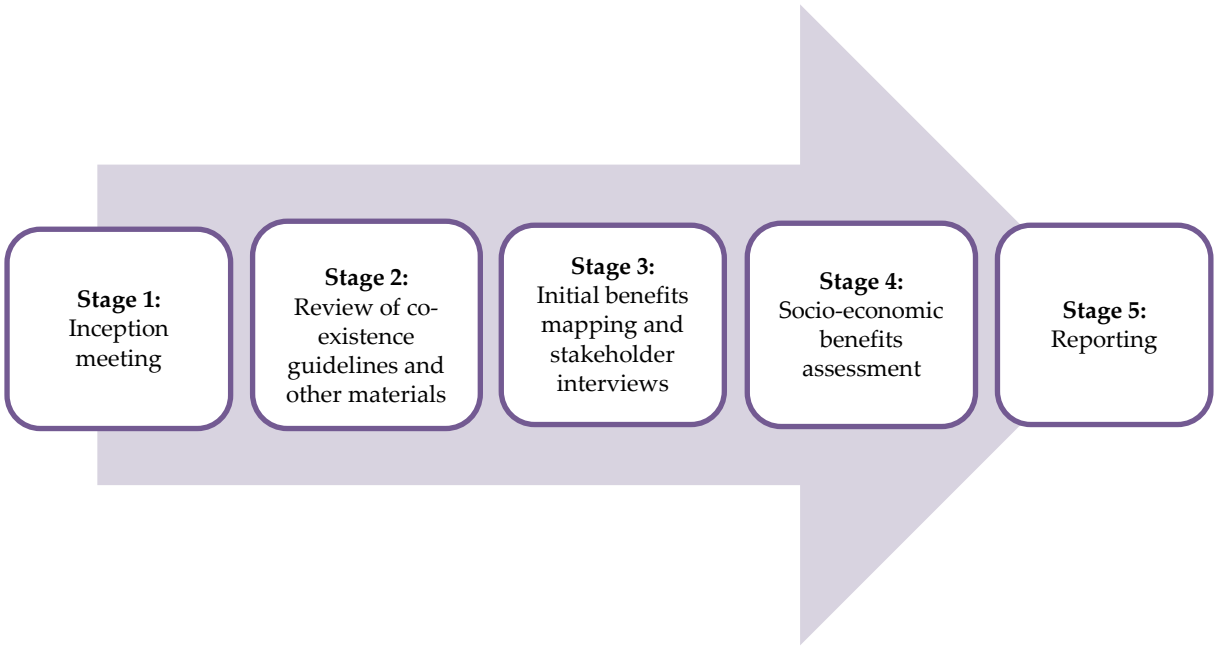
The co-existence guidelines are designed specifically to provide guidance on best practice for renewables developers in the Celtic Seas, regulators in this region, and industries/marine interests affected by development. They were developed through extensive consultation with a range of marine stakeholders and a series of case study investigations to capture lessons learned from previous marine renewables projects.

Through review of these co-existence guidelines and other project materials, interviews with a range of Celtic Seas stakeholders, and desk-based research and data collection, we estimated and valued in monetary terms their potential triple-bottom line (social, economic, and environmental) benefits. While this approach involves modelling forecasts of benefits, rather than reviewing actual impacts, and necessarily incorporates assumptions and hypothetical future trends, the involvement of stakeholders in the process (including renewables developers, environmentally focused NGOs, and sectoral experts) enabled a better understanding of how potential benefits could manifest and the extent to which positive impacts could be attributable to the co-existence guidelines.

Approach

This section details NEF Consulting's approach to the socio-economic benefits assessment. In response to the needs of this study, we developed a staged approach to our research (Figure 2).

Figure 2: Approach by stages



Stage 1: Inception meeting

An inception meeting was held with NEF Consulting and WWF-UK staff to introduce the relevant team members. The aims of the Celtic Seas Partnership project were discussed in greater detail, ensuring an understanding of what would drive the work as well as the intended use of the best practice guidelines. A list of target groups for stakeholder interviews was developed, with WWF-UK establishing first contact with potential interviewees to gauge interest and availability.

Stage 2: Review of co-existence guidelines and other materials

WWF-UK provided links to existing materials relevant to the Celtic Seas Partnership project, including the co-existence guidelines which formed the basis of the assessment as well as a series of reports on Future Trends in the Celtic Seas, produced as part of the project. NEF Consulting reviewed these documents to develop a contextual understanding of the Celtic Seas Partnership and the potential benefits of the co-existence guidelines.

Stage 3: Initial outcomes mapping and stakeholder interviews

Based on the review of materials provided, previous conversations with WWF-UK, and our experience conducting similar analyses, NEF Consulting identified an initial set of potential

economic, social, and environmental outcomes resulting from the co-existence guidelines.[6] From this, we categorised outcomes based on the stakeholders that they would benefit, and considered what changes would be material to these groups. These potential outcomes are discussed in this report, highlighting the six final benefits that were included in the model and the rationale for those decisions.

This identification process provided a basis on which to build a more detailed set of outcomes and assumptions for the subsequent stages of the study.

We then developed a semi-structured interview guide[7] to sit alongside this initial list of outcomes and conducted a series of interviews with stakeholders representing various interests, including renewables developers, local government, coastal communities, environmentally focused NGOs, and large landholders. Eight interviews were conducted in total.[8]

These interviews were a key stage of the assessment, as they provided a means of testing the initial list of potential outcomes, identifying any other possible impacts, better understanding how the guidelines might enable them to materialise, and determining assumptions and further data required to develop a socio-economic benefits assessment. Following the interviews, we developed an Excel-based assumptions matrix to outline potential benefits, specific impacts on different stakeholders, and data/assumptions required to measure key benefits. This tool was shared with WWF-UK for feedback. Final benefits to be measured in the quantitative assessment were selected based on considerations of whether stakeholders perceived a robust relationship with credible mechanisms for change or, if they could not speak to this, if such a relationship existed in secondary literature and whether outcomes were felt to be materially significant. The outcomes were also considered as a group, to remove those which would lead to double-counting.

Stage 4: Socio-economic benefits assessment

Interviews provided a more detailed qualitative understanding of potential outcomes, as well as a quantitative estimate of levels of attribution for the co-existence guidelines (i.e., the amount of benefit experienced that can be attributable to the guidelines). Data captured through the interviews were then combined with data gathered through desk research to fill in gaps and effectively capture broader outcomes (i.e., not just benefits to individual renewables developers). A range of values for each beneficial outcome (expressed in GBP)

[6] Note that throughout this report both 'outcome' and 'benefit' are used to describe the various potential effects of the guidelines. In general, 'outcome' is used as a more generic term for these effects while 'benefit' is used in relation to the final elements that the assessment is conducted on. The word 'impact' is occasionally used in reference to the aggregate effect of the guidelines, or to the degree of change in one of these effects.

[7] Appendix 3

[8] Interviews were conducted by telephone for six of the eight interviewees and in person for the other two.

was then produced, presenting lower- and upper-bound total benefit estimates for each.[9] These values are presented in the results and recommendations section.[10]

Where possible, interviewees from the previous stage were contacted again to review and verify the assumptions developed in the benefits calculations.

Stage 5: Reporting

The remaining sections of this document provide a summary of the outcomes included in the assessment, methods of measurement, and final results, as well as recommendations for the Celtic Seas Partnership going forward.

[9] Lower-bound benefit values use more conservative estimates of attribution, growth rates, etc., while upper-bound benefit values use more optimistic estimates.
[10] Appendix 1 has the full methodology of how these values were calculated.

Outcomes

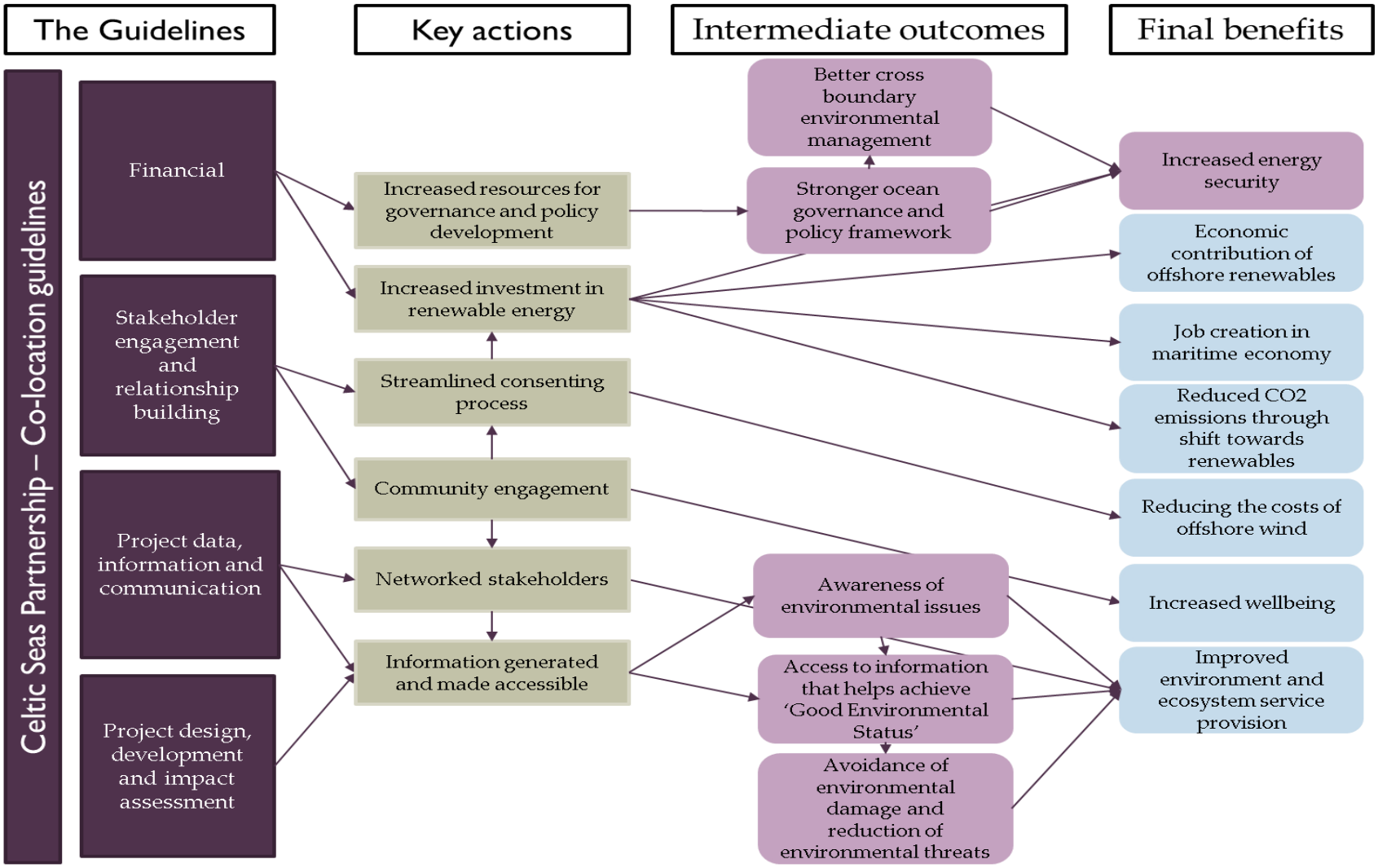
Potential outcomes from the implementation of the co-existence guidelines were first identified through background research into existing material and contextual knowledge of the Celtic Seas region. This initial outcome mapping formed the basis for the stakeholder interviews, which were used to collect evidence and generate assumptions. Each of the mapped outcomes is discussed in regard to our initial interpretation and the informed stakeholder opinion, along with justification for their inclusion or exclusion from the impact assessment.

Outcomes map

Figure 3 maps out the anticipated final benefits from implementation of the co-existence guidelines. It presents linkages from the recommendations in the guidelines through to key actions, the intermediate outcomes they deliver, and the final benefits that would be expected. The anticipated outcomes are displayed in both light purple and light blue. The outcomes in light blue are those benefits that were considered material and included in the model for assessment. The remaining ones in light purple were not included in the model as either they are intermediate outcomes, or there was a lack of data to make an informed estimate. All of the outcomes are discussed in detail in the following section.

Figure 3 also highlights the key actions that follow on from implementation of the guidelines and presents how these drive the various outcomes through use of arrows to indicate causal pathways. For example, the outcomes map demonstrates that community engagement is expected to lead to a number of key actions, such as increased investment in renewable energy, which in turn are expected to support several outcomes. The outcome map has been developed with knowledge of the guidelines and Celtic Seas context and insights gained from stakeholder engagement.

Figure 3: Outcomes map



Economic contribution of offshore renewables

The co-existence guidelines open up the potential for increased offshore renewables in the Celtic Seas. They should help reduce resistance to development by improving relationships between different stakeholders and helping to resolve conflicts where they arise. A Celtic Seas where marine renewables better co-exist with other marine stakeholders could be more appealing to investors, unlocking additional investment in the region and boosting the Celtic Seas' contribution to UK Gross Value Added (GVA).

The stakeholders interviewed agreed that the guidelines could increase income for developers, supporting increased investment in renewables by reducing risk. For example, high levels of local opposition to a project pose the risk of delays which can be costly or even threaten the possibility of a project. Early investment in building local connections, understanding local concerns, and gaining support for the project is important; if a project starts off in a direction with which the local community does not agree, it can cost a lot to amend it in a few years' time after considerable investment has been made.

> With one of our offshore windfarms, we decided to locate rows of turbines so as not to clash with fishermen's currents, or with particular landscapes. If we didn't discuss the project with fishermen and just made our projects as an engineer would, in optimal position for wind, those rows would have been different. The project could be cheaper, but less acceptable with more risk for the development.
>
> - Renewable energy provider

While one stakeholder pointed out that windfarm revenue would not necessarily be affected by harmonious co-existence since revenue comes from contracts with power suppliers, they stated that there could still be a financial impact associated with reducing the potential damage to other stakeholders who could sue for negatively impacting their livelihoods. Therefore, if implemented successfully, improved co-existence could be an advantage for all stakeholders.

> We've had full support from all stakeholders in the area – fisherman, boat owners (tourism). And we've interacted with them over the last 5–7 years, from the very beginning of the project to completion. They use it [the windfarm] as an item they use on their tours. It generates interest from the general public.
>
> - Renewable energy provider

Many of our stakeholders felt that there were already good conversations between marine renewables, local communities, and other marine stakeholders.[11] However, there

[11] The counterfactual in the model follows this logic. It assumes that there is already a level of engagement happening, but that this could be improved in both quantity and quality.

was a view that implementing the guidelines could enhance this by unlocking the resources for more people to engage, and by encouraging developers who stopped at statutory guidance to push their engagement further. While several mentioned factors beyond the scope of the guidelines, such as the important role of government in providing a stable planning and regulation process to support investment by de-risking projects, we still expect this to be a considerable outcome and one that is measurable in economic terms. As such, it has been included in the assessment.

Social value of job creation in the maritime economy

Increased investment and development of offshore renewables would be expected to create jobs. While the economic value of this job creation is largely captured by GVA, there is also a social value associated with increased employment, and that is the focus of this outcome.

Stakeholders saw offshore renewables contributing to job growth in two ways. The first is in the construction and maintenance of renewables sites and in their supply-chain effects. The second mechanism is in the wider maritime economy, as co-existence can ensure that other sectors which rely on the ocean for employment (such as fishing communities and coastal tourism) would not have their livelihoods threatened by the growth of the marine renewables sector, and would thus remain substantial employers in the region. One stakeholder gave the example of an offshore wind-farm developed with the involvement of local fishermen in such a way that they could continue to fish in the shared waters.

Another stakeholder pointed out that the marine renewables industry is in a state of infancy. While the creation of the physical infrastructure required for renewable energy production has already created significant jobs in the construction and installation phases, this level of investment is only sustainable if you are regularly building commercial devices; otherwise job creation is cyclical when devices are built as one-off installations.

Our research with stakeholders suggested that better co-existence could create new jobs in the Celtic Seas by unlocking increased investment in marine renewables as well as by protecting the ability of other maritime sectors, such as fishing and tourism, to continue to grow and employ local people. The social value of these jobs is included to be valued in the assessment.

Reduced CO_2 emissions through a shift towards renewables

If the renewable energy industry grows in the Celtic Seas, as set out in the value from economic contribution of offshore renewables, carbon emissions from energy production should be reduced, as non-renewable energy generation is displaced over time and overall energy consumption falls (as forecast in DECC Updated Energy & Emissions Projections, November 2015).[12] Our interviewees felt that the guidelines could support the growth of

[12] Annex F, https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2015

renewables in the Celtic Seas, since improved communication between marine renewables developers, local ENGOs, and coastal communities could reduce the risk of local opposition to new developments, speeding up consent, and reducing the risk of projects stalling permanently, thus contributing to the UK's move towards low-carbon electricity generation.

Feedback from stakeholders confirmed that once operational, a larger renewables sector would allow for carbon emissions per unit of grid electricity to be reduced. However, there might be some resistance from parts of the public if this leads to an increase in the price paid on electricity bills. Thus, the extent to which the government supports, subsidises, or incentivises people to buy renewables will determine the scale of this outcome, and its financial costs.

With the assumption of the government's continued support of the sector, so that increased supply is matched by increased demand, this outcome is considered to be material to this analysis and as such has been included in the impact assessment.

Reducing the costs of offshore wind

As the renewables industry matures in the Celtic Seas, helped by the co-existence guidelines, the cost of energy from offshore wind should come down. This occurs through economies of scale, improved technology, and more efficient operational decisions. All these will be made more likely if the guidelines can unlock more development, as already discussed. The lowered price should increase uptake and lead to further investment. It was also noted that having better working relationships between universities, researchers, and surveyors who conduct environmental assessments could improve the circulation and application of existing knowledge in the region, and thus increase the rate at which costs are reduced.

Although stakeholders saw potential for the guidelines to cut costs of development and thus reduce costs and increase investment, it was also pointed out that better co-existence in the Celtic Seas would need to be accompanied by national government policy to support price reductions, and other technological breakthroughs to bring some technologies to a commercially viable stage.

This benefit has been included in the assessment as a material outcome which could be supported through adoption of the co-existence guidelines in conjunction with government policy and continued expansion of the sector.

Increased wellbeing

Adoption of the co-existence guidelines could result in increasing wellbeing for local communities resulting from better communication, increased participation, and benefits around engagement and empowerment. In relation to coastal communities, the co-existence guidelines encourage early and regular communication with local communities, beginning before the design stage, building trust and keeping people informed and engaged throughout the process. Some interviewees reflected that statutory requirements for local engagement are often inadequate. This results in local people being opposed to projects and

feeling a lack of control in their local areas. On the other hand, if local people are engaged in decisions at meaningful points, they can feel more empowered and engaged in their communities. Some stakeholders felt that this was a significant outcome of harmonious co-existence.

Improved feelings of wellbeing can also feed back into other social benefits, such as better communication, collaboration, and social cohesion. To this end, the guidelines will be useful for getting people into a room and talking, and this contributes to building trust between sectors and helping people to appreciate others' perspectives.

Furthermore, stakeholders noted that collaborating, feeling valued and that their voice is being heard, will reduce feelings of marginalisation regarding decisions that impact their livelihood, and further contribute to wellbeing.

Some stakeholders pointed out that, as a subjective improvement, it would be hard to draw conclusions about cause and effect, but agreed that more communication can only improve wellbeing. For example, it can be difficult for NGOs to understand the results of environmental impact studies which may cause anxiety towards environmental impact, an anxiety based more on a psychological response than on the reality of the situation. With better communication around impact and past experiences, and early engagement, negative wellbeing impacts can be reduced.

The value from increased wellbeing has therefore been included in the assessment as a material outcome.

Improved environment and ecosystem services provision

Ecosystem services are the flow of services provided by the environment from which humans derive value. They include provisioning, regulating, supporting, and cultural services and are fundamental to both human survival and our enjoyment of our surroundings. In the Celtic Seas region, these services could include everything from habitat for sea life and the production of fish for consumption to carbon sequestration.

All stakeholders agreed on the importance of ecosystem services as without the marine environment, there would be a breakdown of the local economy. As such services need to be maintained, stakeholders considered improved conversation with the public to involve and inform them about the value of ecosystem services to be an important element in their maintenance. To be motivated to change, industry stakeholders need to feel that environmentally damaging practices are socially unacceptable, so wider civil society would also need to be involved.

Stakeholders found it harder to estimate what tangible change the co-existence guidelines might bring about. It could depend on how the guidelines are implemented, and whether any of the principles would be backed by regulatory frameworks or enforcement by statutory bodies. Currently the guidelines are for voluntary adoption. While locally ecosystem services may improve, it is difficult to determine what the overall impact on the

wider environment would be. The potentially long time frames required to realise the impacts on ecosystem service provision were also mentioned, meaning that any changes in behaviour and management resulting from the guidelines would have to be permanent and sustainable for these outcomes to be realised.

Regarding habitat and fish production, it is not immediately clear what the overall impact may be. While the government has published material stating that it believes that wind farming will not affect fish stocks as a whole,[13] in the wider context of the Celtic Seas many species of sea life appear to be declining,[14] potentially due to fishing practices and other factors. Stakeholder opinion ascertained in the interviews was that the current effect of the renewables industry in the Celtic Seas has been neutral; while fish stocks have not increased, fishing rights have not been restricted.

However, stakeholders believe that the illegal removal of fish and destruction of habitats could be reduced if there were a stronger network of groups observing activities in a coordinated manner with information sharing; people would be dissuaded from illegal fishing if they knew there was a well-connected network around them looking out for the ocean. This could improve fish habitat and production, or at least help to reduce the decline.

It was also stated that the guidelines could potentially help deal with pollution and other time-bound incidents, such as oil spills, through increased cooperation among stakeholders, which could facilitate more rapid response to contain emerging issues. However, it was noted that as voluntary guidelines are difficult to enforce, this outcome is difficult to determine. Therefore, this aspect of improving the environment has not been included in the model.

The value from increased ecosystem services provision, primarily regarding habitat and fish production, has been estimated in the assessment as we believe it is an important indicator of improved environment.

Increased energy security

Increasing domestic energy generation reduces dependence on imported energy, which may be subject to greater price volatility and political uncertainty. Renewable energy is a particularly important aspect of energy security since, if managed sustainably, it can be produced indefinitely.

One of our interviewees discussed offshore wind as a reliable contributor to energy security because its production is a fairly stable process, with reliable technology and few interruptions from the surrounding environment and other marine uses (such as shipping or

[13] Offshore wind: Part of the UK's energy mix. (2013). Department for Business, Energy and Industrial Strategy. Available at: https://www.gov.uk/guidance/offshore-wind-part-of-the-uks-energy-mix
[14] Celtic Seas Ecoregion: Ecosystem Overview. (2016). ICES Ecosystems Overviews. Available at: https://www.ices.dk/sites/pub/Publication%20Reports/Advice/2016/2016/Celtic_Sea_Ecoregion-Ecosystem_overview.pdf

marine wildlife). Although the amount of wind power that can be produced will fluctuate on a day-to-day and seasonal basis, the supply is fairly predictable. Other marine renewables, such as tidal energy, are even more so, due to the routine tidal movements.

The co-existence guidelines may not have much effect on ensuring the safe production of wind energy, since this will already be regulated as described, but, as before, they can help to increase energy security by supporting more sites of renewable generation to get planning consent. Interviewees felt that they could reduce conflict with stakeholders who are initially opposed to the development, and either unlock further development if local opposition is blocking it or, at the very least, speed up the process of the development.

If the co-existence guidelines lead to increased offshore renewable energy generation, this will contribute to reducing our dependency on imported energy, and thus contribute to energy security in that way. However, it is not possible to quantify this change since most of the literature on energy security is related to oil and other fuels rather than electricity production and the actual risk posed by importing natural gas for electricity generation is unclear. As such we have not included this in the quantitative assessment.

We have not included this outcome in the assessment as there is not enough information present to make an informed estimate of how the guidelines would contribute to energy security at national level. Energy security in most often thought of in terms of access to oil and other fuels rather than electricity production, though the UK's reliance on imported natural gas does have energy security implications in terms of electricity production. As renewable electricity makes up an increasing proportion of grid electricity generation, reliance on imported fuels drops, but the direct relation is not clear, nor is the actual risk imposed by importing natural gas.

Better cross-boundary environmental management

Adoption of the co-existence guidelines would improve cross-boundary environmental management, ensuring a consistent approach to addressing environmental issues. As environmental issues often are not realised solely within political boundaries, a cross-boundary approach to environmental management could have both economic and environmental impacts.

Stakeholder opinion diverged on this outcome, primarily around how much the co-existence guidelines could change current practice. Some felt that there was already a strong policy framework and strong cross-boundary dialogue, and without putting the guidelines into practice were not sure if additional benefits could be achieved. Others saw a lack of coordination between Marine Spatial Plans, particularly at a supranational level, which could be rectified through adoption of the guidelines. This could lead to better coordination of environmental management and allow a more strategic approach to environmental management across the Celtic Seas.

Stakeholders agreed that improving communication across boundaries is key to improving environmental management. While WWF-UK has produced separate guidelines on transboundary governance[15] some stakeholders also saw the co-existence guidelines as supporting this kind of thinking and suggesting useful processes for this.

On a project level, it was noted that while increased awareness of effective environmental management is important, the commercial case is challenging. One stakeholder suggested that the cost of environmental management should not be shouldered solely by the developer, while another suggested that the guidelines could help developers share more information and data between themselves, thus reducing the need for multiple people repeating the same work.

This outcome was not included in the assessment as its final effect would be to improve the economic and environmental standing of the Celtic Seas; these benefits are already incorporated into other outcomes, so to include here would lead to double counting.

Access to information that helps achieve 'Good Environmental Status'

Interviewees felt that that the co-existence guidelines could be useful to help industries understand what 'Good Environmental Status' (GES) means for them. As the definition is very complex, it was believed that more clarity would help different sectors define what GES means in their context.

Application of the guidelines could also potentially help to increase availability of useful information through sharing and adopting of best practice. At present, there is a lack of clarity and guidance for stakeholders on the interplay between marine protected areas and renewables, as well as a lack of knowledge on applicable standards of best practice. The guidelines, therefore, have the potential to help developers plan better, making cost estimates more realistic in business models.

Despite these perceived potential benefits, there may still be a barrier in terms of incentives to adopt GES. While some industries take a moral stance, there is insufficient consumer knowledge about which industry players are contributing to GES, so most players are not doing their part. It is not clear whether the guidelines can address this incentive issue.

This outcome was not included in the assessment as it would lead to benefits around improving the environment. These benefits are already captured in other outcomes, since a general improvement in environmental status would lead to improved ecosystem services, so to include it here would be double counting.

Stronger ocean governance and policy framework

Some stakeholders felt that a potential legacy of the co-existence guidelines would be an improved framework for international ocean governance. This idea was articulated in two

[15] Best Practice Guidelines for Transboundary Marine Governance

ways. The first saw the guidelines as having potential to help people navigate the existing governance, and to point to new approaches in the short term. In the medium term, however, it was thought that they are too specific to be adopted more widely, and should therefore become more practical, perhaps with a degree of enforceability.

The second view saw a role for improving supranational marine spatial planning, and providing a base from which a more coordinated approach could be taken across the Celtic Seas. Stakeholders were divided over whether there was already a strong enough policy framework around the Celtic Seas, as the UK and the EU have high standards of marine protection. But it was felt that the guidelines could still strengthen existing governance in a positive direction, for example by drawing policymakers' attention to where policies interact and need to be better articulated.

This outcome was not included in the assessment as it is considered an intermediary outcome, which leads to social and environmental benefits that are captured in other outcomes.

Avoidance of environmental damage and reduction of environmental threats

One stakeholder believed that, since it was possible to have harmonious relationships between marine stakeholders without creating a sustainable environment, such harmonious co-existence would have to be supported by a high level of public connection and concern with nature and the environment. The longevity of the guidelines being followed is thus dependent on educating people about what the environment means for their lives. Sharing information between sectors can also help in terms of surveillance for environmental compliance, and lead to an improved understanding of cumulative impacts between communities.

One stakeholder reflected on how strengthening a network of stakeholders in the Celtic Seas could support the avoidance of environmental damage and reduce environmental threats. The ways of working encouraged in the guidelines could produce a stronger network of 'eyes on the ocean' which would allow quicker responses to time-sensitive environmental threats; a fisherman who is well connected with other marine stakeholders would be able to trigger a faster, more effective response if they saw evidence of an oil spill than one who was isolated from the other actors in the Seas. In addition to these time-sensitive risks, it was also felt that the guidelines could support a reduction in illegal activities which are harmful to the environment; if people are aware that there is a stronger group of networked, environmentally concerned stakeholders operating in the Seas, they are likely to be wary of carrying out activities like illegal trawling or overfishing. However, it was also noted that as voluntary guidelines are difficult to enforce, regulation may be required to achieve this outcome.

This outcome has not been included in the assessment as it is an intermediary outcome which would lead to environmental benefits which are captured through other outcomes.

Awareness of environmental issues

The co-existence guidelines promote the sharing of expertise and knowledge. Therefore, they support an increase in environmental awareness. A better exchange of information and data, a large amount of which is collected by the various organisations operating in the Celtic Seas, would be beneficial to a number of stakeholders. For example, fishermen might benefit from information generated for Environmental Impact Assessments if this information was made more accessible to them and other stakeholders who do not usually have access.

Increased awareness is an intermediary outcome – a pre-condition for other outcomes. As such, it has not been included. Environmental benefits resulting from this outcome are captured by other outcomes valued within the assessment.

Results

The results from the model are presented in Table 1. By necessity, the model is strongly based on assumptions and is only meant to give an indication as to the potential benefits of the guidelines. The forecastive nature of the model and interconnectedness of the issues involved in the Celtic Seas means that it is difficult predict with accuracy what overall impacts will be. Thus, each of the assessed benefits is presented with a more conservative lower estimate, and a more optimistic upper estimate. We favour a focus on the lower estimate as the more conservative value, with the upper estimate providing an indication of the potential value to be realised under the most favourable assumptions and conditions.

The results of the model suggest an overall potential benefit from implementation of the co-existence guidelines of nearly £8 million over the five year assessment period[16] (rising to over £36 million with upper bound assumptions).

Table 1: Results of benefits assessment

Benefits	Range	Cumulative
Value from economic contribution of marine renewables	Lower estimate	£109,113
	Upper estimate	£654,679
Social value of job creation in maritime economy	Lower estimate	£4,658,926
	Upper estimate	£23,294,630
Value from reduced CO_2 emissions through shift towards renewables	Lower estimate	£367,402
	Upper estimate	£1,102,207
Value from reducing the costs of offshore wind	Lower estimate	£1,087,335
	Upper estimate	£3,262,004
Value from increased well-being	Lower estimate	£72,108
	Upper estimate	£84,126
Value of improved environment and ecosystem services provision	Lower estimate	£1,616,499
	Upper estimate	£8,082,496
Total	**Lower estimate**	**£7,911,383**
	Upper estimate	**£36,480,141**
	Alternate upper estimate	***£17,844,437***

While positive value is derived from all six modelled benefits, it is clear that three of these are driving the majority of the overall value. These are the value from 1) reducing the cost of

[16] Net Present Value (NPV) using a standard UK discount rate of 3.5% per annum has been applied to all figures.

offshore renewables, 2) the value of improved environment and ecosystem services provision and, in particular, 3) the social value of the job creation in the maritime economy[17].

To test the sensitivity of the model to this one variable, we also looked at how the total upper estimate would change when then the lower estimate for the social value of job creation replaces the upper estimate for this value alone[18]. This results in an overall upper estimate of nearly £18 million, which tightens the range and likely provides a more accurate upper value.

[17] For further discussion on how the value for the benefits was calculated see Appendix 1.

[18] Note that the large value found for this outcome is driven both by a high valuation figure for the social value of a job and the fact that we are applying it to all expected job creation enabled in the maritime economy, not just in the marine renewables sector, as job creation enabled in other sectors (i.e., fisheries) was also raised as a potential benefit of the guidelines during stakeholder engagement.

Future trend scenarios

Once the model was completed, we modified it to look at two future trends scenarios. These scenarios were developed at a high level, drawing on the Nature at Work and Local Stewardship scenarios in the Celtic Seas Partnership Future Trends website[19] and report.[20] We interpreted the impacts these scenarios would have on the modelled benefits and adjusted the key variables accordingly to provide a range of values forecasting the impact of the guidelines under these alternative trend scenarios. Brief descriptions of the future trend scenarios from the Future Trends website are now discussed.[21]

Nature at Work

The environment takes centre stage. Population growth, new technology, and making the most of a healthy environment are the driving forces. Environmental protection is strong, with an extensive network of strongly managed protected areas. The results under this scenario are presented in Table 2 below.

Table 2: Nature at Work benefits assessment

Benefits	Range	Cumulative
Value from economic contribution of offshore renewables	Lower estimate	£418,570
	Upper estimate	£2,511,417
Social value of job creation in maritime economy	Lower estimate	£4,686,202
	Upper estimate	£23,431,009
Value from reduced CO_2 emissions through shift towards renewables	Lower estimate	£461,043
	Upper estimate	£1,383,128
Value from reducing the costs of offshore wind	Lower estimate	£2,522,544
	Upper estimate	£7,567,631
Value from increased well-being	Lower estimate	£144,215
	Upper estimate	£168,251
Value of improved environment and ecosystem services provision	Lower estimate	£2,424,749
	Upper estimate	£12,123,744
Total	**Lower estimate**	**£10,657,322**
	Upper estimate	**£47,185,182**
	Alternate upper estimate	***£28,440,375***

[19] Celtic Seas Partnership. (n.d.). What does the future hold for the Celtic Seas? Available at: http://futuretrends.celticseaspartnership.eu/

[20] Celtic Seas Partnership. (2016). Future Trends in the Celtic Seas Scenarios Report. Available at: http://futuretrends.celticseaspartnership.eu/downloads/R2584d%20Future%20Trends_Final%20Scenarios%20Report_5Aug2016_High_res.pdf

[21] Specific adjustments for each outcome can be found in Appendix 2.

Under the Nature at Work scenario, both the lower and upper estimates have increased from our base case scenario. This is primarily driven by increases in the values estimated for the economic contribution of offshore renewables, the reducing costs of offshore renewables and improved environment and ecosystem services provision. It is not unexpected that a scenario in which the environment is valued more highly and pro-environmental action becomes more prominent leads to increased value from environmental benefits. The results for this scenario suggest a total lower estimate of nearly £11 million over the five year assessment period, and just over £47 million for the total upper estimate (falling to £28 million in the alternate upper estimate with sensitivity testing adjusting the social value of job creation upper estimate).

Local stewardship

Society seeks greater local self-sufficiency. More decisions are taken locally and there is increased pride in local produce. Environmental policy varies across the region as decisions reflect local issues and concerns. Tourism and recreation grow strongly as people choose to holiday at home. The results under this scenario are presented in Table 3 below.

Table 3: Local Stewardship benefits assessment

Benefits	Range	Cumulative
Value from economic contribution of offshore renewables	Lower estimate	£158,982
	Upper estimate	£953,891
Social value of job creation in maritime economy	Lower estimate	£6,512,626
	Upper estimate	£32,563,131
Value from reduced CO_2 emissions through shift towards renewables	Lower estimate	£367,402
	Upper estimate	£1,102,207
Value from reducing the costs of offshore wind	Lower estimate	£1,551,860
	Upper estimate	£4,655,581
Value from increased well-being	Lower estimate	£288,431
	Upper estimate	£336,502
Value of improved environment and ecosystem services provision	Lower estimate	£1,616,499
	Upper estimate	£8,082,496
Total	**Lower estimate**	**£10,495,800**
	Upper estimate	**£47,693,808**
	Alternate upper estimate	***£21,643,303***

Under the Local Stewardship scenario, both the lower and upper estimates increase relative to our base case scenario. This change is primarily driven by the increase in the values estimated for the social value of job creation. It is not unexpected that a scenario in which local communities are valued more and the focus on local job creation increases leads to a larger benefit from job creation. The results for this scenario suggest a total lower estimate of

over £10 million over the five year assessment period, and just under £48 million for the total upper estimate, in line with the Nature at Work scenario (falling to under £22 million in the alternate upper estimate with sensitivity testing adjusting the social value of job creation upper estimate, well below the Nature at Work scenario).

Recommendations

The results from the model indicate that there is considerable benefit to be had from implementation of the recommendations set out in the co-existence guidelines. However, this study has largely been based on a hypothetical situation where these recommendations have been implemented, a situation that is far from certain in the real world. For the outcomes to be realised, the guidelines need to lead to concrete action; all stakeholders strongly agreed on this point.

While there was agreement that the advice set out in the guidelines would improve co-existence within the Celtic Seas, as voluntary measures there was some scepticism as to their ability to affect real change. There was a general sentiment mentioned, in regard to fisherman, that although there was a lot of money being invested in getting people together to produce reports there was still a lack of investment in the actual fishery sector, in spatial planning and to combat austerity, and that big ideas without law or financial resources to back them would create little real change.

It was also expressed that as the guidelines are voluntary, they are likely only to impact those who already share similar concerns and are keen to adopt new, more collaborative ways of working. Therefore, for a wider reach the Celtic Seas Partnership could look to partner with public bodies with which it could work to integrate the guidelines into formal procedures.

Stakeholder feedback also indicated that the scale and cost the Celtic Seas Partnership over the years in developing the voluntary guidance, running engagement workshops and making recommendations about the need for management have been effective in getting to this stage, but that to progress the project further additional action will be needed:

- **Ensure that the guidelines are agreed and taken beyond their current voluntary status.** For example if industry bodies bought in and pushed for regulation based on these guidelines, significant impact could be realised.
- **Ensure that resources are made available for those who are tasked with regulation, monitoring and enforcement** of activities in relevant areas. For example, an industry levy on energy and shipping could help cover the costs, which would lead to future benefits through better management of the Celtic Seas.
- **Ensure compatibility and stability with the wider policy environment** as it is important for improved environmental management and the growth of renewables in the Celtic Seas. For example, a stable and predictable planning and regulation process can make investment more appealing and less risky.

Furthermore, focus could be placed on specific actions which enable the guideline recommendations to be realised as actual benefits. The specific actions which follow from the guideline recommendations that are most directly thought to lead to beneficial outcomes, as demonstrated in the outcome map, are as follows:

- Increased resources for governance and policy development
- Increased investment in renewable energy
- Streamlined consenting process
- Community engagement
- Networked stakeholders
- Information generated and made accessible

As such, it would make sense to focus resources to building on activities which contribute to these actions. In particular, much of the potential overall benefit identified in the model derived from either increased investment in offshore renewables or increased stakeholder engagement. This is perhaps unsurprising, but nonetheless highlights that policy and activities that increase, or remove barriers to, these actions occurring and feeding in to further action, will increase the likelihood of the realisation of wider benefits in the Celtic Seas.

Appendix 1. Assessing the impacts of the Celtic Seas Partnership co-existence guidelines

Six final benefits were modelled, these are considered the most material and realistic to measure:

- Value from economic contribution of marine renewables.
- Social value of job creation in maritime economy.
- Value from reduced CO_2 emissions through a shift towards renewables.
- Value from reducing the costs of offshore wind.
- Value from increased wellbeing.
- Value from improved environment and ecosystem services provision.

A model was created to estimate the total potential benefits of adoption of the guidelines based on these material benefits. The approach to modelling each of these benefits is discussed in turn in this section.

Value from economic contribution of marine renewables

Secondary data were used to model this outcome. The *Future Trends in the Celtic Seas* analysis report (the Future Trends report) estimated that GVA in the Celtic Seas was £15 billion in 2016. The same report also estimated that 0.3% of the Celtic Seas GVA in 2016 came from marine renewables. Combining these figures gives an estimate of £45,000,000 GVA from the marine renewables sector in 2016.

The Future Trends report estimated two growth scenarios – its lower scenario put GVA increase in marine renewables at 3.5% per annum. We included this in our model as the growth rate in GVA over the five-year period from 2017 to 2021. Primary research, namely through stakeholder interviews, generated assumptions around attribution to the co-existence guidelines; that is, how much of the increase in GVA could be attributed to implementation of the guidelines. We were given a range of 1–3% attribution, and applied these figures as higher- and lower-bound estimates.

Social value of job creation in maritime economy

The Future Trends report estimated that between 2016 and 2036 there would be an increase of employment in the maritime economy in the Celtic Seas of between 22% and 32%, reaching 495,000-535,000 Full Time Equivalent (FTE) jobs. We modelled overall employment in the maritime economy, rather than just focusing on employment in marine renewables, because discussions in our original set of interviews implied that successful application of the co-existence guidelines could not only boost activity in the renewables sector, but also ensure that the growth of this sector did not damage other areas of employment supported by the Seas, for example fishing and tourism.

We calculated the annual growth rate over those 20 years – 1% in the low job growth scenario and 1.4% in the higher job growth scenario – and we removed a displacement value of 30%. Displacement accounts for the proportion of intervention outputs/outcomes accounted for elsewhere in the target area. For example, if the growth of marine renewables is not handled through good consultation with other maritime sectors, jobs could be lost in fishing. We followed Department of Work and Pensions guidance on displacement values which recommend 30% for demand-side interventions (i.e., increasing the supply of jobs) as opposed to supply-side interventions (focused on upskilling people).

We applied a financial proxy for the wellbeing value to an individual of having a job to the net job creation calculated above. The proxy value considers a person moving into full-time employment, outside of London (London values tend to be higher) of unknown age. The proxy covers the wellbeing benefits of moving into employment, and does not directly include their change in income. After applying this proxy to the lower, more conservative, estimates of new jobs (1%), we applied an attribution rate agreed through stakeholder consultation. This was 1% (lower bound) and 5% (upper bound).

Value from reduced CO_2 emissions through a shift towards renewables

To calculate the financial value of the reduction in CO_2 emissions, supported by the growth in renewable energy in the Celtic Seas, we modelled only offshore wind. Wave and tidal energy are still emerging technologies and are unlikely to have a material impact on UK renewables supply over the five years which the model covers.

We estimated the capacity of offshore wind in the Celtic Seas by using government figures to calculate the total amount of renewable energy produced by offshore wind in the UK between Q3 2015 and Q3 2016 (this is the most recent 12-month period with data available). To estimate the amount of this value applicable to the Celtic Seas, we compared the capacity of offshore wind in the Celtic Seas (2GW), to overall UK capacity of offshore wind (5GW). The Celtic Seas accounts for 40% of the UK's offshore capacity, with the assumption that this proportion of capacity remains constant when applied to electricity generation.

We calculated an annual growth rate for this figure by looking at the forecast for increased capacity in the Future Trends in the Celtic Seas: Baseline Report. This reports that in 2016, the Celtic Seas had 2000MW capacity, which would increase by 900MW by 2019, a 12% annual growth rate. To apply this growth rate, we made two assumptions: first that the increase in capacity would correspond to a similar increase in generation, and second that this growth rate would continue after 2019.

Having calculated the reduction in carbon from the growth of offshore wind generation (assuming that offshore wind generation, once operational, is carbon neutral), we applied a UK government carbon factor for electricity generation in the UK. This is the amount of CO_2e that is emitted per kWh of electricity generated. We used 2016 figures, as 2017 figures are not yet available. The estimated volume of CO_2e saved was valued with the projected

cost of carbon for each year in the forecast[22]. As this outcome and the outcome for the economic contribution of the marine renewables sector rely on the same event occurring – the guidelines supporting the development of more marine renewables – we applied the same attribution figures (1% as a lower bound and 3% as an upper bound).

Value from reducing the costs of offshore wind

We estimated the value of the reduction in the costs of offshore wind using cost estimates for projects commissioned in 2016 from the Department for Business, Energy, and Industrial Strategy (DBEIS). From its figures in 2016 and 2020, we calculated the annual rate of cost reduction as 1%. The difference in cost between each year and the base year was multiplied by the estimate of the amount of energy produced by offshore wind in the Celtic Seas. As this benefit and the benefits of the economic contribution of the marine renewables sector and reduced CO_2 emissions rely on the same event occurring – the guidelines supporting the development of more marine renewables – we have applied the same attribution figures (1% as a lower bound and 3% as an upper bound).[23]

Value from increased wellbeing

The benefits discussed so far are modelled based on existing forecast data. This did not exist for the outcome of increased wellbeing in coastal communities, so we began by building a hypothetical alternative scenario of the value of engagement that coastal communities would have in the absence of the implementation of the co-existence guidelines. We consulted with an expert on coastal communities and engagement to produce this alternative scenario.

We assume that there are two broad levels of engagement in a community consultation: 90% of those engaged could be categorised as 'light engagement' (approximately one day of involvement) and 10% could be categorised as 'heavy engagement' (approximately five days of involvement). WWF-UK estimates that the Celtic Seas Partnership has engaged with 375 stakeholders per year over the last four years. Applying the values and proportions of light/heavy engagement, this totals 525 days of engagement value per year. We used an opportunity cost method to estimate a proxy value for this, equivalent to income that could be lost by committing this time (the proxy used was a daily pay figure calculated from UK median weekly pay). We applied this proxy to the 525 days.

Consultation with experts on coastal communities suggested that 65–70% of this value would be achieved anyway through existing stakeholder engagement processes outside of the guidelines. This gave us a range of 30% (lower bound) and 35% (upper bound) of

[22] Figures obtained from DECC, 2015.

[23] One renewables developer interviewed was not UK-based. He noted that the costs of developing offshore wind outside the UK have been markedly different – between €50 and €80 on recent European projects. This he attributed to preliminary work taken on by government to de-risk projects before the tender procedure, to allow developers more clarity and a streamlined consenting process.

additional value created by the implementation of the guidelines which was applied to the value of the proxy over 525 days.

Value from improved environment and ecosystem services provision

To assess the value from improved environment and ecosystem services provision, or more generally from reduced environmental harm, a high-level ecosystem services approach was adopted. We used transfer values from *The Economics of Ecosystems and Biodiversity, Chapter 7: Estimates of Monetary Values of Ecosystem Services*[24] in order to place a monetary value on the ecosystem services provided by 'open oceans'. The value was generated as part of a meta-analysis of published academic papers producing monetary values for ecosystem services in biomes all over the world, and was found to be $13 to $84 per hectare of open seas per year (2007 $s).

This value is primarily derived from the provisioning service of food (i.e., fish) and regulating services of climate regulation (i.e., carbon sequestration and temperature modification), and to a lesser extent biological control, attributable to a well-functioning open ocean ecosystem (i.e. distinct from CO2 emission reductions and job creation resulting from a shift to marine renewables).

While a more developed ecosystem services approach would look at each service individually, as a high-level assessment we have applied the whole open ocean transfer value as a proxy[25]. While it may over count the value of some ecosystem services, many additional services which would be applicable have not been included in the development of this transfer value due to lack of evidence, and so overall is likely a conservative estimate. Additionally, we have adopted the lower end of the value range and only included values for which at least two sources are included. The figure was exchanged to GBP and uplifted to 2017 values, resulting in a value of £7.68 per hectare per year.

This value applied to the total area of the Celtic Seas, 93,177,700 hectares, gives an estimate for the total ecosystem services delivered by this open ocean ecosystem. Of this total value, it was estimated by stakeholders that should the environment be managed optimally, and environmental harm reduced or avoided, it would account for approximately a 5% improvement (or avoidance of harm) to the functioning of the ecosystem.

We then considered the attribution of this impact to the guidelines as being between 1% (lower bound) and 5% (upper bound), in line with other attribution estimates, to derive an overall estimate of the impact of the implementation of the guidelines on the environment and provision of ecosystem services.

[24] TEEB. (2010). Estimates of Monetary Values of Ecosystem Services Appendix C. Available at: http://es-partnership.org/wp-content/uploads/2016/06/TEEB-D0-App-C.pdf

[25] The value should be interpreted as representative only; it is not meant as a cashable economic value, but rather is thought to be an appropriate proxy value for the purposes of modelling this benefit.

Appendix 2. Future trend scenarios

While the future trend scenarios adopted for this report draw on the scenarios developed for the Future Trends report, they are not necessarily directly comparable. This assessment has been conducted at a high level with independent stakeholder input, and focuses on different aspects of the Celtic Seas context, namely those that may be impacted by the co-existence guidelines, within a five-year time frame. The assumptions used to build these scenarios are discussed in Table 4 below.

Table 4: Future trend scenarios assumptions

Benefit	Nature at Work	Local Stewardship
Value from economic contribution of offshore renewables	Pro-environmental attitude leads to an increased demand for renewable energy production. The estimated growth rate of renewables in the Celtic Seas rises from 3.5% per annum to 12% per annum (as quoted by Future Trends).	Increased interest in local energy production and local job creation leads to a marginal increase in renewables development from 3.5% per annum to 5% per annum.
Social value of job creation in maritime economy	A focus on renewables production leads to increased jobs in the maritime economy sector, but is offset by a reduction in investment in other more extractive industries. Overall the projected 1% per annum job growth rate is unaffected (based on Future Trends estimates).	A focus on local communities leads to increased investment in industries which support local employment. This increases the projected job growth from 1% per annum to 1.4% per annum (based on Future Trends estimates).
Value from reduced CO_2 emissions through a shift to renewables	Pro-environmental attitudes leads to an increased demand for renewables energy production, increasing investment for development and thus increased capacity. The estimated growth rate of offshore wind capacity increases from 12% per annum (based on Future	Interest in local energy production and a focus on job creation leads to an increase in renewables development, but as policy and investment are not consistently applied across the region, growth in overall capacity remains in line with 12% per annum (based on Future Trends estimates).

	Trends estimates) to 15% per annum.	
Value from reducing the costs of offshore wind	Greater environmental concern leads to government policy favourable to renewables, such as streamlined consenting processes reducing the cost of development. Rate of change moves from -1% (based on DBEIS estimate), to -1.5%.	Although some reduction in development costs through a streamlined consenting process reduces some costs, this is offset by a lack of consistent policy across the region. The rate of change remains the same at -1% (based on DBEIS estimates).
Value from increased wellbeing	Increased concern for the environment leads to a two-fold increase in direct community environmental engagement, from 375 (average of annual engagement levels with Celtic Seas Partnership) up to 750 people engaging per year.	Increase in local community focus leads to a four-fold increase in direct community engagement, from 375 (average of annual engagement levels with Celtic Seas Partnership) up to 1500 people engaging per year.
Value from improved environment and ecosystem services provision	Pro-environmental attitudes lead to an increase in environmental protection policies and activities which improve the environment and increase ecosystem services provision. The improvement rises from 5% (stakeholder estimate) to 7.5%.	Increase in concern for local produce, environmental jobs and marine- and coastal-related recreation and tourism leads to some pro-environmental activities, but increased focus on extractive industries, including fishing, to create local jobs also puts pressure on the local environment, countering some of this benefit to the environment. The improvement stays the same at 5% (stakeholder estimate).

Appendix 3. Semi-structured interview guide

[Intro] WWF-UK is working with the Celtic Seas Partnership project. The partnership aims to draw people together from across the Celtic Seas to set up collaborative and innovative approaches to managing their marine environment.

As part of this project, WWF-UK has commissioned NEF Consulting to conduct a socio-economic impact study to assess potential impacts of a set of co-existence guidelines that it has developed in partnership with many marine stakeholders.

NEF Consulting wishes to interview marine stakeholders such as yourself in order to understand the potential impacts of this project in your space.

Our role as researchers is to gather your honest and genuine views – there are no right or wrong answers.

The results of the study will be used to inform the project's future plans for development.

We want to understand impact of the guidelines. What do you think would happen if guidelines were followed compared to what would happen if they weren't?

How familiar are you with the Celtic Seas Partnership project?

[NOT FAMILIAR]

- (Did workshops and case studies if interviewee asks how the guidelines were developed)
- Best practice guidelines for co-existence of marine interests, designed to help those seeking to develop new projects reconcile competing interests that have been holding back renewables projects. The people regulating, people developing, and other interests (local people, conservation people, marine industries).
- Aim to help parties benefit from the knowledge/experience of others to understand how to build projects that have buy-in from lots of people whose interests may not necessarily be the same, and improve the environment by helping more sustainable projects to happen. Trying to address the fact that people don't like renewable projects. Some key points:
    - Communication:
        - Building trust early: more/better stakeholder consultation – early engagement, regular communication. Go beyond statutory processes. Allowing people to be involved at a time when their contributions can actually be effective and meaningful.
        - More data available for regulators and developers to help them understand challenges of similar projects.

- **Size of projects:** Staying at small/local scale: allows you to build better local links, targeting your project at local needs e.g. jobs.
- More trialling.
- Financial: compensation – for example either directly to affected industries or more broadly into something like a social fund for the local area.

[YES]

Where do you see its value?

[ALL]

1. What are [YOUR DEPARTMENT'S / ORGANISATION'S] interests in the Celtic Seas? What's the focus of the work you do?
2. What are the biggest challenges? What incentivises/dis-incentivises your organisation from undertaking and/or supporting the development of renewable energy infrastructure in the Celtic Seas?
3. When you're trying to get a new project off the ground, what things have you seen which have minimised the challenges around that?
4. How do current conflicts of interest in this area enable or disable effective policy-making and implementation?

[Then go into the outcomes spreadsheet.] We have an initial list of assumed/potential outcomes based on what we've read, and we want to run these by you to see how you think these outcomes manifest, if they actually would, and potentially considering other outcomes that you might expect to experience.

We're also trying to quantify these potential changes, so any estimates you can provide would be very useful – this isn't an exact science and we're looking for best estimates based on your expert judgement rather than exact figures.

1. Walk them through outcomes spreadsheet
2. Ask for any additional outcomes