OXFORD BROOKES UNIVERSITY

Mini review of current practice in the assessment of cumulative environmental effects of UK Offshore Renewable Energy Developments when carried out to aid decision making in a regulatory context

Report to NERC Marine Renewable Energy Knowledge Exchange Programme (MREKEP)

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1. Introduction

The marine energy sector is an industry which is worth £47bn to the UK economy[1]. This sector can also ensure the security of energy supplies, the reduction of the dependence on imported fossil fuels and protection of the environment by de-carbonizing the economy. Delays and/or rejections to renewable projects offshore or onshore could pose major challenges to the ability of the UK to meet its binding 2020 renewable energy targets[2].

The licensing procedures for marine development require the assessment of cumulative effects[3] where the consequences of multiple projects or activities create an effect greater than, or different to, that of the individual project. The assessment of the cumulative effects of developments poses a **major challenge**[4] for industry and regulators for a number of reasons:

1. Lack of 'certainty' of an effective assessment process resulting from inconclusive guidance
2. Inconsistent definition of the scope of assessment and the poorly defined concept of 'reasonably foreseeable' projects.
3. Uncertainty over project level effects (e.g. bird collision and cetacean displacement due to acoustic effect) which are compounded where a number of projects potentially contribute to the same effect
4. Very few significance thresholds have been defined, under which the cumulative effects of projects can be managed.

In order to seek to address these challenges there is a need to look at current practice in the cumulative effects assessment (CEA) process. Supported by funding from the Natural Environmental Research Council (NERC) Marine Renewable Energy Knowledge Exchange Programme (NERC MREKEP) a Mini Review has been carried out of current practice in the assessment of cumulative effects for UK offshore renewable energy projects (focusing on offshore wind farms (OWF)) in order to identify examples of good practice. Nine OWF developments consented during the two year period 2013 and 2014 were selected for evaluation. Those chosen included seven developments off the coast of England and two off the coast of Scotland. The review and evaluation was not intended to be critical, but rather to highlight differences in the approaches to the assessment process and to promote discussion of potential ways in which practice could be improved. The outcome of the review is provided in this report which is structured as follows:

- Section 1 sets out the contextual background for the Mini Review
- Section 2 summarises the regulatory and consenting processes and highlights variations in the process between England and Scotland
- Section 3 gives brief consideration of some of the current generic guidance on the assessment process.

[1] Marine Management Organisation (MMO) Corporate Plan 2013-2016
[2] DECC (2011) UK Renewable Energy Roadmap, p9 http://www.decc.gov.uk/assets/decc/11/meeting-energydemand/renewable-energy/2167-uk-renewable-energy-roadmap.pdf
[3] The phrases 'cumulative impacts' and 'cumulative effects' are often used interchangeably, in both industry and academia. In this report we use the term 'cumulative effects' in order to be consistent with the terminology in the EU Environmental Impact Assessment (EIA) Directive. Further discussion on terminology is given in Section 4 of this report
[4] Derived from the findings from earlier NERC MREKEP funded research which led to the production of 'Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms' published by RenewableUK in 2013

- Section 4 makes observations on the need to clarify terminology associated with cumulative effects assessment
- Section 5 presents the methodology for the evaluation of the OWF developments chosen for review
- Section 6 presents the results and ten case studies of aspects of practice
- Section 7 provides a discussion of the findings and consideration of future direction for practice
- Section 8 presents the overall conclusions of the Mini Review

The opinions expressed in this report are the authors own.

2. Regulatory requirements and consenting process for OWF

Cumulative effects result from the combined effect (additive and synergistic) of multiple developments and multiple effects. The effects from a single development may not be significant on their own, but when combined with others the resultant effect could be significant. The following section provides a brief outline of the regulatory requirement to carry out cumulative effects assessment for UK projects in England and Scotland and of the consenting process for OWF.

2.1.Regulatory requirements

All proposals for projects that are subject to the European Union (EU) Environmental Impact Assessment (EIA) Directive[5] must be accompanied by an Environmental Statement (ES) which contains the outcome of assessment of the likely significant environmental effects of the proposed development.

At the time the Mini Review was undertaken, the EU Directive was implemented for Nationally Significant Infrastructure Projects (NSIPs) in England & Wales through The Infrastructure Planning (Environmental Impact Assessment) (Amended) Regulations 2012. In Scotland it was through The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended by The Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008 (where applicable); and The Marine Works (Environmental Impact Assessment) Regulations 2007, as amended by the Marine Works (Environmental Impact Assessment) Regulations 2011 (where applicable).

The 2011 EU EIA Directive specifically refers to the need to consider the effects of proposed projects/developments on human beings, fauna and flora, soil, water, air, climate, the landscape/seascape, material assets and cultural heritage. It requires the assessment of the likely significant effects, covering the direct effects and any indirect, secondary, **cumulative,** short, medium and long-term, permanent and temporary, positive and negative effects at all stages of the project, and also of the measures envisaged for avoiding or mitigating significant adverse effects.

[5] The EU EIA Directive was first issued in 1985 (Directive 85/337/EEC). It went through three amendments (97/11/EC, 2003/35/EC, 2009/31/EC) before a consolidated directive was issued in 2011 (2011/92/EC). This was subsequently amended in 2014 (2014/52/EU)

Other relevant legislation or requirements which need to be taken into account for OWF developments include: EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna And Flora (commonly known as the 'Habitats Directive'); the EU Strategic Environmental Assessment Directive (2001/42/EC); the UNECE Convention on Environmental Impact Assessment in a Trans-boundary Context (commonly known as the ESPOO Convention). The requirements of these are considered briefly below:

- The Habitats Directive (92/43/EEC) requires that where a plan/project is likely to have a significant effect on a Natura 2000 site (i.e. Special Areas of Conservation (SAC) designated under the Habitats Directive or Special Protection Areas (SPA) classified under the EC Birds Directive (2009/147/EC codified version)), either individually or in combination with other plans/projects, then the proposed plan/project needs to have an Appropriate Assessment (AA) made of its implications for the SAC/SPA. The process of screening (Stage 1) for likely significant effects and, where appropriate, the undertaking of an AA (Stage 2) is known as a 'Habitats Regulations Assessment' (HRA). These Directives are implemented in the UK through The Conservation of Habitats and Species Regulations (2010), with additional legislation applying in Scotland for sites in Scottish waters beyond 22.2 km (12 Nautical Miles) of the coast.

- The Strategic Environmental Assessment (SEA) Directive (2001/42/EC) relates to the assessment of the effects of certain draft public plans and programmes (e.g. on land use, transport, energy, waste, agriculture, etc) on the environment. The SEA Directive states in Annex 1 of the Directive that it requires information to be provided on '*the likely significant effects on the environment, including on issues such as biodiversity, population, human health, fauna, flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage, landscape and the interrelationship between the above factors'*. In a footnote to the Annex is says *'These effects should include secondary, cumulative, synergistic, short, medium and long-term permanent and temporary, positive and negative effects'*. In 2009, the Department of Energy and Climate Change (DECC) completed the SEA of a draft plan/programme to hold further rounds of offshore leasing for wind and offshore oil and gas licensing in United Kingdom waters. During 2010, DECC updated and extended the scope of this report (the '*Offshore Energy SEA Environmental Report*'[6]) to enable further licensing/leasing for offshore energy (i.e. oil and gas, gas storage including carbon capture and storage (CCS) and marine renewables, including wind, wave and tidal devices).

- The Convention on Environmental Impact Assessment in a Trans-boundary Context (UNECE 1991), also known as the ESPOO Convention, stipulates that parties (i.e. countries and developers) should assess the environmental effects of projects that are likely to have significant adverse trans-boundary impacts. The assessment should be carried out at an early stage of planning for those projects and should include consideration of '*proposed activities with particularly complex and potentially adverse effects, including those giving rise to serious effects on humans or on valued species or organisms, those which threaten the existing or potential use of an affected area and*

[6] DECC (2011) Offshore Energy SEA Environmental Report (OESEA2)available from https://www.gov.uk/government/publications/uk-offshore-energy-strategic-environmental-assessment-2-environmental-report

those causing additional loading which cannot be sustained by the carrying capacity of the environment'.

2.2.Consenting processes

England and Wales

Nationally Significant Infrastructure Projects (NSIPs) in England and Wales are consented following an examination process introduced in the Planning Act 2008 (as amended by the Localism Act 2011). The key stages[7] are:

- **Pre-application** – the developer informs the Planning Inspectorate (as the Examining Authority) of their intention to submit an application. Extensive pre-application consultation is carried out by the developer on the proposals, including undertaking the full EIA which is a multi-stage process comprising[8]:
    - Screening (is there a requirement to carry out an EIA)
    - Scoping (what impacts and issues should be considered)
    - Description of the project/development action and alternatives
    - Description of the environmental baseline
    - Identification of key impacts
    - Prediction of impacts
    - Evaluation and assessment of significance of impacts
    - Identification of mitigating measures
    - Production of the Environmental Statement incorporating the findings

- **Acceptance** – a formal application (consisting of a number of key documents including the ES) is submitted to the Examining Authority. If the documentation is of the required standard, then the application is 'formally accepted for examination'
- **Pre-examination** – the Examining Authority hold a preliminary meeting to hear representations from interested parties; this meeting is chaired by an Examining Inspector and are audio recorded
- **Examination** – the Examining Authority give careful consideration of all evidence presented in the written documentation and during the hearings
- **Decision** – the Examining Authority prepare a report including a recommendation which is submitted to the Secretary of State who then makes a decision on whether the development should be consented
- **Post decision** – once the decision is made there is a six week 'window' in which the decision can be challenged in the High Court

Key aspects of the process are consultation with stakeholders throughout, which includes establishing 'statements of common ground' (SoCG). The process is also inquisitorial rather than adversarial. Transparency in decision making is also highly valued and the Planning Inspectorate places all documentation and audio recordings of hearings on their web based planning portal.

[7] For further information see the National Infrastructure Planning website at http://infrastructure.planningportal.gov.uk/application-process/the-process/

[8] Taken from Fig 1.1 – Important Steps in the EIA process in Glasson, J, Therivel, R and Chadwick A (2012) Introduction to Environmental Impact Assessment, Abingdon: Routledge (4th Edition)

Scotland

In Scotland, developments over 1 MegaWatt (MW) for offshore wind farms are consented by Scottish Ministers with the process being managed by Marine Scotland Licensing Operations Team. The legislative basis for the consenting process comes from Section 36 and Section 37 of Electricity Act 1989[9] . The decision making process, whilst similar to that in England and Wales, differs slightly in that although the process involves consultation with key stakeholders and the public, there is no requirement for public meetings unless 'important issues are raised'. If issues are raised then Ministers '*can decide to hold a Public Local Inquiry before decisions are taken'* [10]. All documents relating to the application are also available on the Marine Scotland website.

3. Brief consideration of selected current generic guidance on assessment process

This Mini Review has been informed by consideration of selected examples of international and UK guidance for practice, both generic and those particularly related to renewable marine energy developments. The documents reviewed provide a useful indication of the 'direction of travel' in the development of guidance on assessing cumulative effects. A list of the selected guidance is provided in Appendix A to this report.

Early generic guidance focused on defining and explaining the process and the 1999 EC guidance[11] is still often cited. More recent generic guidance builds on an evidence base of practice and has evolved from guidance on the assessment of particular receptors (e.g. birds) or valued attributes (protected habitats) to guidance for particular sectors (e.g. nature conservation organisations). Recent development are toward guidance being based on reviews of existing/good practice such as the Natural England '*Development of a generic framework for informing cumulative impact* [effect] *assessments related to Marine Protected Areas through evaluation of best practice'*[12] and the IFC (2013) '*Good Practice Guidance Note For Emerging Markets'*.

There is also a huge body of international academic literature on cumulative effects assessment. A useful accessible summary of some of the key literature is provided in the 2014 Natural England report cited above. Whilst a systematic review of the academic literature did not form part of this Mini Review of practice, it has been useful to consider the findings of a review of the international academic peer reviewed literature carried out by Duinker et al[13] in 2013 in which they highlight areas for improvement in cumulative effects assessment practice.

[9] Electricity Act (1989) Chapter 29 Section 36

[10] See Guidance on process available at http://www.scotland.gov.uk/Topics/marine/Licensing/marine/Section36

[11] Hyder (1999) Guidelines for the assessment of indirect and cumulative impacts as well as impact interactions. Brussels: EC DGX1 Environment, Nuclear Safety and Civil Protection.

[12] Natural England (2014) '*Development of a generic framework for informing cumulative impact* [effect] *assessments related to Marine Protected Areas through evaluation of best practice'* (Natural England Commissioned Report NECR147Available at http://publications.naturalengland.org.uk/publication/6341085840277504

[13] Duinker P N, Burbridge E I, Boardley, S R and Greig I A (2013) Scientific dimensions of cumulative effects assessment: toward improvements in guidance for practice. Environmental Review 21 pp40-52

The findings by Duinker et al of the challenges to effective cumulative effects assessment mirror those stated in section 1 of this report. Duinker et al recommend that in order to improve the effectiveness of cumulative effects assessment practice, future guidance needs to focus on a number of factors including:

- Defining concepts of cumulative effect (they suggest simple sentences are not sufficient and conceptual frameworks are needed)
- The use of scenarios and particularly an expanded definition of what are 'reasonably foreseeable projects'
- The evolution of analytical methods (which needs to be reflected and made transparent in records of the outcome of assessment)
- The importance of collaboration of relevant stakeholders and implementation of appropriate governance models (which needs to be acknowledged and addressed)
- The use of thresholds and balancing the precautionary approach
- Strengthening follow-up and monitoring post consent
- Sharing of knowledge accumulated

The importance of such factors have been identified by industry: previous work led by one of the authors of this report (Martin Broderick), which was also funded by NERC MRKEP, led to the development of the '*Cumulative Impact Assessment Guidelines: Guiding Principles for Cumulative Impacts Assessment in Offshore Wind Farms*' published by RenewablesUK (RUK) in 2013. These principles were developed collaboratively by industry, regulators and stakeholders and are reproduced in Text Box 1 below.

Text Box 1 – guiding principles for assessment of cumulative effects in OWF (Source RUK 2013)

1. Cumulative effects assessment is a project level assessment, carried out as part of a response to the requirements of the European EIA, Habitats and Wild Birds Directives, designed to identify potentially significant impacts of developments and possible mitigation and monitoring measures
2. Developers, regulators and stakeholders will collaborate on the cumulative effects assessment
3. Clear and transparent requirements for the cumulative effects assessment are to be provided by regulators and their advisers
4. Cumulative effects assessment will include, early, iterative and proportionate scoping
5. Boundaries for spatial and temporal interactions for cumulative effects assessment work should be set in consultation with regulators, advisers and other key stakeholders, in line with best available data
6. Developers will utilize a realistic Project Design Envelope
7. Developers will consider projects, plans and activities that have sufficient information available in order to undertake the assessment
8. The sharing and common analysis of compatible date will enhance the cumulative effects assessment process
9. Cumulative effects assessments should be proportionate to the environmental risk of the projects and focused on key impacts and sensitive receptors
10. Uncertainty should be addressed and where practicable quantified
11. Mitigation and monitoring plans should be informed by the results of the cumulative effects assessment

4. Clarifying terminology

Assessing cumulative effects is complex; it has been described as a 'dark art', a 'wicked problem' and by Hegmann and Yarranton (2011)[14] as '*like forecasting weather or climate* [as] *the system under examination is complex and often responds to disturbance in a non linear fashio*n'. There are therefore many definitions of cumulative effects, depending on the context of the publication. In academic endeavours it is often felt necessary to devise a 'unique' definition to accompany a new piece of research: in their review Duinker et al include ten 'unique' definitions extracted from a range of peer reviewed literature in order to highlight this. However, Duinker et al also argue that whilst the literature is '*replete with definitions, conceptions, and classifications, with great diversity of direction and utility*' due to the complex nature of cumulative effects they propose that a short, universally agreed definition would be insufficient to guide practice. Rather they propose that a '*detailed conceptual analysis of the meaning of cumulative effects'* is warranted and that future efforts should focus on elaborating '*strong principles and protocols'* for cumulative effects assessment.

We concur that best practice is to clearly set out the concepts and definitions of cumulative effects assessment. However, we disagree that a short definition is insufficient to guide practice. In the following section we set out the definition we have used in this Mini Review to frame our work:

> Cumulative effects[15] are "*those that result from **additive** impacts caused by other past, present or reasonably foreseeable actions together with the plan, programme or project itself and s**ynergistic** effects (in- combination) which arise from the reaction between impacts of a development plan, programme or project on different aspects of the environment* "

This definition is also that included in the RUK (2013) Guiding Principles.

When undertaking an assessment of the cumulative effects of developments it is therefore important to recognise and consider two 'types' of cumulative effects: additive and synergistic. In order to help bring some transparency to the complex 'dark art' of cumulative effects assessment. We aim to and clarify some of the confusion in Table 1 below where we identify how these are often termed differently in regulations and in selected guidance documents:

[14] Hegmann G and Yarranton G A (2011) Alchemy to reason: Effective use of Cumulative Effects Assessment in resource management. Environmental Impact Assessment Review 31 pp484-490

[15] As mentioned previously, in legislation, regulations, industry and in practice, 'impacts' and 'effects' are often used interchangeably. However, the terms are different: e.g. to use the analogy of the hammer hitting and breaking a mirror, the 'impact' is the hammer hitting the glass, the 'effect' is the broken glass on the floor. The authors recognise the difference but have adopted to use the single term 'effects' as this is the vernacular term applied in the EU EIA and HRA directives.

Table 1 – Terminology to describe cumulative effects

Additive Effects: *those that result from **additive** impacts caused by other past, present or reasonably foreseeable actions together with the plan, programme or project itself*	• EIA Directive (2011) refers to these as **'cumulative effects'** • EC/Hyder (1999) guidance refers to these as **'cumulative impacts'** • SEA Directive refers to these as '**cumulative impacts'** • EC Habitats Directive refers to these as **'in-combination effects'**
Synergistic Effects: *which arise from the reaction between impacts of a development plan, programme or project on different aspects of the environment*	• EIA Directive (2011) refers to these as **'interrelationships'** [no hyphen] and effect **'interactions'** • EC/Hyder (1999) guidance refers to these as **'impact interactions'** • SEA Directive refers to these as **'in-combination or synergistic'** impacts • EC Habitats Directive does not refer to these separately

The language used in the EIA, HRA and SEA directives has caused practitioners and regulators considerable confusion. Adoption of the terms 'additive' and 'synergistic' as in the RUK 2013 definition and that used for this study will, we believe, clarify the situation.

5. Evaluation of cumulative effects assessment practice for OWF developments

5.1. Choice of OWF projects to generate case studies

The aim of the Mini Review was to look at examples of practice in the assessment of cumulative effects during the EIA for marine renewable energy projects around the UK, focussing on OWF. An OWF development comprises offshore energy generating infrastructure with offshore and onshore transmission infrastructure. For the Mini Review the focus was confined to the practice of assessing cumulative effects of the offshore energy generating infrastructure only.

To ensure the review was of current rather than historic practice the primary rationale for choosing which developments to review was that they were recently consented. Secondary selection criteria included having representatives of different development contexts (e.g. extension to existing windfarm or standalone development) and geographical locations. Relevant developments were identified from the Nationally Significance Infrastructure Projects (NSIPS) web portal accessed through the Planning Inspectorate (England and Wales) and from the Marine Scotland web portal.

The consented developments selected for inclusion in the Mini Review are listed in Table 2.

Table 2 – OWF consented developments chosen for review

Name of project	Date of Secretary of State/Scottish Ministers decision	Justification for selection
Kentish Flats Extension OWF	19th February 2013	• Extension to existing OWF • Located close to shoreline off Kent coast (east of England)
Galloper OWF	24th May 2013	• Sited in close proximity to another project (Great Gabbard OWF) • Located off Suffolk/Essex coast (east of England).
East Anglia ONE OWF	17th June 2014	• Surrounding area is classed as 'priority development' for future development • Located off Suffolk coast (east of England).
Rampian OWF	16th July 2014	• No other OWF projects in close proximity • Located off the Sussex coast (south of England).
Walney Extension OWF	7th November 2014	• A number of other projects in the vicinity • Located off the Lancashire/Cumbria cost (north west of England)
Hornsea OWF (Zone 4) Project One	10th December 2014	• Large project • Located off the East Yorkshire coast (east of England)
Burbo Bank Extension OWF	26th September 2014	• Extension to existing OWF • Located off the north Wales coast.
Inch Cape OWF	10th October 2014	• Recently consented OWF • Located off the east coast of Scotland
Beatrice OWF	19th March 2014	• Recently consented OWF • Located off the north east coast of Scotland

5.2.Development of methodology

The evaluation evidence was generated by undertaking a comparative analysis of the content of a number of artefacts (such as scoping reports and environmental statements) generated during the EIA and decision making processes. An analytical framework was devised to aid in the comparative study, the criteria selected to be included in the framework were informed by drawing on the following resources:

- 'Quality assurance checklist' from Cooper (2004) *Guidelines for cumulative effects assessment in SEA of plans*. EPMG Occasional Paper 04/LMC/CEA, Imperial College London
- 'Section 5.2 Key criteria for best practice' from World Bank/ESMAP (2012) *Sample guidelines: cumulative environmental impact* [effects] *assessment for hydropower projects in Turkey*

- 'Example of emerging OWF industry practice approaches' from Broderick, Tinsley and Pearson (2012) *Literature review supporting 'Guiding Principles for Cumulative Impact* [effects] *Assessment*' (unpublished report)
- 'CEA assessment checklist' from Broderick (2014) *CEA Workshop*, Oxford Brookes University, UK, 7th April 2014

An initial version of the framework was tested on one of the chosen developments and then slightly modified. The final version of the analytical framework is contained in Appendix B to this report.

As this was a Mini Review and therefore resource constrained, it was necessary to set 'bounds' to the study. The study therefore focussed on:

- the marine energy generating infrastructure aspects of the development only
- the assessment of direct cumulative effects assessment and not the assessment of in-direct effects
- the assessment of practice as codified in relevant artefacts including scoping reports, scoping opinions, the environmental statement, decision makers' reports. Any Appropriate Assessments that were also generated during the application process (see section 2.1) were not included.

Other than the authors of this report there has been no other practitioner, developer or decision maker input to the study. The opinions expressed are the authors own.

6. Findings of the evaluation

The review comprised undertaking a comparative content analysis of key artefacts accessed via the Planning Inspectorate or Marine Scotland web portals. A five step analysis was adopted:

1. Review of decision letter issued by the Secretary of State/Scottish Ministers to identify any contentious issues in the development
2. Review of the Scoping Report produced by the proponent/proponent's consultants
3. Review of the Scoping Opinion issued by the examining authority
4. Review of the Environmental Statement's Non-Technical Summary
5. Review of selected chapters of the Environmental Statement:
    a. Introduction chapter
    b. Methodology chapter
    c. One subject specific chapter
    d. Cumulative effects chapter (where present)

The analysis aimed to identify whether and where each of the 32 criteria in the analytical framework (Appendix B) were addressed in the documentation reviewed. However, none of the projects reviewed addressed all of the criteria. To some extent this was not unexpected as cumulative effects assessment is complex and practice globally is considered to be poorly executed[16]. It was possible to identify aspects of practice that were consistent across some of the studies and to confirm aspects of practice that Duinker et al had identified as needing to be focussed on in guidance in order to improve practice.

[16] See for example Noble, B (2015) Cumulative effects research: achievements, status, directions and challenges in the Canadian context. Journal of Environmental Assessment Policy and Management 17 (1)

Five aspects of practice have been identified which are:

- Influence of decision makers in shaping practice
- Use of cumulative effects assessment guidance/methodologies
- Transparency of methodologies
- Consistency in use of terminology
- Use of evidence and building on practice

Ten short case studies (two for each of the five areas of practice) have been generated drawing on examples of practice from the OWF. In each case study a description of the development is provided along with a brief summary of the aspect of practice and the sections of the analytical framework that it relates to. An observation on the implications for practice and key references are also provided. As mentioned in the Introduction to this report, the aim of the study is not intended to be critical but rather to promote discussion on potential ways in which practice could be improved.

6.1 Influence of decision makers in shaping practice

It was noted that for some projects the cumulative effects assessment methodology changed over the timescale of the assessment (i.e. from that described in the scoping report to that in the final environmental statement). This was due to the influence of unanticipated factors, particularly guidance on cumulative effects assessment practice provided by the examining authorities, statutory stakeholders and regulators.

As described in Section 2.2 of this report the consenting process involves a number of stages of consultation with the examining authority and other key stakeholders. Within documentation deriving from this it is possible to see how these stages can be transformative in the cumulative effects assessment practice. Case Studies 1 and 2 are examples of this.

Case study 1: Influence of decision makers in shaping practice

Proposed Development:

This application was for an extension to the existing and operational Burbo Bank OWF located in Liverpool Bay off the north west coast of England. The existing OWF had been operational since 2007 and consisted of 25x3.6MW turbines (90MW energy generating capacity in total) over a 10km^2 area. The proposed extension comprised an area of 40km^2 and 'estimated capacity of 169 to 234MW'. The extension was consented under the Planning Act (2008) by the Secretary of State in September 2014.

A Scoping Report for the proposed development was published by the proponent in in July 2010. Section 3.6 of the Scoping Report addressed '*Cumulative and In-Combination Impacts* [Effects] *and Appropriate Assessment'*.

The section aimed to define the terminology being used, although with some confusion: '*cumulative refers to all other wind farm projects while in-combination refers to other marine projects or licensed activities, for example, marine aggregate extraction'* . The report also listed activities occurring in the area as well as a number of existing OWF which it stated *'will need to be considered in relation to the cumulative and in-combination impact assessment offshore*'. It also listed '*proposed cumulative impact studies which would need to be carried out'*.

The Planning Inspectorate's Scoping Opinion '*sets out what information [it] considers should be included in the ES'* for the proposed Burbo Bank OWF and is produced in response to the Scoping Report. It reaching its opinion the Inspectorate takes into account responses from statutory consultees and also uses '*professional judgement and experience in order to come to this Opinion*'. In a number of places in the Opinion there is advice for the applicant on how to address cumulative effects. The Opinion notes the applicant's intention to consider cumulative and in-combination effects and provides a description of these which it suggests is an approach that '*should be considered'* by the applicant. This is described on p.60 of the Scoping Opinion as:

Impact Inter-actions/Combined Impacts

Multiple impacts on the same receptor should be taken into account. These occur where a number of separate impacts, e.g. noise and air quality, affect a single receptor such as fauna.

The Commission [Planning Inspectorate] *considers that the combined effects of the development should be assessed and that details should be provided as to how interactions will be assessed in order to address the environmental impacts of the proposal as a whole.*

Cumulative Impacts

The ES should describe the baseline situation and the proposed development within the context of the site and any other proposals in the vicinity. Other major development in the area should be identified beyond the proposal itself including all the associated development. The Commission recommends that this should be identified through consultation with the local planning authorities on the basis of major developments that are:

- *built and operational;*
- *under construction;*
- *permitted application(s), but not yet implemented;*
- *submitted application(s) not yet determined, and if permitted would affect the proposed development in the Scoping Report; and*

- *identified in the Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited.*

Details should be provided in the ES, including the types of development, location and key aspects that may affect the EIA and have been taken into account as part of the assessment.

Related sections on the CEA Analytical Framework (Appendix B): 2, 3, 5, 6, 8, 9, 10, 11

Implications for practice:

Whilst the proponent scoping report aimed to address cumulative effects, the terminology was not conceptually accurate and the approach was not comprehensive. This case study shows how decision making bodies can help to shape good practice and highlights that development of effective EIA practice should occur collaboratively.

Key references:

Dong Energy (2010) Burbo Bank Extension Offshore Wind Farm. Environmental Impact Assessment Scoping Report. July 2010. Available from http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/1.%20Pre-Submission/EIA/Scoping/Scoping%20Request/100708_EN010026_EIA%20Scoping%20Report.pdf

Infrastructure Planning Commission (2010) Scoping Opinion Proposed Burbo Bank Extension Offshore Wind Farm, Liverpool Bay. August 2010 http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/1.%20Pre-Submission/EIA/Scoping/Scoping%20Opinion/100817_EN0100026_202047%20FINAL%20Burbo%20Bank%20Scoping%20Opinion.pdf

Case study 2: Influence of decision makers in shaping practice

Proposed development:

The application was for a proposed OWF in the outer Firth of Tay region off the east coast of Scotland. The site was located approximately 15-22km off the coast and anticipated to consist of approximately 180 turbines covering an area of about 150km^2 with an estimated capacity of 1,000MW. The development was consented by the Scottish Minister under Section 36 of the Electricity Act (1989) in October 2014.

A scoping report was published by the proponent in 2010. The report presented details of the *'baseline environment in an around the proposed Inch Cape development site…[and] …also identifies potential impacts that may arise as a result of this development, directly, cumulatively with other offshore wind farms and in combination with other developments'* .

Section 3 of the Scoping Report addressed *'cumulative and in-combination impact'* and defines these in the following terms:

'A cumulative effect could potentially arise as a result of two or more similar types of developments being constructed (i.e. wind farms and other wind farms)

An in-combination effect could potentially arise as a result of one type of development and different projects and/or activities (e.g. wind farms in combination with dredging or wind farms in-combination (sic) with shipping

All current and foreseeable projects and activities in the study area which may interact to result in cumulative and in-combination effects have been considered. Activities and projects associate with the following sectors will be further studied as part of the EIA.

- *Offshore wind farms*
- *Commercial fisheries*
- *Shipping and navigation*
- *Waterfront and coastal development*
- *Military activities*
- *Cables and pipelines*
- *Tourism and recreation'*

The Marine Scotland Scoping Opinion issued in response to the proponent's scoping report, includes the response from Scottish Natural Heritage (SNH), a statutory consultee in the EIA process. In their response SNH include details of the recommended methodology to assess the landscape and visual impact of the proposal. The guidance provided is quite specific, including details of how to draw up a 'full' (or long) list of viewpoints which need to be considered' and then a subsequent shortlist.

The response also highlights aspects of the methodology given in the scoping report which could be considered weak practice as it may lead to 'pre-determing' the outcome of the assessment. To improve the practice SNH advise that the 'baseline' needs to be defined first and 'the relative sensitivities established prior to determining the significance of the development's impacts'. SNH also advises that for effective assessment of cumulative effects on landscape and visual components a proposed collaborative approach with other offshore windfarm developers be adopted via the Forth and Tay Offshore Wind Developers Group.

The outcome of the EIA did indicate '*that the Development would have visual impacts that range from negligible to major depending upon where the viewer is situated'*. It is conditioned in the development consent a Design Statement 'prepared and signed off by at least one qualified landscape architect' must be submitted to Scottish Ministers prior to commencement of the development.

Related sections on the CEA Analytical Framework (Appendix B): 2, 3, 5, 6, 8, 9, 10, 11, 14, 15, 18, 20, 21

Implications for practice:

Whilst the proponent scoping report aimed to address cumulative effects, the terminology was not conceptually accurate and the approach was not comprehensive. In this case study a statutory consultee is providing guidance which is leading to improvement in practice. The guidance is detailed and specific and also highlighted potential weak practice. It also recommended a collaborative approach to assessment. The outcome of the assessment does identify the development will have significant visual impacts.

Key references:

SeaEnergy (2010) Inch Cape Offshore Wind Farm Environmental Impact Assessment Scoping Report August 2010. Available at: http://www.gov.scot/Resource/0046/00460548.pdf

Marine Scotland (2011) Inch Cape Offshore Wind Farm, Outer Firth of Tay Scoping Opinion January 2011. Available at: http://www.gov.scot/Resource/0046/00460547.pdf

Marine Scotland (2014) Section 36 Decision Letter dated 10th October 2014. Available at: http://www.gov.scot/Resource/0046/00460543.pdf

6.2 Use of cumulative effects assessment guidance

There has been a marked increase in the publication of guidance and methodologies in cumulative effects assessment particularly in the last few years and particularly in relation to specific factors. However, it is not always clear that the guidance has been used. These two case studies give examples of attempts to clarify what guidance has been drawn on.

Case study 3: use of cumulative effects assessment guidance/methodologies
Proposed development: This application was for a new OWF development located in the southern North Sea approximately 43km off the Suffolk coast, east of England. The proposed development was for up to 325 wind turbines with a generating capacity of 1,200 MW covering an area of 300km^2. The proposals considered the potential for utilizing 'a combination of up to three different capacity turbines between 3.0 and 8.0 MW. The development was consented under the Planning Act (2008) by the Secretary of State in June 2014.
Chapter 5 of the ES, published in November 2012, sets out the 'Approach to EIA' including the methods by which 'cumulative and combined impacts' have been assessed. In addition to relevant Directives and regulatory requirements the document also refers to advisory documents it states have been given 'due regard' in carrying out the EIA. These include relevant guidance on assessing cumulative effects available at the time i.e. • IPC [PINS] advice note 9 – Rochdale Envelope. Provides guidance on projects that should be considered in an assessment of potential cumulative effects • King et al (2009) Developing guidance on ornithological cumulative impact assessment for offshore windfarm developers. COWRIE. Crown Estate Use of the PINS guidance results in a 'long list' of projects which are considered for inclusion in the assessment of cumulative effects.
Related sections on the CEA Analytical Framework (Appendix B): 1, 3, 11, 14
Implications for practice: The use of existing guidance ensures that there is consistency in how effects are assessed and also provides confidence in the assessment process.
Key references: East Anglia Offshore Wind Limited (2012) East Anglia ONE OWF Environmental Statement Volume 1 Introduction. Document reference 7.2.5 Chapter 5 – Approach to EIA. Available at: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010025/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.2.5%20Volume%201%20Chapter%205%20Approach%20to%20EIA.pdf

Case study 4: use of cumulative effects assessment guidance/methodologies

Proposed development:

This application was for an extension to the existing and operational Burbo Bank OWF located in Liverpool Bay off the north west coast of England. The existing OWF had been operational since 2007 and consisted of 25x3.6MW turbines (90MW energy generating capacity in total) over a 10km^2 area. The proposed extension comprised an area of 40km^2 and 'estimated capacity of 169 to 234MW'. The extension was consented under the Planning Act (2008) by the Secretary of State in September 2014.

Chapter 36 in Appendix 4 of the ES for this development presents a summary of the assessment of potential cumulative impacts of the project. It identifies where within relevant legislation and guidance there are requirements to carry out an assessment of 'in-combination and cumulative impacts' including:

- Schedule 4 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended 2011, 2012)
- National policy statement EN-1 (overarching policy statement for energy)
- National policy statement EN-3 (renewable energy infrastructure)

It also reiterated the guidance provided by IPC [PINS] in its scoping opinion published in December 2010 as to the categories of combined and cumulative impacts.

Related sections on the CEA Analytical Framework (Appendix B): 1, 2, 3, 5

Implications for practice:

The outcome of following guidance/methodologies is confidence in the robustness of the assessment. In this case a detailed 'long list' of plans and projects which had been screened for consideration in the cumulative effects assessment are included in the chapter

Key references:

Dong Energy (2013) Burbo Bank Extension Offshore Wind Farm Environmental Statement Volume 4 – Chapter 36: in-combination and cumulative impacts. March 2013. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/5.1.4.36%20In-combination%20and%20Cumulative%20Impacts.pdf

Schedule 4 of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2009 (as amended 2011, 2012). Available from: http://www.legislation.gov.uk/uksi/2009/2263/pdfs/uksi_20092263_en.pdf

National policy statement EN-1 (overarching policy statement for energy). Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47854/1938-overarching-nps-for-energy-en1.pdf

National policy statement EN-3 (renewable energy infrastructure). Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/47856/1940-nps-renewable-energy-en3.pdf

6.3 Transparency of methodology

As much of the guidance has been narrow and specifically focused on particular aspects so the general impact on transforming practice has been limited to date. The ES documentation is not always clear on the methodology adopted in carrying out the cumulative effects assessment, therefore the accuracy of the assessment could be challenged. More general guidance is starting to appear and there is evidence of their use in the more recently consented developments. These two case studies represent examples of good practice.

Case study 5: Transparency of methodology

Proposed development:

This application was for a development in the southern North Sea, off the east coast of England. The proposed development would comprise up to 240 wind turbines with a gross electrical generating capacity of 1200MW located approximately 100km off the coast of the East Riding of Yorkshire in an area covering 407km. The proposals were that either two or three windfarms would be constructed within a project 'envelope'. The development was consented by the Secretary of State in December 2014 with the restriction that consent for '*Work No. 3 is subject to the limitation that they cannot be built if more than 80 wind turbines are constructed as part of Work Nos. 1 and 2'* .

The ES included an Annex (4.5.1) which documented the approach taken to assessment the cumulative, transboundary and inter-related effects with regard to the offshore elements of the development. The onshore elements were addressed separately, although the document noted that this *'does not negate the requirement of the offshore EIA to consider onshore projects and plans, where they may have cumulative effects with the offshore elements'.*

In developing its methodology, the authors of the document highlight the influence of advice from PINS issued in their scoping opinion and on the outcome of consultations undertaken in January 2014 (phase 4 of consultations). They also state that the '*the approach to cumulative assessment for Project One takes into account the Cumulative Impact Assessment Guidelines issued by RenewableUK in June 2013*'.

Examples of good practice:

- States what has been included in the baseline assessment and explains how the 'long list' of plans, projects and activities to be considered has been devised
- Explains how the spatial and temporal ranges have been identified
- Provides a clear explanation of methodology for 'screening' projects in or out of the assessment process – see Figure below which is taken from the document

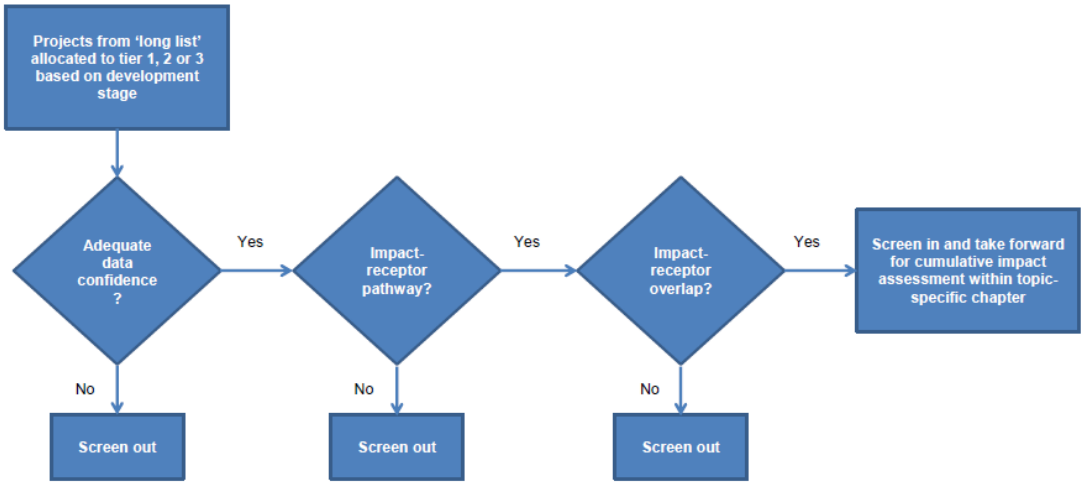


Figure 3.1: Methodology for screening projects/plans in or out of the cumulative impact assessment for Project One.

The results of the screening are presented in tables which are easily understandable – see example extract below:

Table 3.3 Example screening matrix for Project One cumulative impact assessment (full project/plan screening matrix provided in Appendix B).

	No effect receptor pathway. **Screened out.**
	Potential effect receptor pathway, but no potential for overlap between effect and receptor extents. **Screened out.**
	Potential effect receptor pathway and potential for overlap between effect and receptor extents. **Screened in.**
	Low or very low data confidence: Screened on a case by base basis in each topic.

Development	Distance from Hornsea Project One (offshore array) (km)	Status of Development	Data Confidence	Physical Processes	Benthic Ecology	SVIA	Fish & Shellfish Ecology	Marine Mammals	Ornithology	Marine Archaeology & Ordnance	Shipping & Navigation	Aviation, Military & Communications	Commercial Fisheries	Infrastructure & Other Human Users (marine)	Waste & Air Quality
Hornsea Zone - Project One	N/A	Pre-application	High												
Hornsea Zone - Project Two	<1 km	Pre-application	Medium												
Dogger Creyke Beck - Projects A & B	50-100 km	Pre-application	Medium												
Dogger Teesside - Projects A & B	50-100 km	Pre-application	Low												
Dogger Teesside -	50-100 km	Pre-application	Low												

Related sections on the CEA Analytical Framework (Appendix B): 1, 3, 8, 9, 10, 11, 12, 14, 20, 21

Implications for practice:

This example demonstrates the benefits of transparency in methodology of assessment and also provides an example of good practice for other practitioners to reflect on.

Key references:

SmartWind (2013) Hornsea Offshore WindFarm Project One. Environmental Statement Volume 4 Introductory Annexes – Annex 4.5.1 Cumulative, Transboundary and Inter-relationships Document.

Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010033/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.4.5.1%20Cumulative%20Transboundary%20and%20Inter-related%20Effects%20Document.pdf

DECC (2014) Planning Act 2008 – application for the Hornsea One Offshore Wind Farm Order. Secretary of State decision letter dated 10th December 2014. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010033/3.%20Post%20Decision%20Information/Other/Hornsea%20Offshore%20Wind%20Farm%20Notice%20of%20Secretary%20of%20State%20Decision%20and%20Statement%20of%20Reasons.pdf

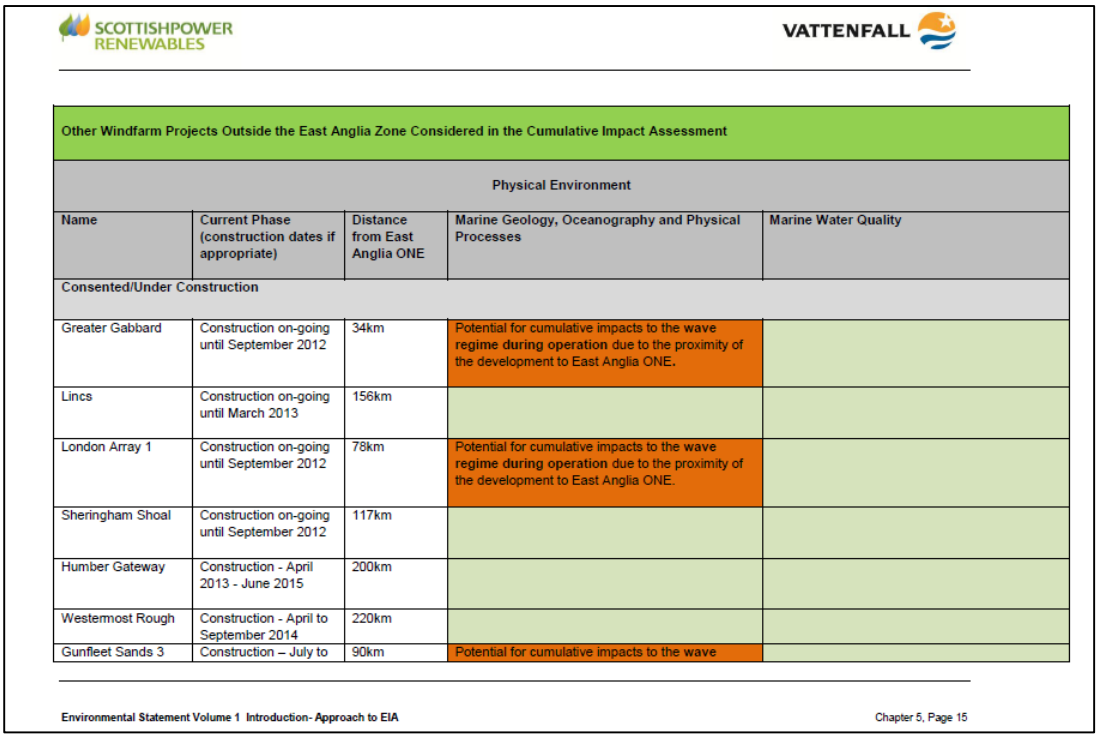
Case study 6: transparency of methodology

Proposed development:

This application was for a new OWF development located in the southern North Sea approximately 43km off the Suffolk coast, east of England. The proposed development was for up to 325 wind turbines with a generating capacity of 1,200 MW covering an area of 300km^2. The proposals considered the potential for utilizing 'a combination of up to three different capacity turbines between 3.0 and 8.0 MW. The development was consented under the Planning Act (2008) by the Secretary of State in June 2014.

Chapter 4 of Volume 1 of the ES (Description of the Proposed Development) notes that the southern North Sea is a 'relatively shallow sea' with water depths of typically less than 40m, although within the development site water depths vary between 31m and 53m.

Chapter 5 of Volume 1 (approach to EIA) includes consideration of the cumulative effects of the development as an integral part of the assessment process. Table 5.2 within this chapter is a useful example of how consideration of the assessment process can be presented – see screen capture below:



SCOTTISHPOWER RENEWABLES VATTENFALL

Other Windfarm Projects Outside the East Anglia Zone Considered in the Cumulative Impact Assessment				
			Physical Environment	
Name	Current Phase (construction dates if appropriate)	Distance from East Anglia ONE	Marine Geology, Oceanography and Physical Processes	Marine Water Quality
Consented/Under Construction				
Greater Gabbard	Construction on-going until September 2012	34km	Potential for cumulative impacts to the wave regime during operation due to the proximity of the development to East Anglia ONE.	
Lincs	Construction on-going until March 2013	156km		
London Array 1	Construction on-going until September 2012	78km	Potential for cumulative impacts to the wave regime during operation due to the proximity of the development to East Anglia ONE.	
Sheringham Shoal	Construction on-going until September 2012	117km		
Humber Gateway	Construction - April 2013 - June 2015	200km		
Westermost Rough	Construction - April to September 2014	220km		
Gunfleet Sands 3	Construction – July to	90km	Potential for cumulative impacts to the wave	

Environmental Statement Volume 1 Introduction- Approach to EIA Chapter 5, Page 15

As noted, the shallow water is a particular feature of this site. The potential cumulative effects on marine geology, oceanography and physical processes are described in Volume 2 (Offshore) Chapter 6.

The chapter explicitly addresses the potential for cumulative effects. The activities likely to contribute to cumulative impacts are stated (para 81 and table 6-9). A source-pathway-receptor model is used and consideration made of the spatial and temporal extent of the changes using scientific methodologies (modeling, use of equations for the settling characteristics of sediment and drawing on

existing knowledge base) to devise a 'conceptual understanding of the likely behaviour of material released during bed preparation activities' (para 127). The assessments of impact and assessment of significance are clearly presented e.g. in tabular form and discussed addressing baseline conditions, the evidence base , the conceptual understanding of effect of activities, assessment of effect and conclusion on significance. This assessment on individual activities ensures that the assessment of significance of cumulative effects is more transparent.

Impacts from Sediment Plume Interaction Associated with the Combined Activities of East Anglia ONE Offshore Cable Installation and Marine Aggregate Dredging									
Receptor Type	Sensitivity				Magnitude of Effect				Significance of Impact
	Value	Tolerance	Adaptability	Recoverability	Scale	Duration	Frequency	Reversibility	
Eroding and sensitive coast	High	High	Medium	High	Small to medium	Short term	Low	High	Not Significant
		Negligible			Low				
Offshore sand banks with conservation designations	High	High	Medium	High	Small to medium	Short term	Low	High	Not Significant
		Negligible			Low				

Extract from Table 6.33 impacts on Receptors Resulting from Sediment Plume Interaction Associated with the Combined Activities of East Anglia ONE Offshore Cable Installation and Marine Aggregate Dredging

Related sections on the CEA Analytical Framework (Appendix B): 1, 11, 12, 18, 19, 20, 21, 22, 23

Implications for practice:

This example demonstrates the benefits of transparency in methodology of assessment and also provides an example of good practice for other practitioners to reflect on.

Key references

East Anglia ONE Offshore Windfarm (2012). Volume 1 Introduction. Chapter 4 – Description of development. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010025/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.2.4%20Volume%201%20Chapter%204%20Description%20of%20Development.pdf

East Anglia ONE Offshore Windfarm (2012). Volume 1 Introduction. Chapter 5 – Approach to EIA. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010025/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.2.5%20Volume%201%20Chapter%205%20Approach%20to%20EIA.pdf

East Anglia ONE Offshore Windfarm (2012). Volume 2 Offshore. Chapter 6 – Marine Geology, Oceanography and Physical Processes. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010025/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.3.1%20Volume%202%20Chapter%206%20Marine%20Geology%20Oceanography%20and%20Physical%20Processes.pdf

6.4 Consistent use of terminology

As described in Section 4 of this report, the issue of confusion in terminology is prevalent within cumulative effects assessment practice. Confusion and variation occurs not only within the practitioner community, but also in policy and also in the stakeholder and regulator communities. Transparency on how key terms such as sensitivity and significance area also important

Case study 7: Consistent use of terminology

Proposed development

The application was for a proposed offshore wind farm in the Outer Thames Estuary, located approximately 27km (14.6 nautical miles) at its closest point to the Suffolk coast, east of England. The proposed development comprised up to 140 wind turbines with a gross electrical capacity of up to 504MW covering an area of 183km^2. The development was consented under the Planning Act (2008) by the Secretary of State in May 2013.

Clarity and consistency in the terminology when referring to cumulative effects is important. All stakeholders involved in the EIA process should be consistent in their use of terminology and in defining the concept of cumulative effects assessment, although this is not always the case. This case study compares the terminology used by various stakeholders in relation to this proposed windfarm development.

Definition given in the Proponent's scoping report (June 2010):

Cumulative Impact Assessment

1.5.10 Cumulative impact assessment (CIA) forms part of the EIA process. It considers the effects of the construction, operation and decommissioning of GWF in isolation, cumulatively with other offshore wind farm projects as well as with other non-wind farm related activities. Consultation has taken place with the Joint Nature Conservation Committee (JNCC), Natural England, Centre for Environment, Fisheries and Aquaculture Science (Cefas), the Marine and Fisheries Agency (MFA, prior to it becoming the Marine Management Organisation (MMO)) and Local Planning Authorities (LPA), with regard to cumulative considerations.

1.5.11 During this consultation it was made clear by the Government advisory bodies, that there is a potential conflict between the use of the phrases 'in-combination' effects and 'cumulative' effects. To date, within wider cumulative assessment work, the phrase 'incombination effects' has been used to discuss those effects arising from interaction between the project (e.g. the wind farm) and other non-related human activities (such as aggregate extraction or fishing).

1.5.12 However, under The Conservation of Habitats and Species Regulations 2010 and The Offshore Marine Conservation (Natural Habitats, &c.) (Amendment) Regulations 2010, the term 'in-combination' effects is used to describe impacts on the designated site arising from the interaction of any plans or projects that are not directly connected to its management (i.e. for conservation purposes).

1.5.13 Therefore, to provide a consistent approach throughout this EIA and to align with legislative terminology (as set out within the Habitats Regulations), the following approach will be adopted:

*The term **Cumulative effects** will be broadened to encompass all impacts of the GWF project that have the potential to overlap with any existing and reasonably foreseeable plan or project (be it other wind farms or non-related human activities). Within the EIA the cumulative impacts will be classified as follows:*

- *Effects within the project (to describe cumulative effects that occur between different aspects of the considered project); and*
- *Effects between other plans or projects (to describe cumulative effects between the considered project and external sources).*

*The term **In-combination effects** will be restricted to describing the effects of the GWF project with any other plans or projects on European designated sites.*

Definitions within statutory consultee responses contained within PINS Scoping Opinion (August 2010):

Local Authority response (July 2010):

Landscape and Visual Assessment Including Impact on Heritage Landscape

'For both off-shore and any associated on-shore developments (e.g. work compound, sub-station) the ES/EIA would need to provide:

- *An assessment of the cumulative impact of this development taken together with the other (a) operational wind farms, (b) permitted wind farms in the area and (c) development proposals likely to come forward'*

Ecology

'*The need to consider cumulative impact is a requirement of the EIA process. This is of particular importance when considering ecological impacts. Projects to be incorporated in such an assessment must include those in the past, present and foreseeable future. Projects to be incorporated in such an assessment must include not only other potential wind farms but also other types of project taking place in the marine environment or onshore so that all elements of the infrastructure are assessed.'*

MMO/CEFAS (August 2010):

Cumulative Impacts

'28. In order to address any cumulative impacts the EIA will need to assess the impact of the scheme in combination with other projects in the vicinity of the scheme. For example other wind farms such as Greater Gabbard Offshore Wind Farm, London Array Offshore Wind Farm, Gunfleet Sands Offshore Wind Farms, Thanet Offshore Wind Farm, as well as offshore Aggregate Dredging in the local area. This list is not compressive (sic) and is only included as an indication of developments that should be considered.'

JNCC/Natural England (August 2010):

2. Cumulative and in-combination effects

'One of the greatest areas of concern for this development in environmental terms is the potential for cumulative impacts arising with other operational, planned and in-construction marine activities in the area. This includes interaction with other wind farm developments (primarily the original Greater Gabbard wind farm of which this is an extension), but also other activities in this area such as other constructed wind farms in the Thames Strategic Area and marine aggregates.

Phase 1 of the London Array development - It is the opinion of JNCC and Natural England, that at this stage only this phase is required to be considered when undertaking an analysis of in-combination effects.

Should the timetable of the Galloper wind farm project proposal slip for any reason, it will be necessary to consider whether there is sufficient information to characterise the proposed development within Zone 5 and any subsequent work within the Thames Strategic Area, such as the extensions to Thanet or the Kentish Flats and any subsequent development of London Array, to incorporate into a cumulative impact assessment.

We consider that the assessment of cumulative and in-combination effects could be more robustly presented within the ES. We advise that in addition to the identification of potential cumulative and in-combination effects under sub-chapters within the ES, there should be an additional chapter/section dedicated to cumulative and in-combination effects which summarises and discusses all the issues identified under each topic heading, and presents the topic in its entirety. It is critical that cumulative impact assessment is thoroughly considered at the scoping stage, so that it can be undertaken robustly.

For example, the developer could present their activities in a table format and define what they consider to be the activities to be considered in-combination with the proposed development, considering both the spatial and temporal aspects. It may be useful to present this for each phase of development (i.e. construction, operation and decommissioning) as this would clearly set out which effects are likely to be short-term in nature, and which are more likely to be lasting effects.

With respect to the above cumulative and in-combination issues relating to birds and marine mammals, it is clear that due to the wide ranging and mobile nature of such species, both the assessment and potential mitigation would be more easily addressed at a wider level. It is therefore pertinent to note that there is a (Greater Thames Environmental Forum) set up to discuss issues of ecological relevance and to encourage developer co-operation enabling assessment of cumulative impacts at a more informative regional level. This will be of particular significance for bird species (e.g. red-throated diver of the Outer Thames pSPA) and marine mammals (e.g. harbour porpoise).'

Related sections on the CEA Analytical Framework (Appendix B): 2, 3, 4, 5, 6, 11

Implications for practice

The extracts from the scoping documents demonstrate that it is important to have clear definitions to aid in establishing the methodology for cumulative effects assessment.

Key references

SSE Renewables Development UK Ltd & RWE Npower Renewables Ltd (2010) Galloper Wind Farm Project Scoping Study. June 2010 Final Report . Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010003/1.%20Pre-Submission/EIA/Scoping/Scoping%20Request/Galloper-Scoping-report_web.pdf

IPC (2010) Scoping Opinion Proposed Galloper Wind Farm Project. August 2010. Available at: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010003/1.%20Pre-Submission/EIA/Scoping/Scoping%20Opinion/100817_EN010003_202166%20Final%20GALLOPER%20scoping%20opinion.pdf

Case study 8: consistency in use of terminology

Proposed development:

This application was for a development in the southern North Sea, off the east coast of England. The proposed development would comprise up to 240 wind turbines with a gross electrical generating capacity of 1200MW located approximately 100km off the coast of the East Riding of Yorkshire in an area covering 407km^2. The proposals were that either two or three windfarms would be constructed within a project 'envelope'. The development was consented by the Secretary of State in December 2014 with the restriction that consent for '*Work No. 3 is subject to the limitation that that cannot be built if more than 80 wind turbines are constructed as part of Work Nos. 1 and 2*' .

Whilst setting out the conceptual understanding of what cumulative effects are and how they will be assessed is vital for ensuring the assessment is transparent, there are other aspects of the assessment which also need to be clearly established to ensure the assessment is robust. Good practice in cumulative effects assessment is to use a source-pathway-receptor conceptual model and vital to this is establishing the sensitivity of the receptors and defining significance.

For this proposed development an 'iterative' approach was adopted for the EIA as summarized in Figure 7.1 from the Non Technical Summary:

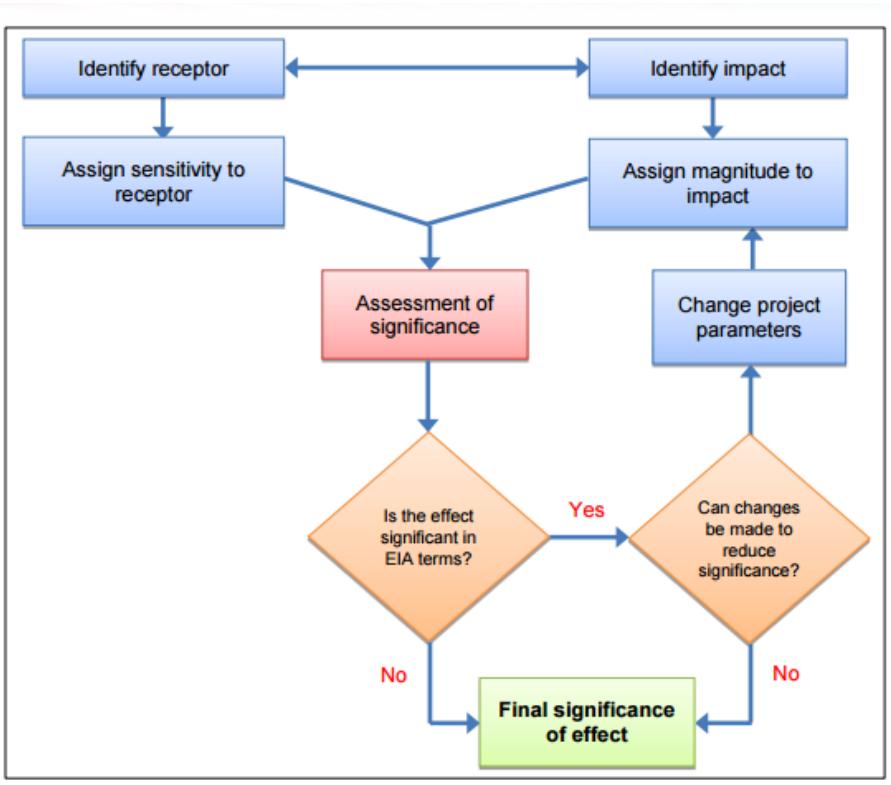


Figure 7.1 Iterative approach to mitigation within the Project One EIA.

The methodology for the assessment of effects is summarized in the Non-Technical Summary as:

'*Data from project-specific surveys and studies was used to inform the impact assessment stage of the EIA so that site-specific issues were identified and addressed. The magnitude of each impact, defined by the spatial extent, duration, frequency and reversibility of the impact was identified. The sensitivity of receptors was then determined, based on the vulnerability, recoverability and value/importance of each*

receptor. The overall significance of effect was then determined by consideration of the magnitude of impact alongside the sensitivity of receptor using a matrix approach'.

Definition of vulnerability, recoverability etc is not given in the Non Technical Summary but is provided the Environmental Impact Assessment chapter (reproduced below):

Table 5.2 Definition of the vulnerability, recoverability and value/importance when defining the sensitivity of a receptor (IPCC, 2001; MarLIN, 2012; IEEM, 2010).

Term	Definition
Vulnerability of the receptor	The degree to which a receptor is susceptible to injury, damage, or harm from an activity.
Recoverability of the receptor	The ability of a receptor to be able to return to a state close to that which existed before an activity or event caused damage.
Value/importance of the receptor	The importance of the receptor in terms of ecological, social/community and/or economic value.

Consideration of cumulative effects were also included in defining significance levels (Table 7.1 from the Non Technical Summary):

Table 7.1 Definition of significance levels.

Term	Definition
Negligible significance	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.
Minor significance	These beneficial or adverse effects are generally, but not exclusively, raised as local factors. They are unlikely to be critical in the decision making process, but are important in enhancing the subsequent design of the project.
Moderate significance	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision-making if they lead to an increase in the overall adverse or beneficial effect on a particular resource or receptor.
Major significance	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
Substantial significance	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international, national or regional importance that are likely to suffer a most damaging impact and loss of resource integrity. However, a major change in a site or feature of local importance may also enter this category. Effects upon human receptors may also be attributed this level of significance.

An example of how the outcomes of the iterative assessment is presented in the Non Technical Summary is given below:

'8.13.5 *Cumulative impacts from oil and gas activities and other offshore wind farm developments were assessed and predicted to result in effects of negligible, minor adverse significance (not significant in EIA terms) or moderate adverse significance (significant in EIA terms) upon infrastructure and other users. The cumulative impact of Project One and Project Two during construction may restrict oil and gas conventional towed streamer seismic exploration activities due to safety zones. This effect is of moderate adverse significance (significant in EIA terms). The agreement for lease development site, designated area and dredging restriction zones may exclude drilling and the placement of infrastructure within 235 m either side of the order for lease for the offshore export cable route, restricting oil and gas or carbon capture and storage projects. The cumulative effect with Project Two is of moderate adverse significance (significant in EIA terms). For both impacts the use of alternative technology and programme consideration have the potential to reduce this impact. On-going consultation with DECC and oil and gas operators will promote and maximise cooperation between parties and minimise both spatial and temporal interactions between conflicting activities. Open dialogue and further*

provision of information may reduce the potential cumulative effects to minor adverse significance (not significant in EIA terms).'

Related sections on the CEA Analytical Framework (Appendix B): 5, 18, 19, 20, 21, 22, 30

Implications for practice:

This case study demonstrates transparency in methodology and gives clarity on how the assessment has been carried out.

Key references:

SmartWind (2013) Hornsea Offshore WindFarm Project One. Environmental Statement – Non Technical Summary. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010033/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.1a%20Non%20Technical%20Summary.pdf

SmartWind (2013) Hornsea Offshore WindFarm Project One. Environmental Statement – Volume 1 – Introductory Chapters. Chapter 5 – Environmental Impact Assessment Methodology. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010033/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.1.5%20Environmental%20Impact%20Assessment%20Methodology.pdf

References listed in Table 5.2:

Intergovernmental Panel on Climate Change (IPCC) (2001). Climate Change 2001: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change.

Marine Life Information Network (MarLIN) (2012). Sensitivity Assessment Rationale – A summary. Available at: http://www.marlin.ac.uk/sensitivityrationale.php

Institute of Ecology and Environmental Management (IEEM) (2010). *Guidelines for ecological impact assessment in Britain and Ireland - Marine and Coastal*. Institute of Ecology and Environmental Management, Winchester Hampshire. Available at: http://www.cieem.net/data/files/Resource_Library/Technical_Guidance_Series/EcIA_Guidelines/Final_EcIA_Marine_01_Dec_2010.pdf

6.5 Use of evidence and building on practice

The importance of sharing data and sharing knowledge accumulated in cumulative effects assessment has been identified through the RUK study and by Duinker et al. These example demonstrate how reference is being made to the use of a range of data sources, studies, and academic literature and also how consultants draw on their own knowledge based on other projects. It gives confidence of a robust evidence base for the assessment.

Case study 9: use of evidence/building on practice
Proposed development: This application was for a new OWF development located in the southern North Sea approximately 43km off the Suffolk coast, east of England. The proposed development was for up to 325 wind turbines with a generating capacity of 1,200 MW covering an area of 300km^2. The proposals considered the potential for utilizing 'a combination of up to three different capacity turbines between 3.0 and 8.0 MW. The development was consented under the Planning Act (2008) by the Secretary of State in June 2014.
Chapter 6 of the Environmental Statement which addressed assessment of Marine Geology, Oceanography and Physical Processes describes the analytical techniques which have been used in the assessment. The approaches are described (section 6.4.2.4) as: • 'The 'evidence base' containing monitoring data collected during the construction and operation of other offshore windfarm developments, and other publically available windfarm ESs. ' • 'Numerical modelling of the hydrodynamic regime (estimating changes to patterns of water levels, currents and waves). ' • 'Standard empirical equations describing the relationship between (for example) hydrodynamic forcing and sediment transport or settling and mobilisation characteristics of sediment particles released during construction activities (e.g. Soulsby, 1997). ' For the evidence base, the assessment drew on: Monitoring evidence compiled during the construction and operation of earlier windfarms which is publicly available (e.g. COWRIE ScourSed-09). It also refers to the consultants themselves maintaining 'an offshore windfarm evidence database containing these and other relevant publications (such as academic journal articles and other windfarm ES chapters) pertaining to the effects of offshore windfarms upon the physical environment'. One aspect of the development which may have a cumulative effect is the interaction of sediment plumes as a result of the combined activities of offshore cabling installation and marine aggregates works. Fifteen aggregate areas 'either already licensed, under applications or options' are located within a distance of 'one spring tidal excursion ellipse from the East Anglia ONE offshore cable'. The assessment for this potential impact includes a discussion of the evidence base including in text citations to the sources of the evidence. However, the report on the assessment does not provide the full reference and nor do they appear in the more detailed technical appendix.

Related sections on the CEA Analytical Framework (Appendix B): 19, 23

Implications for practice:

Demonstrating that the assessment is based on evidence provides transparency. It also provides for the further development of the knowledge base through the sharing of knowledge accumulated.

Key references:

East Anglia ONE Offshore Windfarm (2012). Volume 2 Offshore. Chapter 6 – Marine Geology, Oceanography and Physical Processes. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010025/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.3.1%20Volume%202%20Chapter%206%20Marine%20Geology%20Oceanography%20and%20Physical%20Processes.pdf

East Anglia ONE Offshore Windfarm (2012). Volume 2 Offshore. Chapter 6 – Marine Geology, Oceanography and Physical Processes Appendices. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010025/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/7.3.1b%20Volume%202%20Chapter%206%20Marine%20Geology%20Oceanography%20and%20Physical%20Processes%20Appendices%20(App%206.1%20-%206.4).pdf

Case study 10: use of evidence/building on practice

Proposed development:

This application was for an extension to the existing and operational Burbo Bank OWF located in Liverpool Bay off the north west coast of England. The existing OWF had been operational since 2007 and consisted of 25x3.6MW turbines (90MW energy generating capacity in total) over a 10km^2 area. The proposed extension comprised an area of 40km^2 and 'estimated capacity of 169 to 234MW'. The extension was consented under the Planning Act (2008) by the Secretary of State in September 2014.

The Secretary of State decision letter for this development summarises that this development will have 'harmful seascape, landscape and visual effects', although concludes that these 'do not outweigh the renewable energy benefits that the scheme would deliver'.

The assessment within the Environmental Statement sets out the response of consultees most of which relate to agreeing the methodology for assessment. It also lists the guidance which was drawn on to develop the methodology including Scottish Natural Heritage 'Guidance Cumulative Effect of Windfarms version 2'.

In addition to project specific surveys collected as part of the assessment, the assessment also drew on 'other data and literature' which was collected and reviewed. A table comprising a 'summary of key reports' is included in the main ES chapter. This chapter Environmental Statement does not provide the full references, but refers the reader to the list of references within the Technical appendix which comprises a fuller list of previous studies and other literature which has informed the assessment.

The outcome of the cumulative assessment screening indicated that cumulative effects are likely from operational, consented and developments at scoping stage. The assessment concluded that there were significant cumulative effects e.g.:

Table 20.22: Summary of Cumulative Seascape Effects

Regional Seascape Unit (RSU)	Sensitivity to type of change proposed	Magnitude of Cumulative Effect	Significance of Cumulative Effect
Dee Estuary RSU	High	Medium	Major-Moderate

Related sections on the CEA Analytical Framework (Appendix B): 18, 21, 23, 26

Implications for practice:

Demonstrating that assessment has taken into account evidence from the existing knowledge base and that the outcome and included in assessment documentation ensures that the knowledge base develops and that accumulated knowledge is shared.

Key references:

DECC (2014) Planning Act 2008. Application for the Burbo Bank Extension Offshore Wind Farm Order. 26 September 2014. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/3.%20Post%20Decision%20Information/Decision/Decision%20letter%20and%20Statement%20of%20Reasons%20from%20the%20Secretary%20of%20State%20for%20Energy%20and%20Climate%20Change.pdf

Dong Energy (2013) Burbo Bank Extension Offshore Wind Farm. Environmental Statement Volume 2 - Chapter 20: Seascape, Landscape and Visual Impact Assessment. Document reference: 5.1.2.20. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/5.1.2.20%20Seascape%20Landscape%20and%20Visual%20Impact%20Assessment.pdf

Dong Energy (2013) Burbo Bank Extension Offshore Wind Farm. Environmental Statement Annex 20: Seascape, Landscape and Visual Impact Assessment. Document reference: 5.1.5.20. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/5.1.5.20%20Seascape%20Landscape%20and%20Visual%20Impact%20Assessment.pdf

Dong Energy (2013) Burbo Bank Extension Offshore Wind Farm. Environmental Statement Volume 4 – Chapter 36: in combination and cumulative impacts. Document reference: 5.1.4.36. Available from: http://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010026/2.%20Post-Submission/Application%20Documents/Environmental%20Statement/5.1.4.36%20In-combination%20and%20Cumulative%20Impacts.pdf

7. Discussion

The aim of the Mini Review has been to review current practice in the assessment of the cumulative effects of OWF based on the recognition of a number of challenges to practice i.e.:

1. Lack of ‘certainty’ of the most effective assessment process resulting from inconclusive guidance
2. Inconsistent definition of the scope of assessment and the poorly defined concept of ‘reasonably foreseeable’ projects.
3. Uncertainty over project level effects (e.g. bird collision and cetacean displacement due to acoustic effect) which are compounded where a number of projects potentially contribute to the same effect
4. Very few significance thresholds have been defined, under which the cumulative effects of projects can be managed

The Mini Review has identified that for some of these there is evidence of evolving practice but also that some questions still remain:

Assessment process and guidance

Guidance is being developed on cumulative effects assessment for a number of sectors (e.g. World Bank/ESMAP guidelines on hydropower projects in Turkey). Guidance specifically on the methodology for EIA for offshore renewables (not just OWF) has also recently been published by British Standards Institution (BSI)[17]. This guide draws on the RUK Guiding Principles document in establishing the terminology and key principles for cumulative effects assessment. It does not go so far as to give specific guidance on methodology but refers to other guidance also available (such as Natural England guidance).

The BSI guide does emphasise the importance of 'confidence assessments' to ensure that evidence used in any assessment is robust. It provides an evaluative process to ensure that evidence is 'fit for purpose' to be used to inform decision making. The case studies from the Mini Review has shown that there are examples of where the assessment methodology is codified, in detail, in the EIA artefacts: this gives the opportunity for other practitioners to learn of other methods of practice. Where the evidence base is also documented this also gives confidence of the robustness of the assessment process. However, as noted in the case studies, the source of the evidence was in some cases only partially presented and instead attempts were made to cross reference to technical appendices. This leads to a debate on how scientific evidence should be presented in an ES which is separate area of discussion to that addressed by the Mini Review.

Scope and concept of 'reasonably foreseeable' projects

For the projects consented in England and Wales through the Planning Act 2008 (PA2008) there is evidence that the examination process is helping to shape practice in these areas. Collaboration between all parties involved in the consenting process is essential. Collaboration and open dialogue between proponents and key stakeholders is something that is more transparent through the PA2008 as the examination process is inquisitorial rather than adversarial.

Uncertainty over project level effects

This is likely to always be an issue. Kelly et al (2014)[18] in attempting to address cumulative effects assessment in marine spatial planning around the Shetland Islands note that trying to resolve the relationship between human use of the marine environment and its ecosystem components is '*widely acknowledged'* as difficult as '*several human activities have the same or similar effects on the marine environment and its ecosystems. Attempting to attribute or distinguish each effect to a single use in multi-use areas has not been achieved convincingly to date'.* However, using the 'source-pathway-receptor' model as part of the assessment methodology can aid in identifying where there may be site specific issues. Four of the case studies refer to adopting this methodology

[17] BSI (2015) PD6900: 2015. Environmental impact assessment for offshore renewable energy projects - guide
[18] Kelly, C, Gray, L, Shucksmith, R J, Tweedle, J F (2014) Investigating options on how to address cumulative impacts in marine spatial planning. Ocean & Coast Management 102 pp139-148

Significance thresholds

Case study 8 demonstrated a model for how project specific thresholds were defined through establishing the sensitivity of receptors and how this led to the definition of significance levels. Other assessments reviewed often used generic significance matrices. The importance of considering project or site specific attributes is emphasized by Kelly et al who modeled and 'scored' the cumulative effects of marine activities around the Shetland Isles using an integrated Ecosystem-based Risk Assessment. They note the importance of detailed local scale mapping of activities was essential, as was the benefit of local knowledge and expertise, and observe that the *'exercise would not have provided such a robust outcome should it have used national-scale datasets'*. Based on the work of Kelly et al establishing significance thresholds is likely to be only achievable on a localized case by case basis.

Consideration of future direction of practice

The Mini Review has identified that practice in cumulative effects assessment for OWF is improving and evolving. Key to driving practice forward has been the requirements made by decision makers and statutory stakeholders at the scoping stage particularly due to the PA2008. Practitioners are also being more transparent in their methodologies which will aid others to reflect on their own practice and innovate. Reviews such as this and the generation of examples of good practice will also aid this.

Improving assessment practice which is based on transparent methodology and robust evidence will also aid the decision makers, although as Hegmann and Yarranton (2011) observe cumulative effects assessment *'can assemble geographical and biological information and present it in a manner useful to decision makers, but it is not itself a method of decision making'.* Consideration could be given to the need for a 'tool' to aid decision makers as whilst a wealth of 'tools' already exist to support marine spatial planning, research by Stezenmuller at el [19] noted that many of the current tools '*are designed to be used by scientists, programmers or strategic planners, with only a few that could be used by case officers (regulators)*'. Kelly et al (2014) experimented in developing a GIS based tool to aid decision making in marine spatial planning around the Shetland Isles. They 'scored' or 'weighted' the cumulative effects of existing marine activities around the islands using different criteria. They note many challenges with doing this including: the need for local evidence and the importance of local stakeholder and expertise input; that applying 'scores' to different impacts/pressures could be seen as subjective and therefore open to challenge; and that it focused on direct additive effects only so did not take into account synergistic or in-direct effects. Hegmann and Yarrantan (2011) suggest that ultimately in decision making '*choices have to be made, choices which no computer simulation, statistical analysis, habitat analysis, air quality analysis, mapping or cumulative effects assessment are going to make. But such information can assist in making decisions about the acceptability of a project, or the geographic use of a region by a number of projects, or choices between different future uses of resources and even different futures*'.

[19] Stelzenmuller, V et al (2013) 'Practical tools to support marine spatial planning: a review and some prototype tools'. *Marine Policy* **38** pp 214-227. Paper based on findings of a DEFRA funded project 'Practical Tools to Support Marine Spatial Planning'

8. Conclusions

This Mini Review is set in the context that the marine renewable energy sector is vital to the UK economy, to ensuring the security of energy supplies, the reduction of the dependence on imported fossil fuels and protection of the environment by de-carbonizing the economy. The licensing procedures for marine development require the assessment of cumulative effects where the consequences of multiple projects or activities create an effect greater than, or different to, that of the individual projects. Although the requirement to consider cumulative effects ex ante development is established within EU EIA legislation assessing cumulative effects is complex and academic research suggests that globally practice is generally poor. The aim of the Mini Review was to seek to address challenges in the assessment of cumulative effects of OWF by evaluating current practice. The aim of the Mini Review was not intended to be critical but rather to highlight differences in the approaches to the assessment process and to promote discussion of potential ways in which practice could be improved.

The outcome has been to show that all stakeholders involved in the EIA process are aware of the need to address cumulative effects but that lack of consistency in terminology and lack of transparency in the methodology used to assess the effects are key areas that need to improve. Within this report we have proposed the adoption of the definitions for cumulative effects which were developed as part of earlier NERC MREKEP funded research i.e.:

> Cumulative effects are "*those that result from **additive** impacts caused by other past, present or reasonably foreseeable actions together with the plan, programme or project itself and s**ynergistic** effects (in- combination) which arise from the reaction between impacts of a development plan, programme or project on different aspects of the environment* "

This definition is also included in the British Standard 2015 guide to environmental impact assessment for offshore renewable energy projects (PD6900:2015).

The analytical framework (contained in Appendix B) which was used in the evaluation also provides a useful step by step guide to ensuring that all relevant issues have been included in the assessment process. As part of the dissemination of the findings the framework has been used in a number of practitioner/decision maker professional development workshops at Oxford Brookes University.

It is hoped that the use of a clear definition, the continuing development of guidance (such as the CEA Analytical Framework developed for this Mini Review) and the publication of case studies of practice will aid in continuing to improve, and shine light on, the 'dark art' of cumulative effects assessment.

Appendix A – selected examples of guidance on assessing cumulative effects

Documents are listed in date order.

Council on Environmental Quality (CEQ) (1997) Considering Cumulative Effects Under the National Environmental Policy Act. http://energy.gov/nepa/downloads/considering-cumulative-effects-under-national-environmental-policy-act (accessed 31st July 2014)

Hyder (1999) Guidelines for the assessment of indirect and cumulative impacts as well as impact interactions. Brussels: EC DGX1 Environment, Nuclear Safety and Civil Protection. http://ec.europa.eu/environment/eia/eia-studies-and-reports/guidel.htm (accessed 31st July 2014)

Cooper, L (2004) Guidelines for Cumulative Effects Assessment in SEA of Plans. EPMG Occasional Paper 04/LMC/CEA, Imperial College London http://www.imperial.ac.uk/pls/portallive/docs/1/21559696.PDF (accessed 31st July 2014)

DEAT (2004) Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism, Pretoria https://www.environment.gov.za/sites/default/files/docs/series7_cumulative_effects_assessment.pdf (accessed 31st July 2014)

Canter (2008) Conceptual models, matrices, networks and adaptive management- emerging methods for CIA. http://www.iaia.org/iaia08calgary/documents/Conceptual%20Models%20Paper%2012-08.pdf?AspxAutoDetectCookieSupport=1 (accessed 31st July 2014)

King et al (2009) Developing guidance on ornithological cumulative impact assessment for offshore wind farm developers. COWRIE. Crown Estate http://www.thecrownestate.co.uk/media/5975/2009-06%20Developing%20Guidance%20on%20Ornithological%20Cumulative%20Impact%20Assessment%20for%20Offshore%20Wind%20Farm%20Developers.pdf (accessed 31st July 2014)

RPS (2010) Assessment methodology for determining cumulative impacts of wave and tidal marine renewable energy devices on marine birds http://www.scotland.gov.uk/Topics/marine/marineenergy/Research/snhbirds (accessed 31st July 2014)

CEFAS (2013) Evaluation of the current state of knowledge on potential cumulative effects from offshore wind farms to inform marine planning and licensing. Marine Management Organisation project:1009 http://webarchive.nationalarchives.gov.uk/20140108121958/http://www.marinemanagement.org.uk/evidence/1009.htm (accessed 31st July 2014)

Renewables UK (2013) Guiding Principles for Cumulative Impact Assessments in Offshore Wind Farms http://www.renewableuk.com/en/publications/index.cfm/cumulative-impact-assessment-guidelines (accessed 31st July 2014)

Essa Technologies Ltd. and International Finance Corporation (IFC) (2013) Good Practice Note - Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets
http://www.socialimpactassessment.com/documents/CIA_PNG_ExternalReview.pdf

Broderick M (2014), CEA Assessment Checklist. Presented at CEA workshop, Oxford Brookes University, 7th April

Natural England (2014) Development of a generic framework for informing Cumulative Impact Assessments (CIA) related to Marine Protected Areas through evaluation of best practice. NECR147 http://publications.naturalengland.org.uk/publication/6341085840277504 (accessed 31st July 2014)

World Bank/ESMAP (2014) Sample guidelines: cumulative environmental impact assessment for hydropower projects in Turkey https://www.esmap.org/node/2964

British Standards Institution (2015) Environmental Impact Assessment for offshore renewable energy projects – guide. PD6900: 2015 http://shop.bsigroup.com/forms/PASs/PD-6900/

Appendix B - analytical framework used to evaluate practice in cumulative effects assessment (CEA) for OWF

This framework was used to gather the evaluation evidence of practice in OWF.

To aid in relating the framework to the case studies in Section 6 of the report, the Case Study number is provided in the 'Observations' column. Where there are gaps this should not be taken to imply that none of the developments carried out this aspect of practice, but rather that it did form part of the Case Study

Case study details:	**Name of project:**
	Location:
	Status:
	Proponent:
	Lead author of ES:
CEA assessment criteria	***Observations***
1. How and where is pertinent CEA information included in the ES?	Case study 3, 4, 5, 6
2. What is the definition of CEA stated in the ES?	Case study 1, 2, 4, 7
3. How are cumulative effects (additive, incremental) distinguished from in-combination (synergistic) effects?	Case study 1, 2, 4, 5, 7
4. What methods are used to undertake scoping?	Case study 3, 7
5. Has the scoping been iterative i.e. reviewed and revisited?	Case study 1, 2, 4, 7, 8
6. How were stakeholders engaged?	Case study 1, 2, 7
7. How are relevant stakeholder CEA responses recorded in the ES?	
8. Are spatial/ geographical boundaries for the project clearly established overall?	Case study 1, 2, 5

9. How are the temporal boundaries established?	Case study 1, 2, 5
10. Is the temporal scope for analysis clearly established?	Case study 1, 2, 5
11. What range of other projects are considered? In scoping cumulative effects, reasonably foreseeable other major developments, plans and activities should be identified through consultation with the local planning authorities and other relevant authorities on the basis of those that are: • under construction; • permitted application(s), but not yet under construction; • submitted application(s) not yet determined; • those registered with PINS/Marine Scotland; • projects registered on the PINS/ Scottish Executive Programme of Projects; • identified in the relevant Development Plan (and emerging Development Plans - with appropriate weight being given as they move closer to adoption) recognising that much information on any relevant proposals will be limited, and • identified in other plans and programmes (as appropriate) which set the framework for future development consents/approvals, where such development is reasonably likely to come forward.	Case study 1, 2, 3,5, 6, 7
12. Is there a tabulated long list of Reasonably Foreseeable Future Projects (RFFPs)?	Case study 5, 6
13. Is there a map of RFFPs?	
14. Is the long list of RFFPs reduced to a short list of CEA Other Projects	Case study 2, 3, 5
15. Are reasons for ruling RFFPs out given	Case study 2, 5

16. Is there a tabulated short list of Other CEA Projects?	Case study 6
17. Is there a map of 'Other CEA Projects'?	
18. How have the receptors been defined? e.g. VEC is often used to refer to 'Valued Ecosystem Component' but is also used to refer to 'Valued environmental and social component' (IFC, 2013)	Case study 2, 6, 8, 10
19. Has it been determined what past, present and future human activities (sources) have affected or will affect these receptors, and what has led to these activities (context)	Case study 6, 8, 9
20. Is it clear what are the 'source-pathway-receptor' links i.e. are the: - Source - Pathway - Receptors all identified?	Case study 2, 5, 6, 8
21. Were the environmental threshold, pollution, climate or baseline conditions fully understood or established – where there any uncertainties or limitations	Case study 2, 5, 6, 8, 10
22. Have any thresholds or indicators of significant effects been defined or established	Case study 6, 8
23. Were tools used to evaluate the cumulative (sensu lato) effects e.g. network analysis, carrying capacity, ecosystems analysis etc)? Are the quantitative tools supported by qualitative discussion based on professional judgement?	Case study 6, 9, 10
24. Are mitigation measures proposed and mitigation measures assessed?	Case study 10

25. In mitigation recommendations, were alternatives recommended to mitigate cumulative effects specifically?	
26. Are residual effects after mitigation considered? Are they clearly stated and defended	Case study 10
27. Is monitoring proposed?	
28. Is there an Environmental Management Plan (EMP), Construction EMP or any other MP?	
29. Were possible cumulative effects included in the monitoring or management plan?	
30. How are cumulative effects summarised in the non-technical summary	Case study 8
31. Do you have any observations on uncertainties and limitations of the CIA?	
32. What is the overall impression?	

Appendix C – dissemination/pathway to impact activities

Completed Activities

Conference/Seminar papers:

Durning B (2015) '*EIA and Nationally Significant Infrastructure Projects (NSIPs)'.* Presentation at Royal Town Planning Institute (RTPI) West Midlands Branch Event '*EIA: A changing environment'*. Birmingham, UK, 24th June

Durning B (2014) '*Development of normative values for assessing cumulative environmental impacts of marine renewable energy projects currently within the planning system'.* Annual UK-Ireland Planning Research Conference, Oxford, UK, 9-11th September.

Practitioner CPD Workshops:

Cumulative (Environmental) Effect Assessment – 1 day CPD open event, 10th March 2015
17 attendees comprising representatives from: EIA consultants, government department, nature conservation group, decision makers (local planning authorities)

Cumulative (Environmental) Effect Assessment – 1 day CPD closed event, 13th October 2014
15 attendees comprising senior practitioners from an EIA consultancy practice

Cumulative (Environmental) Effect Assessment – 1 day CPD open event, 7th April 2014
24 attendees comprising representatives from: EIA consultants, regulators, decision makers (local planning authorities), offshore renewables proponent

To be completed:

Project website with case studies

Academic paper (to be submitted to 'Environmental Impact Assessment Review')

Practitioner article (to be included in Institute of Environmental Management and Assessment (IEMA) monthly publication 'Environmentalist' due ~ April 2016)

Cumulative (Environmental) Effect Assessment – 1 day CPD open event, March 2016 (will continue to be delivered on an annual basis)