European Offshore Wind Deployment Centre

Environmental Research & Monitoring Programme

Socio-Economic Study

Second Progress Report: Feb 2019

Impact Assessment Unit, Oxford Brookes University

VATTENFALL

Contents

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1. Introduction: why research the socio-economic impacts of offshore wind farms?

There is an increasing momentum to include both socio-economic and bio-physical impacts in the assessment of the potential impacts of major projects. This partly responds to the push for developers to have a 'Social Licence to Operate' from the impacted community, from agencies such as the International Finance Corporation/World Bank Group (IFC), with its required *Environmental and Social Sustainability Performance Standards* (2012), and the International Association for Impact Assessment (IAIA) with its *Guidelines for Social Impact Assessment (2015).* The revised EU Environmental Impact Assessment (EIA) Directive (2014) also gives a higher profile to population and health impacts.

There is some history of assessing the socio-economic impacts of onshore wind farms, especially in relation to landscape, noise, jobs and community benefits. However there has been much less for offshore wind farms - out of sight out of mind? Yet, there are onshore elements to offshore projects, and some offshore projects may be highly visible. There are now many UK Offshore Wind Farm (OWF) projects with significant economic and social impacts (e.g. jobs, supply chain, community benefits) at various spatial scales (from local to national and beyond). The UK OWF industry is now very substantial and the largest in Europe (see Figures 1-3).

Figure 1: European OWF—Connected turbines and installed capacity in MW 2017.
Source: Wind Europe 2018

COUNTRY	NO. OF FARMS	NO. OF TURBINES CONNECTED	CAPACITY INSTALLED (MW)	CAPACITY INSTALLED/ DECOMMISSIONED IN 2017 (MW)
UK	31	1,753	6,835	1,679
GERMANY	23	1,169	5,355	1,247
DENMARK	12	506	1,266	-5
NETHERLANDS	7	365	1,118	0
BELGIUM	6	232	877	165
SWEDEN	5	86	202	0
FINLAND	3	28	92	60
IRELAND	2	7	25	0
SPAIN	1	1	5	0
NORWAY	1	1	2	0
FRANCE	1	1	2	2
Total	**92**	**4,149**	**15,780**	**3,148**

Figure 2: OWF project pipeline – 5 year outlook
Source: WindEurope 2018

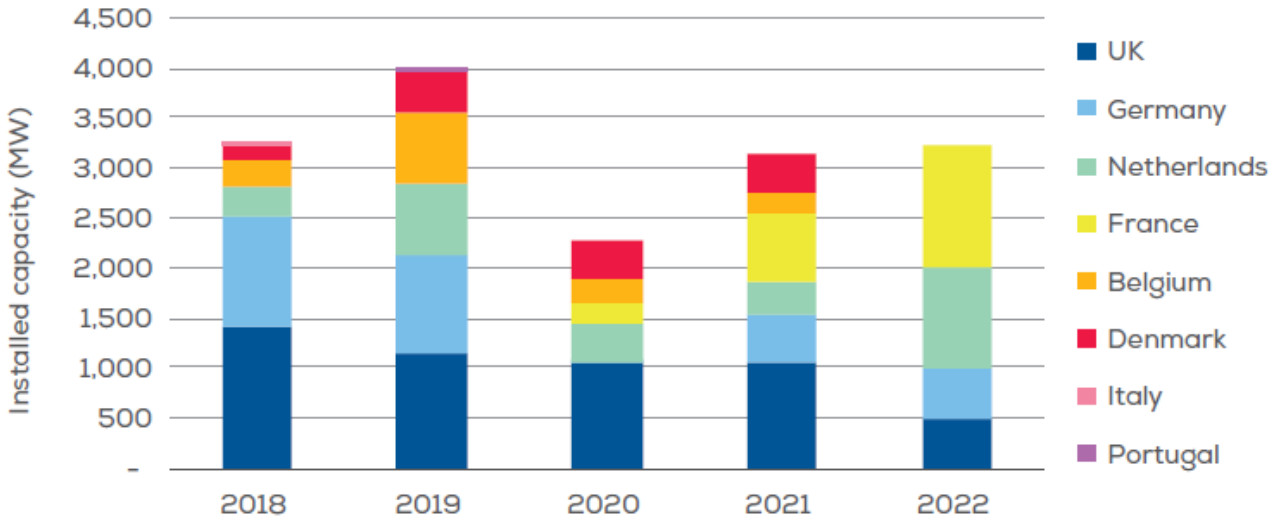


Figure 3: Offshore wind power—cumulative capacity to 2030
Source: Wind Europe 2018

	CENTRAL (MW)	LOW (MW)	HIGH (MW)
United Kingdom	22,500	18,000	30,000
Germany	15,000	14,000	20,000
Netherlands	11,500	4,500	18,500
France	7,000	4,300	11,100
Denmark	4,300	3,400	6,130
Belgium	4,000	1,600	4,000
Poland	3,200	2,200	6,000
Ireland	1,800	1,200	2,000
Estonia	600	-	1,200
Sweden	300	300	800
Portugal	150	-	175
Italy	-	-	650
Total	70,200	49,500	98,930

2. The aims and methods of this EOWDC research project

Aims – to:

- Explore methods used to predict socio-economic impacts
- Compare predicted impacts with actual impacts
- Enhance understanding of OWF socio-economic impacts
- Highlight best practice in how to maximise local benefits

Methods – 4 parallel elements, to:

- Examine evolving socio-economic impacts literature, especially on OWFs
- **Monitor the European Offshore Wind Deployment Centre (EOWDC) (Aberdeen OWF) over the project lifecycle**
- **Review the socio-economic content in recent OWF Environmental Statements (ES) for the UK and other EU states**
- **Compare EOWDC socio-economic impacts with other studies of OWFs: Beatrice, Hornsea and floating OWFs**

The focus of this Second Summary Progress Report is on the emboldened work programme elements.

3. Examining the evolving literature and reports

A comprehensive literature review of socio-economic impacts of major projects, and especially OWFs, has been undertaken (to be updated).

3.1 Some initial messages on generic socio-economic impacts of major projects

Socio-economic impacts include a growing range of impact types: direct economic; wider indirect/induced economic; demographic; housing; other local services; socio-cultural; and distributional (who gains/who loses from developments?). The focus tends to be on the more quantifiable economic impacts, especially on local employment content, local supply chain procurement, and other potential impacts on local businesses (e.g. on tourism). There can be issues in prediction, with uncertainties about the actual nature of the project. The enhancement of socio-economic benefits is evolving fast (e.g. promoting local supply chain and local employment), but there is very little monitoring of predictions and on what socio-economic impacts actually happen in practice.

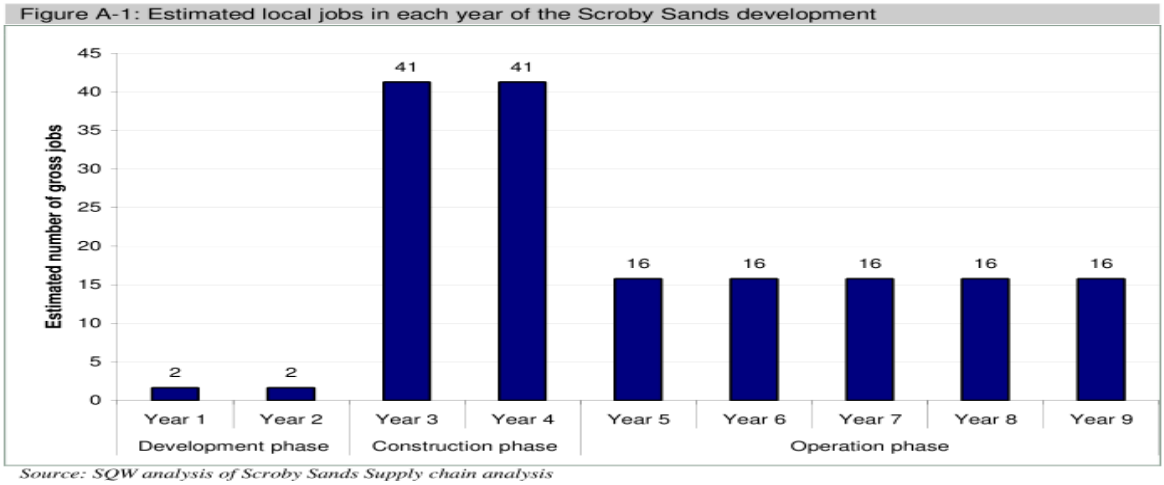
3.2 Some initial messages on the socio-economic impacts of OWFs

Findings from the literature show a focus on the economic impacts, especially local jobs and local Gross Value Added (GVA) of the offshore element of the construction stage. There is little coverage of the onshore element of OWFs, and very little coverage of social impacts. There are major local economic leakages from OWFs; much of the offshore work is outsourced from well beyond the local area. There is more local economic potential from the onshore element of projects (e.g. sub-station connections; local port improvements). Also, do not underestimate the local significance of the

Operations and Maintenance (O&M) stage, which can bring more stable and long-standing impacts. The impacts of multiple OWF developments can be cumulative, and can be a catalyst for port development and other supply chain activities (e.g. set down areas, assembly and, in some cases, fabrication facilities) (See Hornsea case in Section 6).

There is some good practice work on enhancement measures – especially the promotion of local supply chain opportunities and on early community engagement – with the growing role of often substantial Community Benefits Agreements. However there is very little hard evidence on socio-economic impacts from monitoring studies. The graph below (Figure 4) shows the local job years for East Anglia over the development stages from monitoring data for the small (60 MW) Scroby Sands OWF. Robin Rigg provides another example of actual impact monitoring. Table 1 shows the range of average UK-scale economic content for recent UK OWF projects for the DEVEX, CAPEX and OPEX stages, with the highest UK content % for the OPEX (O&M) stage.

Figure 4: SQW analysis of Scroby Sands OWF supply chain analysis
Source: SQW 2011



	Lower	Upper	Weighted average 2017	2015	Change against baseline
DEVEX	27%	92%	**73%**	**57%**	**+16%**
CAPEX	22%	38%	**29%**	**18%**	**+11%**
OPEX	52%	89%	**75%**	**73%**	**+2%**
TOTEX	44%	53%	**48%**	**43%**	**+5%**

Table 1: 2017 Industry Report on UK Content

Source: RenewablesUK (2017)

Although there are similar attitudes and perceptions to onshore and offshore wind developments, recent studies suggest that it is important to consider the meaning of the marine context and a community's attachment to the sea and seascape when assessing the social impact of OWF.

Research findings (eg. Firestone et al, 2012; Hattam et al, 2015) indicate that OWFs overall can have a positive impact on well-being. Other findings show that early community engagement in the development of an OWF can alleviate fears and uncertainty, which in turn has a positive effect on the social impacts of an offshore development. Similarly, engagement throughout the development process also contributes to equity and justice issues, with communities feeling that they are engaged in decision-making about their future. Mitigation and enhancement methods, such as offering community benefits, are also seen as positive, although they have also been interpreted by some commentators as 'bribes' to the community.

4. Monitoring the EOWDC project lifecycle

4.1 Research aims, approach and issues

Aims

The in-depth study of the EOWDC provides the most detailed element of the research programme. Through detailed monitoring of the EOWDC, over its lifecycle, the research aims to provide a more robust evidence-base on actual socio-economic impacts, particularly at the local and regional level, and so help to reduce uncertainties in future assessments. The research compares these, as far as is possible, with the predicted impacts in the Environmental Statement (ES) for the project. Further, as the consenting process in Scotland occurs at both national and local decision-making levels, it will help inform impact assessment and consenting for OWF more widely.

The Aberdeen OWF is a relatively small OWF with 11 turbines/c with installed capacity of up to 96.8 MW. It is located 2.4km offshore. It is also an innovative project in terms of technology. It has offshore and onshore elements; the latter includes a sub-station at Blackdog, and a 7.5 km cable connection to SSE's Dyce sub-station. Construction was completed in the Summer of 2018, and the first power flowed into the grid in July of that year and was inaugurated in September 2018. The monitoring study seeks to identify actual economic and social impacts for key steps in the lifecycle, including the pre-construction, peak construction, and early operation and maintenance (O&M) stages.

Approach

The research approach included the following activities:

- regular meetings/telecoms with Vattenfall project staff
- workshops with representatives of local authorities/agencies and with the local Belhelvie Community Council to explore evolving project impacts and responses
- various surveys through the lifecycle of the project which sought to identify actual socio-economic impacts, included:

  - workforce data from tier 1 (main-) and tier 2 (their key sub-) contractors
  - contracts data from Vattenfall and from the tier 1 and 2 contractors
  - local community benefits projects information from Vattenfall
  - local community meetings and surveys on perceptions of impacts
  - coverage of the project in the media

The research used a hierarchy of impact areas, from Scotland (Figure 5a) to Aberdeenshire/Aberdeen (Figure 5b), to local Community Council (Figure 5c) as set out below. The particular focus has been on identifying local impacts; local was taken as including Aberdeen City and Aberdeenshire. This was

identified as the Inner Study Area in the Environmental Statement for the project. Scotland, including the Inner Study area, was the Wider Study Area.

Figure 5a: Scotland study area

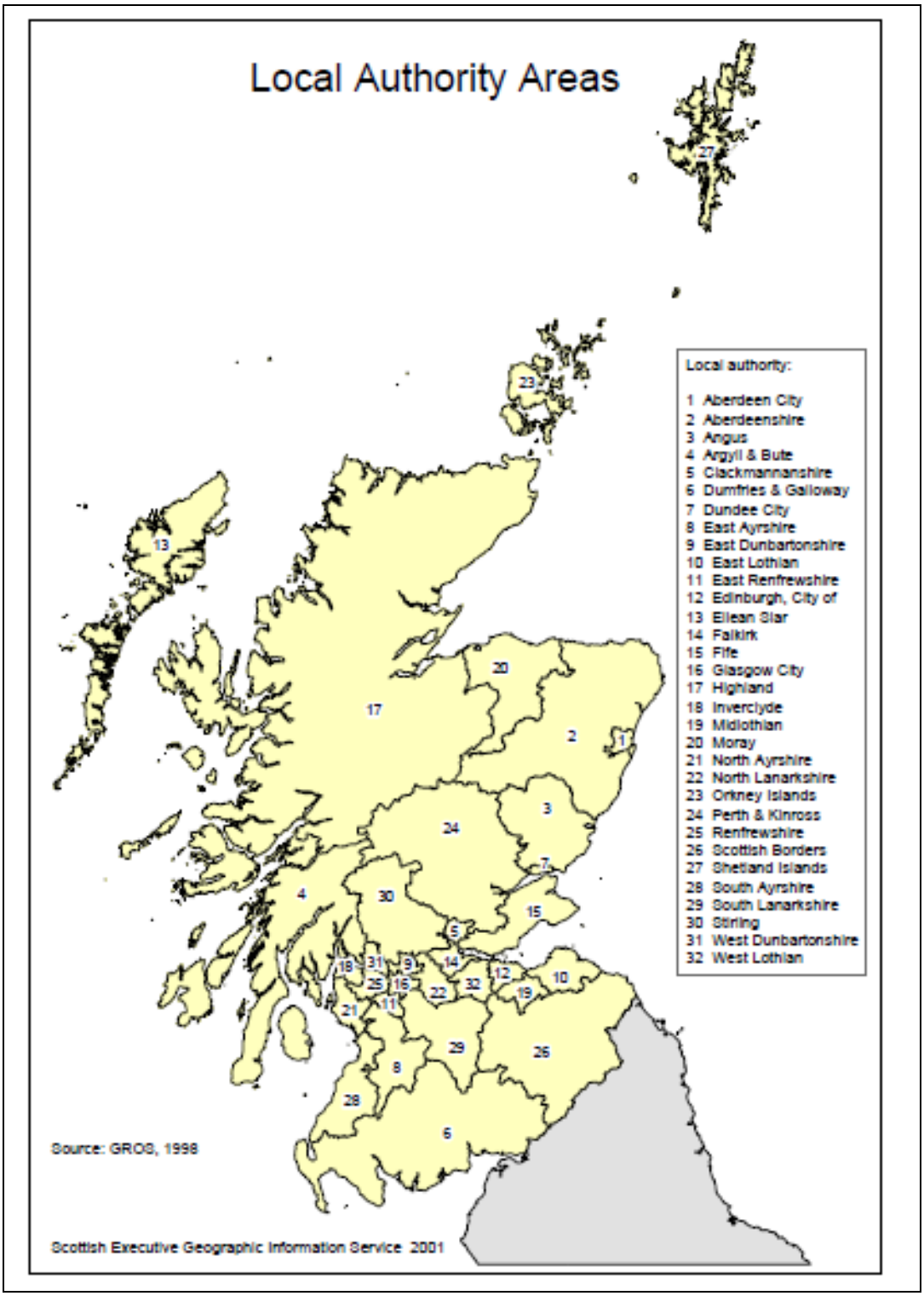


Figure 5b: Aberdeenshire and Aberdeen study areas

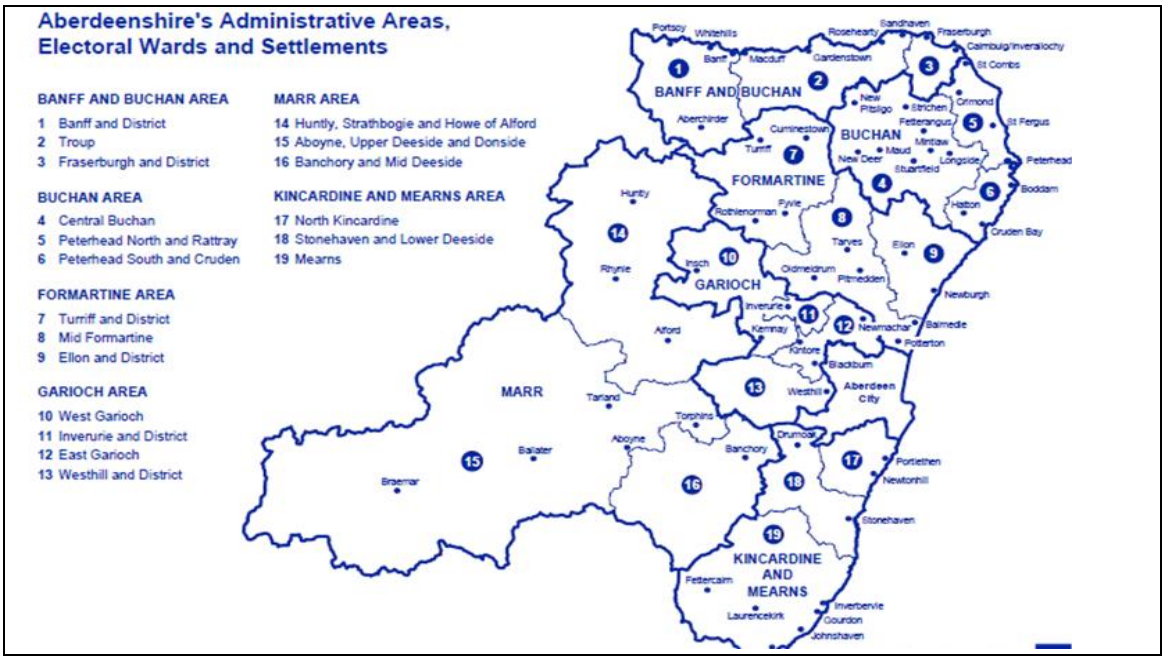
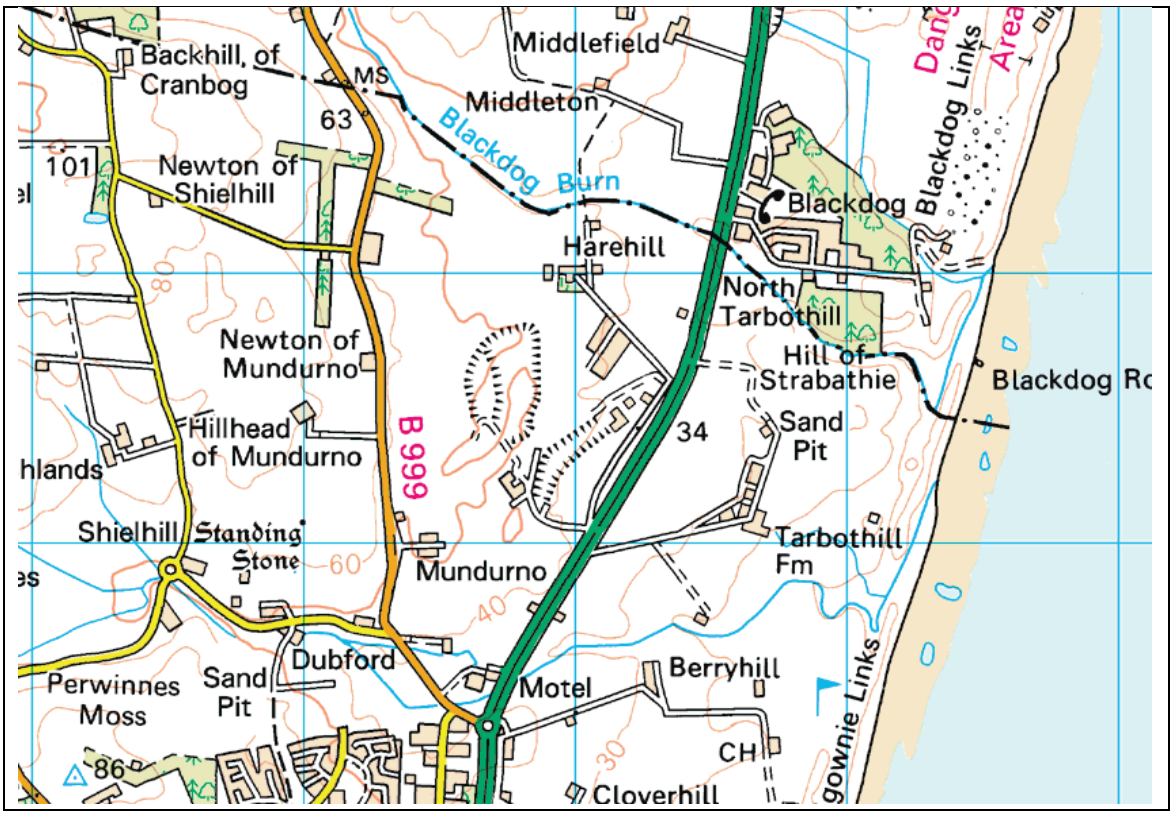


Figure 5c: Local study area



Data issues

The key data challenge has been on accessing, and disaggregating, employment and contract spend data for the construction stage of the Aberdeen project. This involves a working relationship with the tier 1 contractors, via Vattenfall. The current position on data availability is:

Good/useful: Vattenfall all contracts spending; major onshore contractor contracts data, and sub-station workforce survey; local agency/community responses to construction stage surveys and meetings. Media coverage over project lifecycle.

Limited/missing data: contract and workforce details for major offshore contractors; further community perceptions of completed project. Missing data are being pursued, as far as possible, in early 2019.

4.2 Economic impacts: from predictions to actuals

Pre-construction stage (contracts)

There were no employment and expenditure predictions for the pre-construction stage, but Vattenfall has provided some data on actual project contracts, with a value totalling several millions. Several of these contracts are with local firms and several others are with other Scottish firms in Glasgow, Edinburgh and in other centres). Taken together, they bring an important share of the pre-construction stage expenditure into Aberdeen, Aberdeenshire and Scotland at large.

Baker Tilly UK Audit	Brown & May Marine	Cathie Associated	emapsite.com	FGDS	Fugro GeoConsulting	Fugro GEOS
Hayes McKenzie Partnership Ltd	IOM Consulting	Kelly Services	LDA Design Consulting	Nordtek	Ove Arup & Partners	Savills (UK)
Serco	SgurrEnergy	SLR Consulting	Structural Soils	The Big Partnership Group	Xero Energy	Mwaves
Pelagica Environmental Consult	Babcock Marine (Rosyth).	Donside Safety	TVP Studios	Maersk Training	Archer Marketing	

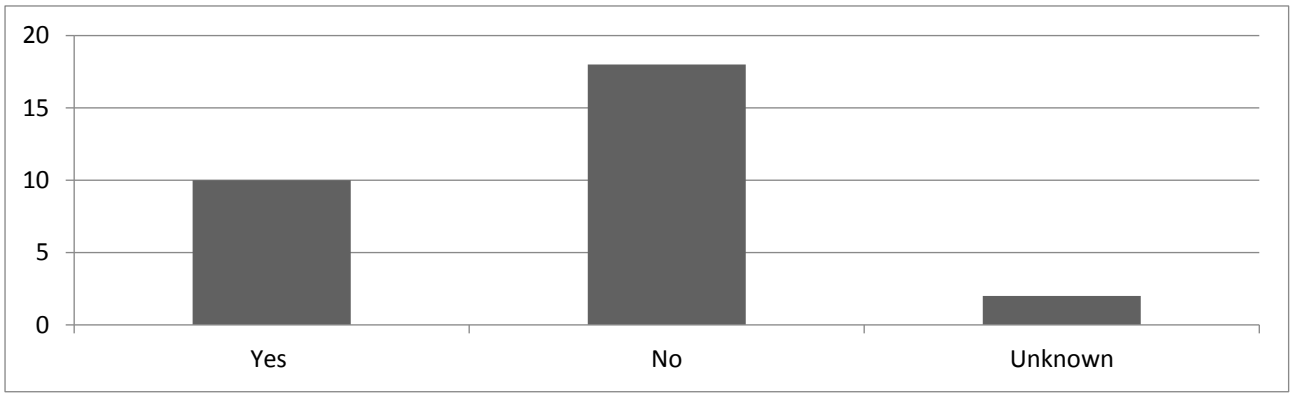
Table 2: EOWDC some pre-construction contractors
Source: Vattenfall 2016

Construction stage—economic impacts (jobs and contracts)

Employment predictions, in the Environmental Statement (ES), for the main construction stage were of the order of 300 jobs for the Inner Study Area (Aberdeen and Aberdeenshire) (i.e. 150 jobs pa over two year period) and 740 (370 pa) for the wider study area (Scotland). These include both onshore and offshore jobs. There was an estimate of c30 jobs for onshore sub-station/connection work. Contract expenditure predictions were Scotland GVA of £40m, of which £16m would be in the Inner Study Area, all out of a total project cost of £260m. Calculation of actual employment and expenditure has been difficult, especially for the offshore work.

For the ***onshore*** construction work, good data from the main contractor (sub-station/connection) and estimates of SSEN work (cable to Dyce) indicate a small number of employees in total over a period of about 12-18 months. Our survey work on the sub-station employees indicate over half of this workforce came from the Inner Study Area, and most of the remaining from the rest of Scotland, with some making a daily commute of over two hours. Most workers travelled to the site by car. Local content estimates for the Dyce cable connector work are taken to be similar.

Figure 6: Number of workers that migrated to work on the sub-station project



Source: Sub-station site survey (Nov 2017)

Local multiplier impacts are likely to have increased the total employment impact for the period involved, by an order of about 50%. Detailed contract and sub-contract data from the onshore sub-station contractor indicates about 50% of contract spend in Scotland, with the bull in the Inner Study Area.

We do not have detailed workforce data from the Tier 1 ***offshore*** contactors, but we do have some useful estimates from the Vattenfall marine coordinators' team for the Aberdeen project. This relates primarily to peak construction (Spring 2018). At peak, there were very approximately 500 personnel offshore on the installation vessels. A very broad mix of nationalities was involved in the project. There were vastly more other Europeans (80%) compared with British (10%) and other nationalities (10%). Dutch personnel constituted the largest group at peak construction. The turbine supplier noted that due to the small nature of the EOWDC project and the resultant short construction period, a large percentage of the overall personnel working on the project were sourced externally to the local area. This was due to personnel already being employed, experienced, trained and skilled, and that existing production facilities are already established outside of Scotland. Overall, with some allowance for multiplier impacts, Inner Study Area employment associated with the offshore activities is likely to have been lower than for the onshore works.

It is not easy to pin-down the detailed distribution of offshore construction stage contracts from the EOWDC project, without more information from the tier 1 offshore work contractors. However, an *interim assessment* from both Vattenfall and from our own analysis of the project's overall contract data indicate, *as a minimum*, the percentage share of the offshore construction work is at least 25% for the UK as a whole, but with very much smaller percentages for Scotland and for Aberdeen/Aberdeenshire. Again, a multiplier adjustment of approximately 50% would substantially

increase the overall expenditure impact. The Aberdeen/Aberdeenshire local area expenditure includes many small service based contracts, plus a few larger contracts.

***Estimates of the total economic impact of the construction stage (onshore and offshore*).** Both the total number of jobs and the contract expenditure are, based on current information, less for the Inner and Outer Study areas than in the ES predictions. Of these estimates, the onshore work currently appears to have the most significant local economic impact. However, the estimates of actual expenditure are preliminary and may change as more information becomes available. Detailed figures will be included in the Final Report.

O&M stage — economic impacts (jobs and contracts)

Vattenfall and the turbine supplier will share the wind farm servicing for the first five years, after which Vattenfall takes full control. O&M staffing is already in place in Aberdeen with about 10 Vattenfall employees, and about 5 of the turbine supplier employees. Most staff are from Aberdeen and Aberdeenshire. With long-term contracts over 20 years, there may be a higher multiplier impact, increasing total job impacts to c30pa, giving a significant 600 FTE over the life of the project, and roughly in line with the predicted O&M impacts.

Local contracts to support O&M operations include with Aberdeen Harbour Board, for quayside space/facilities and Regent Centre space; crew transfer vessel; onshore balance of plant; and offshore balance of plant. Some contracts are yet to be finalised. Currently, total O&M contracts are of the order of £1m pa. With additional contracts, and multiplier impacts, the annual local supply chain impact of contracts may be c £2m pa. With the addition of O&M employee expenditure, the total annual impact of O&M activities may be of the order of £2-3m pa.

4.3 Social impacts: from predictions to actuals

Pre-construction and construction – social impacts

There is very little coverage of social impact issues in the Environmental Statement. The EIA Technical Report focuses largely on economic impacts, but does note the potential of job creation to reduce unemployment in the area, and to offset partially the anticipated contraction in employment in other sectors such as oil and gas and manufacturing. The ES assessed the impacts on tourism, for example from the visual effects on the landscape and seascape potentially to deter tourist visits, and the effects on local coastal recreation activities, as of negligible significance.

Since the FID in July 2016, Vattenfall has implemented a proactive, two way community ***engagement strategy***, involving an extensive engagement with local residents and key local stakeholders, providing briefings and attending meetings and events to inform and consult on the construction of the windfarm (e.g. with the Belhelvie Community Council meeting, and Blackdog Residents Association). The role of the Local Community Liaison Officer has been particularly significant in the implementation of this successful strategy. A key component of the engagement strategy has been/is educating and raising awareness of the renewable industry and the technology and innovations associated with the AOWF project. This has involved, for example, working collaboratively with the Aberdeen Science Centre to facilitate education-outreach sessions, workshops and events to deliver relevant information in an interactive, accessible and engaging way.

There has been ***associated funding*** from Vattenfall for various community initiatives in support of the engagement strategy. Over £80,000 in funding has been provided to date for a variety of local causes including the Aberdeen Science Centre, Aberdeen Football Club, Belhelvie Girl Guides, Aberdeen and Grampian Chamber of Commerce, Robert Gordon University and various other local groups.

Social impacts of construction include a mix of quantitative and qualitative findings. The former, including impacts on the housing market, local services, quality of life and community cohesion, are difficult to disentangle from the impacts of other community activities, especially when they are quite small in total, and somewhat diffuse. However, one specific location, the community of Blackdog, has encountered some of the immediate impacts of the onshore construction, in particular of the construction of the substation. Focus group discussions with the community, at the time of the construction of the sub-station, raised a number of points, including:

- the community had been involved in the project from the planning stage, and it was acknowledged that Vattenfall had engaged with the community more than would have been expected;
- whilst there were local residents who were 'very vocal' in objecting to the development, it was observed that there were 'larger amounts who generally didn't mind';
- the area suffers from a historic legacy of landfill over 50 years and there were sentiments that the community felt 'blighted', with multiple other developments including the Aberdeen Western Peripheral Road, construction of 600 homes, construction of a multiplex, industrial estate and gypsy travellers site;
- there has been some impact on community cohesion from the construction phase with some community members continuing to oppose strongly the development and to monitor construction activities (especially traffic); and
- perceptions on potential local benefits included whether the community would receive cheaper electricity (question asked at a public meeting). It was noted that the main financial community benefits would probably only come once the project was operational.

Wider, more perceptual findings, included views as portrayed in the local press, and some local surveys by the team. A small survey by the project team of visitors to the Vattenfall Renewable Energy Exhibition, held in Aberdeen Library in February 2018 (around the time of peak construction), provided a general overview of local views on renewable energy, and particularly on offshore wind. Most respondents were well aware of the different types of renewable energy, especially onshore wind, offshore wind and solar. There were positive views on offshore wind. Comments included, for example: *sense of pride-demonstrating Scotland's commitment to renewables; I love the look of windfarms, they are beautiful; clean energy is beneficial to everyone; benefits for jobs and the environment; can take over when oil runs out.* There were far fewer negative comments, but some examples included: *possible disruption to wildlife/sealife; disruptive onshore infrastructure; visual disbenefits.*

A more recent small survey (Jan 2019) of local residents at the launch of the community benefits fund, with most of the respondents from the Balmedie, Belhelvie and Inverurie areas, reinforces these views. There was strong support for renewable energy from offshore wind. For the EOWDC, respondents were asked for their views on local impacts over the project lifecycle. Views were overall neutral on the developer's assessment, communication and management of potential impacts before and during project construction. A summary of the views on impacts five months into operation are set out in Table 3. Most are as expected, or not experienced, with the clear exception of visual

impacts. There was considerable surprise for some respondents at the size and nearness to shore of the windfarm – the visual scale was unexpected (although this should not necessarily be interpreted as a negative response). Some ('a fairly small minority') are against the windfarm as it 'spoils the view' whereas others are very positive and some just 'aren't that bothered'. There was a view that the community benefit fund will 'help' with acceptance. A further on-line survey is underway to seek to further assess changing views from the wider Aberdeen/shire community over the lifecycle of the project to date.

Table 3: Broad findings on community experience five months into operation of the AOWF

	More than expected	***As expected***	***Less than expected***	***Not experienced***
a) Traffic impacts	*0*	*7*	*2*	*16*
b) Visual impacts of the onshore component of windfarm	*4*	*10*	*3*	*8*
c) Project bringing benefits to local economy	*1*	*11*	*4*	*9*
d) Project providing local employment opportunities	*0*	*9*	*2*	*14*
e) Project bringing change to the community character	*1*	*6*	*5*	*13*
f) Visual impacts during installation of the turbines	*10*	*9*	*4*	*2*
g) Project providing local education opportunities	*1*	*11*	*3*	*10*
h) Project bringing social benefits	*1*	*8*	*4*	*12*

Source : Project survey 2019

A review of the coverage of the project in the press and social media has also been undertaken. Findings from the period July 2016 to August 2017 (Box 1) show a generally positive reponse to the project and to its implications for the region. Further in depth review of this material, and of subsequent material through to the present day, is in hand.

O&M stage – social impacts

A key feature of the late construction/ early O&M stage to date has been the development of the ***Aberdeen OWF Community Benefits Fund (CBF***). This has built on pioneering Scottish guidance, as well as on other UK and international examples (see Haggett 2017). The Local Community Liaison Officer followed up such guidance with discussions with local stakeholders and an online survey of the local community on various options and priorities for the Aberdeen CBF. The positive outcome is a CBF of £150,000 pa for 20 years. It applies to the whole of Aberdeen City and Aberdeenshire, but with 10% (ie £15,000) pa ringfenced for Blackdog projects.

There will be two levels of application—small projects, and large projects. Through the adminstrator Foundation Scotland, support is offered to communities to develop ideas and approaches to make the most of the funding and achieve maximum impact. The first invitation for applications to the fund commenced in January 2019. This fund is a major additional, social and economic benefit, for the O&M stage, which, with multipier impacts, is likely to generate a substantial social return on investment. If the claims made for the equivalent Beatrice Fund (NEF, 2017) were to eventuate for

the Aberdeen Fund, the £3m fund might deliver total social benefits of up to £9m (at current prices) over the life of the project.

Box 1: Summary of early press and other media comment on the project

News clipping review (1-2-19)

This provides a brief summary of an initial first stage review of the clippings collected by Vattenfall Local Community Liaison Officer between July 2016 (when Vattenfall announced the Aberdeen Windfarm programme) and August 2017. It represents only partial findings from this part of the study focusing on the general sentiment of the media reporting. Clippings reviewed are from newspapers (UK, Scottish and local), business and technical news sites (web based), TV and radio. We have not reviewed press releases from Vattenfall.

Newspapers

28 clippings were collected during the period of which 19 were in July 2016 (when it was announced the windfarm would go ahead), 2 were in August 2016 (when the EOWDC research programme was announced) and 4 in August 2017 (3 relating to the award of contract to Peterhead Port and 1 relating to the launch of the research programme). Nearly all the clippings from July 2016 included reference to Trump opposition to the windfarm (Guardian and Reuters also referred to 'Brexit'). The majority expressed positive aspects to the development for the region e.g. 'enormous opportunity', 'positive opportunity', whilst also referring to Trump views on the development. However, in the majority of clippings the overall sentiment was one of positivity.

Business/Technical internet sites

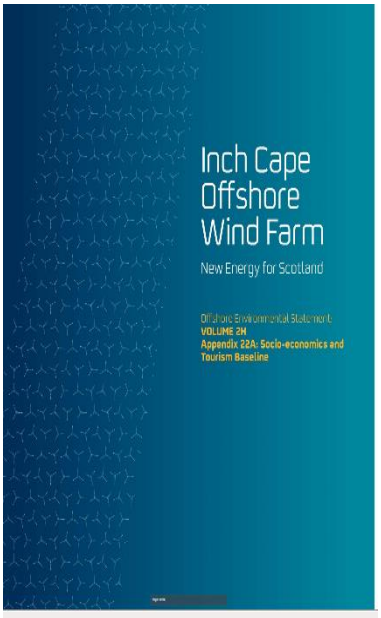
61 'clippings' from reports on business/technical sites were reviewed. Their focus was on: Vattenfall announcing the project would go ahead; the launch of the research programme and the announcement of the contract to Peterhead Port. For the latter there were a number of positive statements on what this would mean for business in the area.

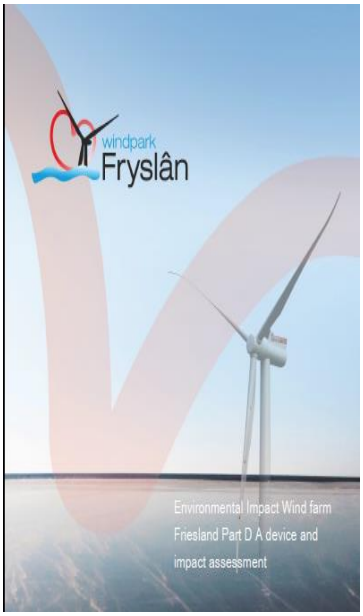
TV/Radio

8 'clippings' from TV and Radio were reviewed. These referred either to Vattenfall announcing the development would go ahead or to the award of the contract to Peterhead Port. All were positive on what the implications would mean for the region and for Scotland although three also referred to Trump.

There will be more in depth analysis of all media coverage (including accessible social and other media posts, via for example Twitter and YouTube), plus further work on clippings collected for the period beyond August 2017, in the second stage of the media review.

5. Recent socio-economic content in OWF Environmental Statements





5.1 Aim and approach

The focus of this element of the research is the socio-economic content of Environmental Statements (ESs) and relevant decision documents for OWF consent applications since the start of 2010 – for developments with a minimum capacity of 50 MW. We have reviewed the ESs for 24 UK OWF projects, and 12 non-UK OWF projects (Belgium, Netherlands, Denmark, Sweden and Ireland).

The purposes of the review are to document the extent and nature of the socio-economic coverage; trends over time; new issues; evolving methodology; and to explain variations in predicted socio-economic assessment impacts (e.g. variations by size of project; developer; country; location in relation to the coast etc). A standard pro-forma has been used to aid the comparisons.

5.2 UK studies

The UK review includes 24 projects ranging in size from 50 MW to 2400MW. In total, the ESs contain proposals for over 15GW of power. This very brief summary sets out some of the findings from the substantial ES review exercise, and from the detailed appendix summarising the socio-economic content of each ES:

- *All the UK ESs include a section on socio-economic effects*, but there is considerable variation in length of coverage (eg from 17pp for Blyth Demonstration to over 150 pp for the Atlantic Array and Moray East). Although there is evidence of considerable growth in the size of OWF ESs and projects over time (eg. Hornsea 3 at 2400MW) (Howard 2013), the socio-economic element has not grown substantially, and the content in the more recent ESs is normally in the range of 50-100 pages. However, precision is difficult, as some studies have additional

appendices, and extra sections sometimes required by examination bodies. Of course, length of coverage does not always equate with depth and quality of coverage.

- *The bulk of the ESs come under the National Significant Infrastructure Planning regime* (Planning Act 2008), and many of the OWFs are now in operation or under construction. The developers include international energy companies such as DONG (now Ørsted), Vattenfall, and SSE which are each responsible for promoting several projects. There are also several other single project-specific developers. Several major consultancies, such as Royal Haskoning and RPS, have undertaken the studies, with increasing use of subcontracting content to firms that specialize in this field, such as Regeneris and SQW.
- *There is much more coverage of economic than social* (with a ratio of about c 5:1). This may reflect the more quantitative and measurable nature of economic impacts. The relative coverage of social impacts appears even less in some of the most recent ESs, many of which are for projects that are a long distance offshore, and several social impacts (e.g on accommodation and health) are scoped out of the assessment from the beginning. ESs clearly recognise the variations in socio-economic impacts over the OWF life cycle. Most include both the construction and the operation and maintenance (O&M) stages, and increasingly the decommissioning stage. By far the most attention is for the construction stage. Some studies make clear distinctions between the onshore and offshore activities, but for many this is not clear, and the focus is primarily on the offshore activities. This is unfortunate as the onshore can have important local socio-economic impacts. There is only limited coverage of cumulative impacts. For many ESs, there is little or no mention of the monitoring of socio-economic impacts, although there are some notable recent exceptions (e.g. Beatrice, Hornsea, and Norfolk Vanguard).
- The *ES economic focus is on employment especially, and on supply chain and Gross Value Added (GVA) impacts.* There is also coverage of some related sector impacts, especially on tourism and fishing for offshore works, and on agriculture for the onshore cable route. In all of the studies, there is a dominance of baseline scene - setting before the coverage of the impact assessments. On methodology, there is evidence of increasing sophistication from early studies where there is only a vague description of the approach used, through to more studies using a scenario approach, and some studies using an Input-Output modelling approach. The scenario approach is the most popular, and provides a way of allowing for uncertainty in relation to (i) port location, especially for the construction stage, and (ii) amount of UK supply chain content. In some cases, there is also use of a 'Rochdale-envelope' worst-case scenario approach. The scenarios normally have three levels – low/medium/high – of local/regional/UK supply chain content. However, there are many interesting variations to the nature of the low/medium /high scenarios (e.g. *Triton Knoll:* with high assuming 70-100% UK sourcing; medium 50% of high and low 10% of medium; *East Anglia 3:* with high assuming 55% UK sourcing; medium 35% and low 20%).
- *Much depends on port location* and most studies are unclear on this issue, arguing that it will depend on the specification and sourcing of key construction elements (turbines, blades etc). Some projects (eg Dogger Bank Creyke Beck) argue that the port location issue negates any detailed economic analysis. However, as particular ports become used for actual construction and O&M stages for live projects, the port locations for subsequent projects (often next in a sequence at a broad location) should hopefully become easier to identify in the ES (?). There is also the issue of *what is local and/or regional in terms of economic impact.* Some studies avoid specification altogether. Where it is included there is some focus on adjacent coastal local areas, although there is considerable variation in approach.

- The *specification of potential employment associated with OWFs* is not clearly discernible from the ESs, and predicted employment can vary widely between impact scenarios. For example, as noted in Section 6, for the Beatrice project total local area job years predictions vary from 400-1800 for the construction stage, and from 3200-6000 for the total O&M stage, for low and high scenarios. For Hornsea 3, construction employment estimates range from 120 (low scenario) to 2140 (medium scenario) to 4060 (high scenario) for the Humber local area pa. In addition, for some ESs it is not clear whether the figures used are for the whole project life cycle or just for a key stage (normally construction). If for construction, is the figure for peak employment or again for total FTEs? There are also frustrating issues of which spatial level is being used, and for which scenario? One increasing area of consistency is the practice of using a Direct plus Indirect and Induced approach to employment impacts, although there is considerable variation in the size of multipliers used.
- Notwithstanding these problems, which do limit the utility of findings, the research sought to identify a range of potential local and regional employment impacts for total construction and for each O&M year, using a *job per project MW size approach*. These figures include Direct plus Indirect and Induced. For total construction FTEs, the forecast jobs per MW range from about 0.2 (local/low impact scenario), to about 0.5 (local/medium impact scenario) to about 1.5 (regional/medium impact scenario). For O&M the annual FTE per MW over the 20-25 year life of the project is much less, and may be of the order of 0.15-0.2 per MW for a regional /medium impact scenario. Almost all the ESs provide some *significance assessment of the potential employment impacts.* All assessments see construction employment impacts as positive, but perhaps surprisingly, very few ESs assess them as of major significance, with medium or minor as equally likely to be the level of significance (local and regional?). For O&M employment, assessment is in almost all cases assessed as minor positive.
- Many of the ESs include the *potential wider economic/GVA impacts associated with OWFs,* although it is not always possible to be specific and to make comparisons based on the review of the ESs. There is again a use of a scenario approach. Over time there has also been increasing use of guidance from sources such as of HM Treasury's *Green Book* (2013), Scottish Enterprise (SE) *Additionality and Economic Impact Assessment Guidance Note* (2008), and NPS Energy projects guidance. A few studies have used an Input-Output analysis approach to predict direct and indirect/induced economic impacts for the various OWF project stages, for example the Beatrice study. On average, predicted local/regional GVA per MW is of the order of £ 0.1-0.5 m for the total construction stage, and c £ 0.04m pa for the O&M stage (the latter averaging about £15-20 m pa for the total project for medium size projects; and up to £50m for very large projects). It is likely that there will be less difference between the low case and high case scenarios for the O&M stage, as there is likely to be more opportunity for local sourcing of the goods and services involved. The significance assessment is similar to that for employment effects.
- Several of the ESs also include discussion of the *potential impact of the project on other economic sectors, especially on tourism and fishing.* For the construction stage, the ESs assess the impacts on tourism as negative, and of minor and in some cases of medium significance, drawing on previous studies of the impacts on tourism of both onshore and offshore wind farms. There are fewer mentions of the negative impact on fishing from the construction stage; where mentioned they are seen as minor negative, but major in one important North Sea fishing area. There are also a few minor negative mentions of the impact of onshore cable laying on local agricultural activities. The findings are similar for the O&M stage, although there is occasional mention of the potential tourism value of OWFs.

- *The coverage of social impacts of OWFs is disappointing*. Many ESs give little coverage at all. Some briefly mention social impacts, especially potential construction workforce impacts on housing and local services. A few go further in their coverage of demographic impacts, housing and local services impacts and impacts on local quality of life (QoL). However, even in the latter cases there is normally a lack of depth with respect to specific issues, for example of impact of projects on community demographics, cost of housing, community wellbeing and perceptions. Overall, there appears to be a general assumption that social impacts are not important for OWF developments and many can be scoped out altogether. Methodology is largely descriptive and qualitative; there is a predominant use of professional judgement and comparative studies. Several ESs regard social impacts as deriving from the economic and environmental conditions, with economic impacts, especially employment, providing a measure of social impacts.
- In some ESs, for *the construction stage, there is mention of the potential impacts of the workforce on housing and local services, and occasional mention of impacts on community cohesion and QoL;* some of these comments related to onshore works, including the disturbance of the construction of substations and cable laying. In most cases, the ESs assessed significance as minor and negative. However, some studies also identified potential positive impacts, including enhanced training opportunities and demographic shifts with the attraction of more young people into the host area. For the O&M stage there was even less coverage of social issues, other than some limited mention of continuing visual impacts (negative/minor) and upskilling opportunities (positive/minor). A likely future topic, which was surfacing in recent studies, was the opportunity for community benefits initiatives.
- In many studies, there is *only limited evidence of the role of public participation* to assess such impacts, yet this is important for socio-economic issues. However, there is some evidence in a few studies. Appropriate stakeholder consultation is a requirement under the English National Infrastructure regime. For example, the Norfolk Vanguard ES reports considerable consultation work with local community/local stakeholders. “The project employed a Local Liaison Officer and Skills and Education Champion based in Norfolk, as well as procured support from a Norwich based Public Engagement agency. The project has continued to deepen and broaden engagement with organisations that support and represent the interests of people and businesses local to landfall, onshore cable route, onshore project substation and National Grid substation, and in the region”.
- *The ESs are limited on consideration of mitigation and enhancement measures*. However, there is some evidence of a growing focus on the provision of incentives to get the community involved in the project through, for example, training and educational incentives aimed at up-skilling and training in the local communities. There is also increasing use of special initiatives/protocols for local businesses to get involved in the supply-chain for the project. Mitigations/enhancements are more oriented towards enhancing economic gains and less towards social well-being *(although having a job can bring all kinds of social benefits).*
- With regard to *cumulative socio-economic impacts across projects*, coverage is partial with some limited recognition of the need to mitigate potential pressures on local labour demand, but more on the potential enhancement opportunities for delivering significant wider local/regional economic benefits in combination with other local OWFs. There is an emerging recognition of the importance of a tiering approach as a way of managing the growing number of OWFs, especially in the North Sea.
- *There is little evidence of monitoring in most of the ES reviewed so far.* There is some advantage for some projects in drawing on earlier projects in the same area, although

surprisingly there is little or no evidence of any systematic monitoring of earlier projects to assist in this (*although difficult if projects not yet under construction*). Recent English ESs are moving towards the good practice inclusion of a requirement for an *Employment and Skills Plan*, or equivalent, to support effective implementation of socio-economic undertakings (predominantly economic).

5.3 Other EU state studies

This aspect of the research included reviewing the socio-economic content of 12 OWF ESs from five countries: Belgium, the Netherlands, Denmark, Ireland and Sweden. The research included difficulties additional to those encountered for the UK study, including tracing all relevant documentation, language challenges, changes to legislation and process over time, and limited number of reviews bunched in a short timescale. This brief review provides summary reports on findings from two countries only -- Denmark and the Netherlands.

Denmark

- *All four ESs reviewed included a section or report covering socio-economic impacts*. Three of the ESs included separate reports for offshore and onshore. Across the four ESs, there is variation in page number allocated to the socio-economic aspect, with estimates complicated by referral to other chapters. Vesterhav South separated health, population and recreation impacts from socio-economic impacts. Kriegers Flak ES included a separate population, health and socio-economic report (69 pages) as did Horns Rev (35 pages). The developers included major international energy companies such as DONG (now Orsted), and Vattenfall.
- *There is greater coverage of economic than social impacts*. Kriegers Flak was an exception with more detail regarding social impacts, including in particular barrier effects. There is recognition of variations in socio-economic impacts between the construction and the O&M stages; there is less detailed coverage of the decommissioning stage (sometimes predicted to have the same impact as construction). Most attention is concentrated on the construction stage.
- The *key economic topics considered* are tourism (onshore and offshore); commercial fishing, shipping; traffic; mining; and agriculture/forestry. The coverage of employment is variable and largely neglected for two of the projects. GVA (Gross Value Added) and input-output studies were not included in any of the ESs. There is little original analysis; employment figures, when included, draw largely on data from previously established windfarms. There is a presentation of combined construction and operation figures, but with separation of direct, indirect and induced employment numbers. Local impacts are the primary consideration in these studies; regional implications typically focus on commercial fishing; nationally the content is around energy policy and renewable targets. The ESs do not provide a significance assessment of the potential employment impacts but, where stated, the assessment of employment impacts is generally positive.
- *The coverage of social impacts and impacts on local quality of life is minimal*. Recreation is one focus, along with changes in ferry trip duration and noise levels. Kriegers Flak proved an exception covering social impact more broadly and did address the effect on accommodation and housing. As with the UK reviews there is a lack of depth with respect to impact of projects on community demographics, cost of housing, community wellbeing (increased vehicular movements, diversions etc), and on crime and community cohesion. There is no

disaggregation of distributional impacts on various community groups (eg young/old; M/F). There are some examples of using the public consultation phase to help determine impacts of the prospective windfarm.

- *Mitigation measures* typically include measures to reduce noise, and the visual impact of the OWF via appearance of the turbines and positive landscaping, plus where possible the planning of construction activities out of season. There is little or no mention of monitoring for socio-economic impact.

Netherlands

- *The three ESs reviewed were produced between 2015 and 2016. Two of them are in the Netherlands EEZ windfarm zone*; they fall under the responsibility of the State rather than individual developers and the National Water Plan (2015) and the Netherlands Offshore Wind Energy Act (2015) provide a strategic level of assessment. This led to them taking the same topics and format, and with no direct reference to socio-economic impacts. In contrast, the Fryslan development, which is not in the zone and is located nearshore (next to a dam), has some coverage of socio-economic impacts, both onshore and offshore. The OWF developers include major international energy companies -- Orsted and Ventolines BV. Pondera consultants are responsible for all the ESs reviewed.
- *The Fryslan study includes impacts on employment*, but these are minimal and not broken down into the project stages nor rated for impact significance. Fryslan also includes noise and shadow, electromagnetic radiation as well as impacts associated with housing. A positive impact on local accommodation due to increased employment is anticipated
- *All the ESs include potential impacts on tourism, commercial fishing and shipping/sailing*. Studies draw on background information (largely qualitative) obtained from other windfarms, related studies and academic articles. Determining the economic impacts on tourism and recreation was key for all ESs; Fryslan has its own research study carried out by the European Tourism Futures Knowledge Institute (ETFI).
- *There is coverage of cumulative impacts of additional wind farms* on fishing, sailing safety and landscape. The Hollandse Kust Zuid I project included interesting research on the cumulative impact of the windfarms on weather and cloud movement.

5.4 Some summary overall findings and best practice lessons for the future

- *UK comparisons with other EU studies* indicate that socio-economic impacts, in terms of topics covered in this report (especially employment, GVA, wider economic development and supply chain, demography, housing, local services and community wellbeing) are much more fuller discussed in UK ESs than in ESs for OWFs in the other EU countries examined for this project. Indeed, ESs in these other countries cover socio-economic impacts very thinly, if at all; in some cases decisions over whether impacts are acceptable had been pre-determined at an earlier strategic level when the windfarm 'zone' was set. However, there is some overlap in the potential impacts of OWFs on other economic sectors, especially on tourism and fishing.
- *Socio-economic impact assessment* is now an established element of ESs for UK OWFs, but with a very clear economic focus on employment and wider economic development. Social impacts are thinly covered, and there appears to be a tendency for some of the more recent, and very large (and quite distant from shore) projects, to scope them out almost completely.
- *On methodology,* the use of a scenario approach with wide ranges of economic impacts can create considerable uncertainty on understanding the potential scale of such impacts for local

and regional stakeholders. The port location issue underpins much of the scenario approach. However, as particular ports become used for actual construction and the O&M stages for operational projects, the port locations for subsequent projects (often next in a sequence at a broad location) should hopefully become easier to identify in the ES, allowing clearer predictions to be made.

- The focus of assessment tends to be on the construction stage. However, it is also important to recognise *the importance and local potential of the much longer-term impact of the O&M stage.* A topic of growing importance for the 20-25 years project lifecycle is the opportunity for community benefits initiatives, which can be substantial.
- With more UK OWF developments, especially in the North Sea, *cumulative issues become more significant*. There is a recognition of the importance of a tiering approach as a way of managing the impact assessment of a growing number of OWFs.
- Recent English ESs are moving towards the good practice inclusion of a requirement for an *Employment and Skills Plan*, or equivalent, to support effective implementation of socio-economic undertakings (predominantly economic).

6. Comparative studies of OWF projects

6.1 Range of comparative studies

The project has two main comparative OWF studies to provide examples of the socio-economic impacts of larger projects and the cumulative impact of several projects. These are Beatrice, located in the Moray Firth, and the Hornsea projects, which are part of a cluster of North Sea OWF projects located well off the coast of Humberside. Our first comparative study focused on the Beatrice project. We now also have an initial study of the Hornsea cluster. In addition we have also added studies of the two small floating OWFs adjacent to the Aberdeen project, Hywind and Kincardine, to provide two local and different type of comparator projects. Hywind is now in place, as is part of the Kincardine project.

6.2 Beatrice *(as for Progress Report 1)*

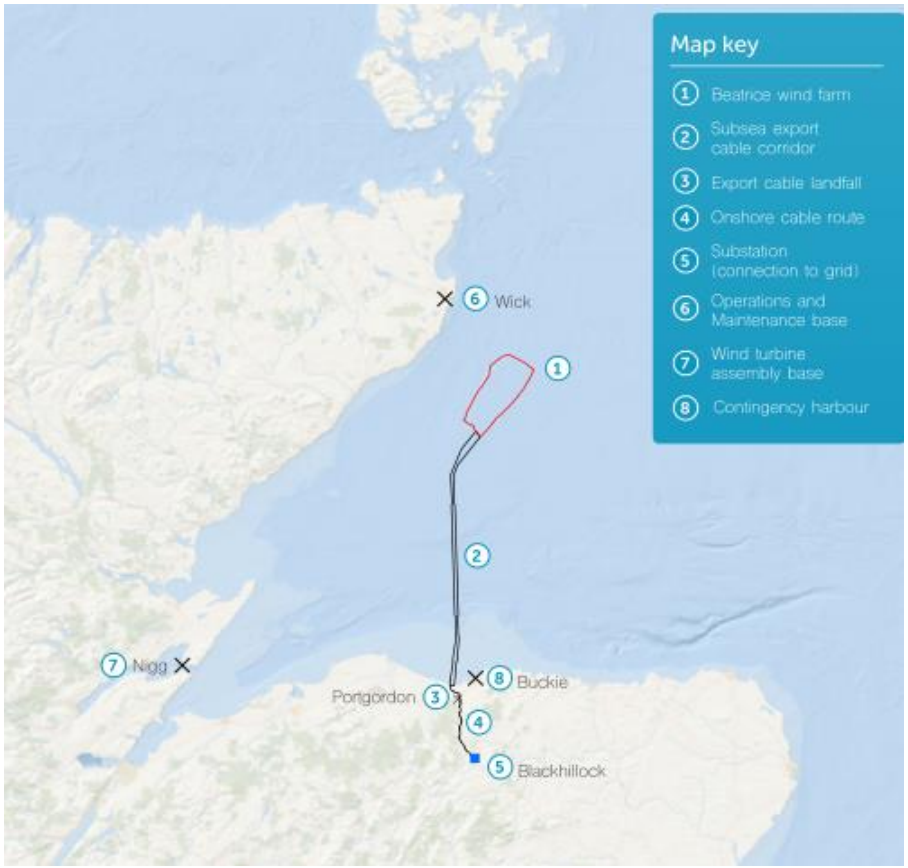
Beatrice is a 588MW project, with 84 turbines and Capex of £2.6 bn. It lies 13.5 km off the Caithness coast, and will be connected to the grid via a 65 km cable route to Portgordon on the Moray coast, and then onland to a new sub-station at Blackhillock, Keith (Figure 7). The construction project is roughly on the same timetable as the Aberdeen project. First power was exported in July 2018, and the project will be fully operational in 2019. The Beatrice ES predictions use very wide 'low-to-high case' socio-economic scenarios. For example, local area job years predictions vary from 400-1800 for the construction stage, and from 3200-6000 for the O&M stage.

Some interim conclusions on the Beatrice socio-economic study show a strong focus on economic impacts, especially GVA and employment, with very little on social impacts until the advent of the £6m Community Benefits Fund (CBF). The economic leakages out of the study area/Scotland are however high at 80% capital expenditure (Capex). The local study area is likely to gain most from the O&M stage, and the development of the ports at Wick and Buckie to service the project appear to be meeting local expectations for the project. Beatrice Opex figures are not yet available.

The project does have some good practice socio-economic impact lessons. For example, there is an attempt to monitor the actual economic impacts using an Input-Output model, and to estimate the

wider impacts of the CBF using a Social Return on Investment model.There is also an innovative two tier approach to the distribution of the CBF, although there were some local queries about the nature of the process used to arrive at the size and nature of the fund. The project also exemplifies the significant cumulative impacts from the project: sustaining a Scottish supply chain and enhancing key infrastructure, especially a network of Scottish port sites which may be of considerable significance for future offshore renewable energy projects.

Figure 7: Key elements of the Beatrice OWF project
Source: Beatrice OWF website



6.3 Hornsea 1- 4

Taken together, the four Hornsea projects, as and when fully developed, will constitute one of the largest clusters of OWF energy worldwide, with potentially up to 900 very large turbines, and around 7GW of power. They provide a major contrast to the single c600MW Beatrice project, and the small 90MW Aberdeen project. They also lie in an area of the North Sea where there are many more large OWFs at various stages of development. They also lie off a major port and industrialised coast, including the ports of Hull, Grimsby and Immingham. As such, the Hornsea case study provides an example of offshore wind farm development on a large scale, with the potential for substantial supply chain development, associated production/fabrication initiatives, and cumulative impacts. The key features of the four projects are set out in Table 4, and their broad North Sea locations in Figure 8.

Project	Key features
Hornsea 1	Hornsea 1 - 170 turbines of 7MW, 1.2GW, 103km offshore. The project was consented in Dec 2014, following an Examination under the English national infrastructure regime. Onshore construction began in early 2016; offshore construction is also underway and by late 2018, there is installation of about one third of the offshore foundations and monopiles. The cable connection comes ashore south of Grimsby and runs for c 40miles to a sub-station at Killingholme on the Humber Estuary.
Hornsea 2	Hornsea 2 - 165 turbines of 8.4 MW, 1.4GW, 89km offshore. This project followed the same examination process and received development consent in Aug 2016. Onshore sub-station construction works began in 2018. The cable route follows that for Hornsea 1, to the same sub-station.
Hornsea 3	Hornsea 3 – 2.4GW, up to 400 turbines, 120km offshore. This is the largest proposed UK OWF to date; the developer submitted an ES with an application for development consent in 2018 and the project is currently under examination by PINS National Infrastructure. Unlike the first two projects, the 120km offshore cable corridor for Hornsea 3 runs to the North Norfolk coast.
Hornsea 4	Hornsea 4 – will have a maximum of 180 turbines. This most recent of the Hornsea projects is currently (in 2018) at the scoping stage of the planning and application process. The provisional cable corridor is routed to come ashore south of Bridlington in Yorkshire.

Table 4: The set of Hornsea OWFs

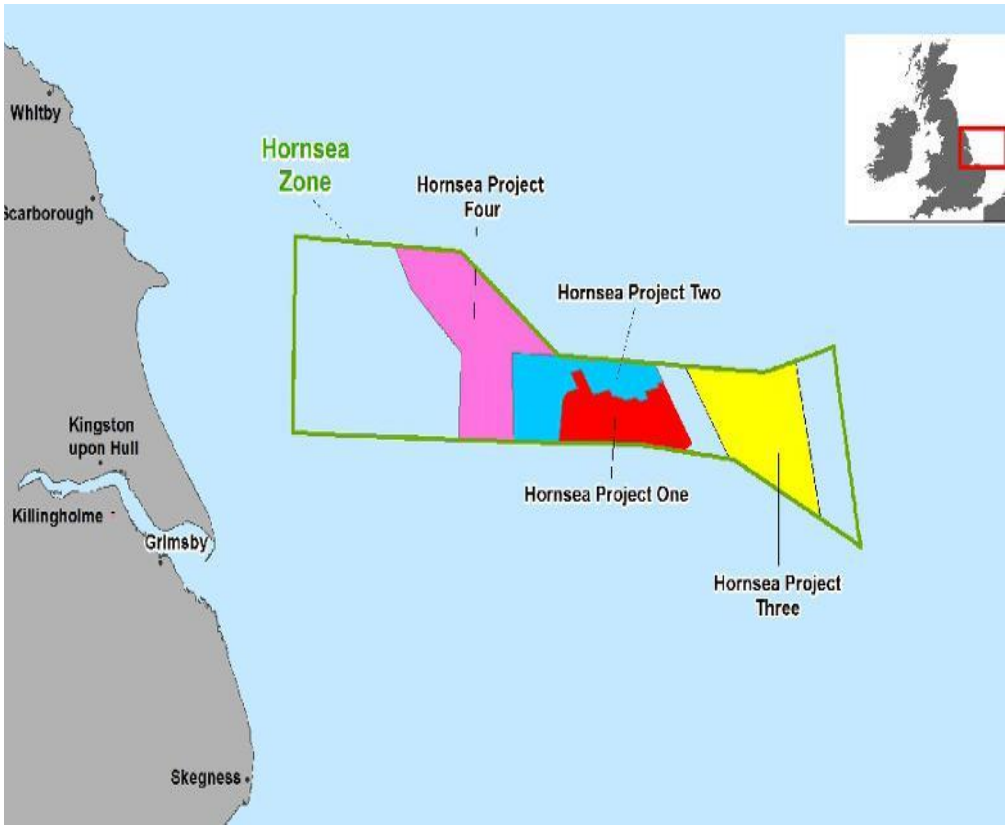
All of the project ESs include substantial chapters on socio-economic impacts, some including methodology appendices. They have a focus on the construction stage economic impacts, with a distinction between onshore and offshore impacts. The early projects do include also limited consideration of social impacts, but what is particularly noticeable in the Scoping Report for Hornsea 4 is the scoping out of many of the more social/community impacts. There is a narrow focus on economic impacts, with an anticipation of recruitment of much of the substantial construction workforce from the local and regional community.

The economic predictions for Hornsea projects 1-3 display great variability and uncertainty. For example, for the construction stage in total for Hornsea 1, the low impact scenario for the local area is only about one tenth of the medium impact scenario for sourcing, employment and GVA. The outcome from the examination was a move towards a low/medium scenario, so the predictions shifted to somewhere in the middle of the wide range between the two sets of predictions.

Cumulatively the Hornsea projects provide a set of overlapping socio-economic impacts, with the medium scenarios for projects 1 and 2 averaging about 1000 local construction jobs pa, and project 3 double that number. Similarly, the O&M stage is very significant cumulatively, with annual estimates

of jobs pa under a probably realistic medium scenario of 308(H1), 450 (H2) and 620 (for the large H3 project, but high scenario), giving over 1000 jobs pa over much of the combined project life cycles.

Figure 8: Location of the Hornsea projects (1-4)



The Dong/ Orsted Hornsea projects, which themselves follow on other earlier Humberside OWF projects (e.g Humber Gateway, Westermost Rough), indicate the strengths of a pipeline of projects for substantial local and regional socio-economic impact. A report on Dong investments in the Humber area, notes that:

In order for the offshore wind sector to have a sustainable economic benefit in the Humber Region a series of investments over a long period is critical. The nature of the sector is such that there is a large level of activity during the construction phase including manufacture and installation of components (typically over one to three years), followed by a smaller, sustained level of activity in the ongoing O&M of the wind farm. This means that a one-off wind farm development in an area would have limited sustained economic impact, because workers based temporarily in the area, who would move on once the construction was completed, would deliver most of the local construction phase activity. In the Humber, however, the group of wind farm developments over 10+ years has provided the area with the opportunity to establish a stronger foothold in the sector, secure inward investment and enable local businesses to gain access to supply chain opportunities (Regeneris, 2015).

Examples of that inward investment include: Siemen's £310m investment in a new turbine factory in Hull which, as well as creating an expected 1100 new direct jobs, will create further supply chain opportunities. Other activities include approval of the Able Marine Energy Park on the Humber, a

bespoke £450m bespoke port facility for the renewable energy sector, particularly offshore wind. Dong/Orsted has also invested £200m in the establishment of a major OWF O&M servicing base in Grimsby Docks which became operational in Spring 2018, creating at least a further 200 jobs. In combination, the OWF developments and linked onshore investments all enhance the identification of the Humber as a major OWF hub. In addition, an East Coast Community Fund, currently for the Hornsea 1 and Race Bank projects, commits up to £465,000 pa for the 20 years of O&M, for a wide range of local community and environmental initiatives.

6.4 Hywind and Kincardine floating OWFs

As well as the Aberdeen project, there are two other significant offshore windfarm projects in the immediate Northeast Scotland area: the five turbine, 30 MW, floating Hywind Scotland Pilot Park Project (Peterhead) which is now operational and the eight 6MW floating Kincardine Offshore Windfarm turbines project, which has now partially started generating. Given the close proximity of the three Northeast Scotland offshore windfarms it is useful to assess the approach and methodology taken; this may assist in providing for an eventual more integrated and comprehensive assessment for all stakeholders involved in these projects in this area. These two projects also provide an opportunity to explore any particular socio-economic impacts associated with the new offshore floating windfarm technology.

Hywind

The Hywind OWF is located 25km east of Peterhead and with a landfall location for the connector cable being in Peterhead itself. Assumptions used for the socio-economic impact assessment were total capital expenditure for the project of £150m, equating to £5m per MW installed and £100m O&M spend over a 20-year timescale, based on £5 million pa average spend. There were two impact scenarios, varying according to the amount of construction and installation work provided from outside Scotland. In practice, the outcome has been the non-Scotland scenario. The actual construction work for the turbines took place at Stord in Norway during 2017. In November 2018 Halvor Hoen Hersleth, plant manager for the project, said a “lower” number of local companies competed for contracts for the project than expected. However, he confirmed that Northeast firms could do more to win orders and that in the O&M stage there is almost none of the work that could not be done locally once the industry was in place.

Kincardine

Kincardine Offshore Windfarm Limited (KOWL) is a company formed by Pilot Offshore Renewable Energy (PORL) and Atkins Ltd. PORL is an Aberdeen based joint venture between MacAskill Associates Ltd and Renewable Energy Ventures (Offshore) Ltd. Both are Scottish companies with extensive experience in the wind industry. KOWL was established in order to develop, finance, construct, operate, maintain and decommission the Kincardine Offshore Windfarm. In contrast to the Hywind project, the Kincardine project uses a more ad-hoc/professional judgement approach, with no monetary valuations put upon the impacts, and a very high-level assessment of potential jobs. An interesting aspect of the project is the use of the Kishorn dry dock in Wester Ross, a site unused for 23 years, for the fabrication of the semi-spar substructure for the floating turbines. The project began exporting power in October 2018 with 1 x 2MW unit turbine. The developer plans to install six more floating wind turbines at the site, each with an individual output of up to 8.4MW, in 2019/20.

Floating and Aberdeen OWF socio-economic impact assessment comparisons

It seems reasonable to assume that floating windfarms would have more flexibility in construction location than conventional OWFs, with the possibility of generating very little construction stage socio-economic impacts in their final destination location. This does seem to be the case for the Hywind project. In contrast, the Kincardine project does provide an example of where there can at least be some regional benefits, if an appropriate construction base is available. For the O&M stage, there may be more similarity in socio-economic impacts with conventional OWFs. Table 5 provides a summary of some of the socio-economic features contained in the ESs for the three Aberdeen coastal OWF project.

Socio-economic content in ES	**Hywind**	**Kincardine**	**Aberdeen: EOWDC**
Methodology: Scottish Enterprise's economic impact assessment and additionality guidance / HM Treasury Green Book guidance	✓	×	✓
Stages of development covered –construction /O&M/ decommissioning	✓	✓	✓
Consideration of both onshore and offshore impacts	X	✓	✓
Scale of analysis of impacts—local, regional, national	✓	✓	✓
Direct employment effects, including employment generation, local content and safeguarding of existing employment;	✓	✓?	✓
Indirect employment effects; other labour market effects, such as changes in wage levels or commuting patterns;	✓?	×	✓?
Expenditure and income effects, including the use of local suppliers and other types of project-related expenditure;	✓	?	✓
Displacement/ Leakage/ Multipliers used	✓	×	✓
Employment impacts – no of jobs created	✓	✓	✓
GVA impacts – monetary impact of direct and indirect expenditure calculated	✓	×	✓
Economic effects on existing commercial activities (including tourism);	✓	✓	✓
Effects on the development potential of the area, including changes in the image of the area or in investor confidence;	✓	✓	✓
Social effects/ impacts on human population and in particular local residents and community	×	×	X?

Table 5: Comparative summary of socio-economic content of the ESs for the three Aberdeen coastal ESs

Cumulative socio-economic impacts from construction were not seen as significant for the projects in terms of a negative pressure on the local economy/workforce. However, there were perceived opportunities in terms of developing local supply chains and skilled labour inputs, and with the potential to attract inward investment especially for turbine manufacture, tower/substructure

fabrication. For the long-term O&M stage, there may be some opportunities for sharing, including for example vessels servicing the turbines.

There is also the important innovation, and demonstration, features of the three projects. The Aberdeen project is pioneering innovations in turbine size, cabling and control systems. The other projects are pioneering floating windfarm technology. The Hywind ES considered that the project is potentially a springboard to the wider opportunity for Scotland of developing expertise in floating offshore wind, where experience gained could lead to cumulative projects -- for example, a potential larger offshore park off the Scottish coast or in-combination with other current/future offshore projects. *(In January 2019, the Crown Estate announced support for a new study that would examine whether building more floating wind farms could boost the Scottish economy. The project will look into scenarios modelling differing scales of development, the impact of government policy and the resulting levels of economic benefit).*

7. Next steps

The project has raised a number of challenges, including the accessing and disaggregating of employment and contract spend data for the construction stage of the Aberdeen project. We do however have some useful data from Vattenfall, and from some contractors. Other challenges have included: maximising responses for our various local stakeholder and community surveys; and going beyond published/semi-published data, via SSE, Orsted and Statoil contacts, for the Beatrice, Hornsea and Hywind comparative studies. On the other hand, we have benefitted from a good working relationship with our Vattenfall contact staff, including especially the Aberdeen project Local Community Liaison Officer. The latter contact also gave us a live insight into community engagement for the project, including latterly the development of the Community Benefits Fund. We have also had access to a burgeoning set of literature and research documents on OWFs.

Ongoing work in the final nine months of the project will focus on completion of the already draft reports for each project element, and production of an overall final report addressing the project aims. To further underpin these reports, there will be some continuing work on the socio-economic impacts of the Aberdeen project, for the construction and, especially, the early operational stages, including further Vattenfall, contractor data and community survey results as available; completion of the Orsted Hornsea socio-economic impacts comparative study, plus some possible updating of the Beatrice study into the operational stage; drawing out of any further findings from the Environmental Statements' review for the various EU states; and an updating of the Literature Review.

In addition to the presentations to the Steering Group, we presented some initial information on the research to the *All Energy* conference in May 2018. We will make further presentations to the annual conference of the *International Association for Impact Assessment (IAIA*) in May 2019 and to the *RenewablesUK* conference (Project Delivery theme) in June 2019.

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