Technical Report 1: EOWDC Research Project – A Literature Review on the Socio-economic Impacts of Offshore Wind Farms (OWFs) and their Assessment

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https://doi.org/10.24384/epat-3z98

VATTENFALL

Dec 2019

Contents of the literature review

Executive summary

This research report seeks to provide a systematic review of current literature (both academic and grey) on socio-economic impact assessment methodology and mitigation/enhancement methods. It includes academic, industry and government literature relating to OWF published over the 10 years to 2019. The review first considers impact assessment methodology, and then its application to Offshore Wind Farms (OWFs), for both economic and social impacts. There is then a specific examination of socio-economic impacts of OWFs, with particular reference to Scotland. The executive summary here briefly sets out the nature of socio-economic impacts and their assessment, and associated challenges and opportunities in relation to OWF development, especially in Scotland.

Nature of socio-economic impacts and their assessment: Socio-economic impacts can be summarised as the "people effects" of development actions. They cover a wide range of social and economic impacts and the boundaries are fuzzy between social and economic impacts. Economic impacts can range from the macro-impacts on a nation's GNP to the impact on construction workers' wage levels in a town adjacent to a project. Social impacts may include impacts on local demographics, livelihoods, housing, local services, and wellbeing and community cohesion. Socio-economic impact assessment seeks to identify the impacts of development actions on people, and who benefits and who loses; it can help to build the needs and voices of diverse groups in a community into project planning and decision-making. The consideration of the social and economic impacts of major developments has been the poor relation of impact assessment until the current century. However, it is now a much more important element in the assessment of the impacts of major projects. Evolving international guidance, standards and legislation on SIA stress the importance of maximizing opportunities for **local content** (i.e. jobs for local people and local procurement), and the necessity for a project to earn its '***social licence to operate'*** in the host community***.***

Assessing the economic impacts of OWFs – challenges and opportunities: OWF is a rapidly increasing energy sector and the UK is the global leader. Yet there is concern that the UK offshore wind sector has not sufficiently capitalised on its lead to secure local economic content, in terms of UK investment and UK jobs. Economic leakage is greatest for the construction (CAPEX) stage, with only on average about 20% of expenditure staying in the UK; but in contrast, around 70% of the operational (OPEX) stage stays in the UK. Whilst much of the offshore construction work will not be from local companies, there is more local potential with onshore work (e.g. sub-station connections; local port improvements) and operation and maintenance. The impacts of multiple OWFs 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). A modelling trend that has evolved in the OWF sector over the last decade is the development of an Input–Output (I-O) approach to the prediction of economic impacts. However, this "top-down" approach does have some limitations. The focus of mitigation and enhancement is very much on the enhancement of local benefits, for example through developer support to maximise local supply chain benefits and local employment via training and recruitment policies. Monitoring of actual, rather than predicted local impacts, is essential for the advancement of the planning, assessment and management of economic benefits in the interests of the local community. Yet such monitoring has been very limited to date.

Assessing the social impacts of OWFs – challenges and opportunities: Methods to analyse social impacts, as well as mitigation and enhancement methods, are developing. There is increasing recognition of the need for both technical and participatory approaches, in order to capture the complexity and nuances of potential social impacts on a given community or group of communities. Early community engagement is crucial, in order to lessen the impact in relation to fear and anxiety, which in turn has a positive effect on the social impacts of an offshore development. It is also important to ensure sustained engagement throughout the project's lifetime, in order to mitigate or avoid longer-term social impacts. This review also demonstrates the importance of taking into consideration culturally meaningful aspects, such as the importance of seascape, which might have impacts on the community's attitude and perception. Research indicates that OWF overall have a positive impact on well-being, motivated by beliefs about environmental impact, job creation and local economic growth. However, there can be opposition motivated by concerns over profitability, decreases in property values and impacts on wildlife. The host community generally sees mitigation and enhancement methods as positive. Research suggests that emphasising the community benefits, rather than benefits to individuals, will garner greater support for offshore wind developments. Overall, there is an emerging literature on the social impacts of OWFs, but there is a need for more work, particular in relation to potential impacts on the sense of community and belonging.

Socio-economic impacts of OWFs, with particular reference to Scotland: Scotland has great potential for renewable energy development, with an estimated 25% of all of Europe's offshore wind and tidal potential. There is considerable government ambition for the industry at both UK and Scotland levels, with strong strategy positions and support initiatives, and in local authorities and other Scottish agencies. Yet the take-up of OWF projects in Scotland is currently low, compared with take-up for Scottish onshore wind and with English offshore wind. However, starting with the 588 MW Beatrice project, the number of major projects now in the pipeline could see Scottish offshore wind at least matching the 5GW capacity of Scottish onshore wind by the early/mid 2020s. Scotland is also pioneering innovation in the offshore wind industry, exemplified by the turbine size (8.4MW) and suction bucket technology for the Vattenfall Aberdeen project, and the Statoil floating Hywind project. Research on socio-economic impacts for offshore wind in Scotland identifies some impact issues and opportunities relating to: process (e.g. how to improve community participation), economy (eg the potential from the O&M stage), and social (e.g. on rural way of life), plus for other sectors, such as fishing. There is also the key issue of the importance of the provision of the required facilities needed at Scottish ports to support the offshore wind industry. However, there is growing good practice by developers such as SSE, Scottish Power and Vattenfall, who have promoted an array of measures to mitigate negative impacts and enhance positive impacts, especially on local employment and supply chain opportunities and with community benefits agreements.

1. Overview of the nature of socio-economic impacts and their assessment

1.1 Introduction--evolving literature on socio-economic effects

This research report seeks to provide a systematic review of current literature (both academic and grey) on socio-economic impact assessment methodology and mitigation/enhancement methods. It includes academic, industry and government literature relating to OWF published since 2009; this date is the chosen starting point, as we are aware of the 'Wind Energy' project (Wind Energy-the facts, undated) which has a comprehensive reference list of publications relating to OWF prior to 2009.

The consideration of the social and economic impacts of major developments was very much the poor relation of impact assessment largely until the current century (Glasson and Heaney, 1993; Chadwick, 2002). There was some early work in the 1970s and 1980s on, for example, hydro schemes in Canada, and the UK's North Sea oil –and gas- related developments, plus academic work by authors such as Wolf (1974) and Finsterbusch (1985). But much of the consolidation of the literature has been post-2000.

A number of wide ranging, and current overviews, are provided by:

- Arce-Gomez et al (2015) on developing a conceptual framework for SIA;
- Burdge (2016) on concepts, process and methods of social impact assessment (SIA)*;*
- Chadwick and Glasson (2017) on social impacts;
- Esteves, Franks and Vanclay (2012) on state of the art of social impact assessment
- Glasson(2017) on economic impacts;
- IAIA (2015) on social impact assessment guidance;
- IFC (2012) on performance standards on environmental and social sustainability;
- Rodriguez-Bachiller and Glasson (2004) on expert systems for socio-economic impacts
- Vanclay and Esteves (2012) on new directions in social impact assessment;
- Tethys – an ongoing source of valuable literature on wind and marine renewable energy (to 2019)

1.2 Definitions and concepts

Socio-economic impacts can be summarised as the "people effects" of development actions. They cover a wide range of social and economic impacts and the boundaries are fuzzy between social and economic impacts. Economic impacts can range from the macro-impacts on a nation's GNP to the impact on construction workers' wage levels in a town adjacent to a project. Social impacts may include impacts on local demographics, livelihoods, housing, local services, and wellbeing and community cohesion. Table 1.1 provides an overview of some of the most current socio-economic issues associated with the development of major projects.

Socio-economic impact assessment/social impact assessment (SIA) focuses on the human dimension of environments. It seeks to identify the impacts of development actions on people, and who benefits and who loses; it can help to ensure that the needs and voices of diverse groups in a community are taken into account during project planning and decision making.

Some authors refer to social impact assessment rather than socio-economic impact assessment. Some see SIA as a separate field of study, a separate process (Esteves et al, 2012), often more associated with a developing world context. Others, including the approach taken here, see SIA as an integral part of environmental impact assessment (EIA), providing the essential "human elements" complement to the often narrow "bio-physical" focus of many EISs: 'from the perspective of the social impact agenda, this meant valuing people "as much as fish" …' (Bronfman, 1991). Our focus is on the wider definition of socio-economic impact assessment, within a holistic impact assessment process (be it called EIA, EA, IA, ESIA, ESHIA etc) that is of relevance to all stages of a project's lifecycle.

***Table 1.1**: Types of socio-economic impacts*

1. **Direct economic:**
   - employment, including employment generation and safeguarding of existing employment;
   - characteristics of employment (e.g. skill group);
   - labour supply and training; and
   - other labour market effects, including wage levels and commuting patterns.

2. **Indirect/induced/wider economic/expenditure:**
   - employees' retail expenditure (induced);
   - linked supply chain to main development (indirect);
   - labour market pressures;
   - wider multiplier effects;
   - effects on existing commercial activities (eg tourism; fisheries);
   - effects on development potential of area; and
   - GVA and GNP.

3. **Demographic:**
   - changes in population size; temporary and permanent;
   - changes in other population characteristics (e.g. family size, income levels, socio-economic groups); and
   - settlement patterns

4. **Housing:**
   - various housing tenure types;
   - public and private;
   - house prices and rent / accommodation costs;
   - homelessness and other housing problems; and
   - personal and property rights, displacement and resettlement

5. **Other local services:**

- public and private sector;
- educational services;
- health services; social support;
- others (e.g. police, fire, recreation, transport); and
- local authority finances

6. **Socio-cultural:**
   - lifestyles/quality of life;
   - gender issues; family structure;
   - social problems (e.g. crime, ill-health, deprivation);
   - human rights;
   - community stress and conflict; integration, cohesion and alienation; and
   - community character or image

7. **Distributional effects:**
   - effects on specific groups in society (eg: by virtue of gender, age, religion, language, ethnicity and location); environmental justice

Source: adapted from Glasson (2017)

1.3 Evolving guidance, standards and legislation

Whilst the importance of socio-economic impacts was partly covered in evolving EIA legislation--- for example as "impacts on human beings" in the first EU EIA Directive (EC, 1985), the focus of the Directive was very much on bio-physical impacts. In similar vein, in the US context, in a review of the effectiveness of the pioneering US National Environmental Policy Act, Canter and Clark (1997) drew out five priorities for the future, including the need for better integration of bio-physical and socio-economic factors and characteristics. More specifically for the UK, Chadwick (2002) argued for explicit recognition by all EIA stakeholders (including developers, consultants, and competent authorities) for inclusion of socio-economic impact as an impact category; for further quantification and for improved guidance on the assessment of the range of such impacts. Such improved guidance has been more forthcoming in recent years, as set out in Table 1.2. The Equator Principles 4 (BSR 2019), also have more focus on human rights issues.

Table 1.2*: Some evolving international guidance, standards and legislation on SIA*

International Finance Corporation's (IFC) *Performance Standards on Environmental and Social Sustainability* (IFC 2012).	Performance Standard 1(PS1) establishes the importance of integrated assessment to identify the environmental and social impacts, risks, and opportunities of projects. It also notes the importance of effective community engagement, and the management of project impacts throughout the life cycle of the project. All these are crucial for effective socio-economic impact assessment. PS2, on Labour and Working Conditions, focuses on the importance of employment creation and income generation, its significance for quality of life, and the importance of the protection of the fundamental rights of workers (including, inter alia, non-discrimination, compliance with employment laws, and safe and healthy working conditions). PS7, on Indigenous Peoples, recognises the particular situations often facing indigenous peoples, in relation to defending rights, and problems in accessing the benefits from development. The standard includes, inter alia, respect for human rights, minimisation of impact on communities, and informed consultation and participation.

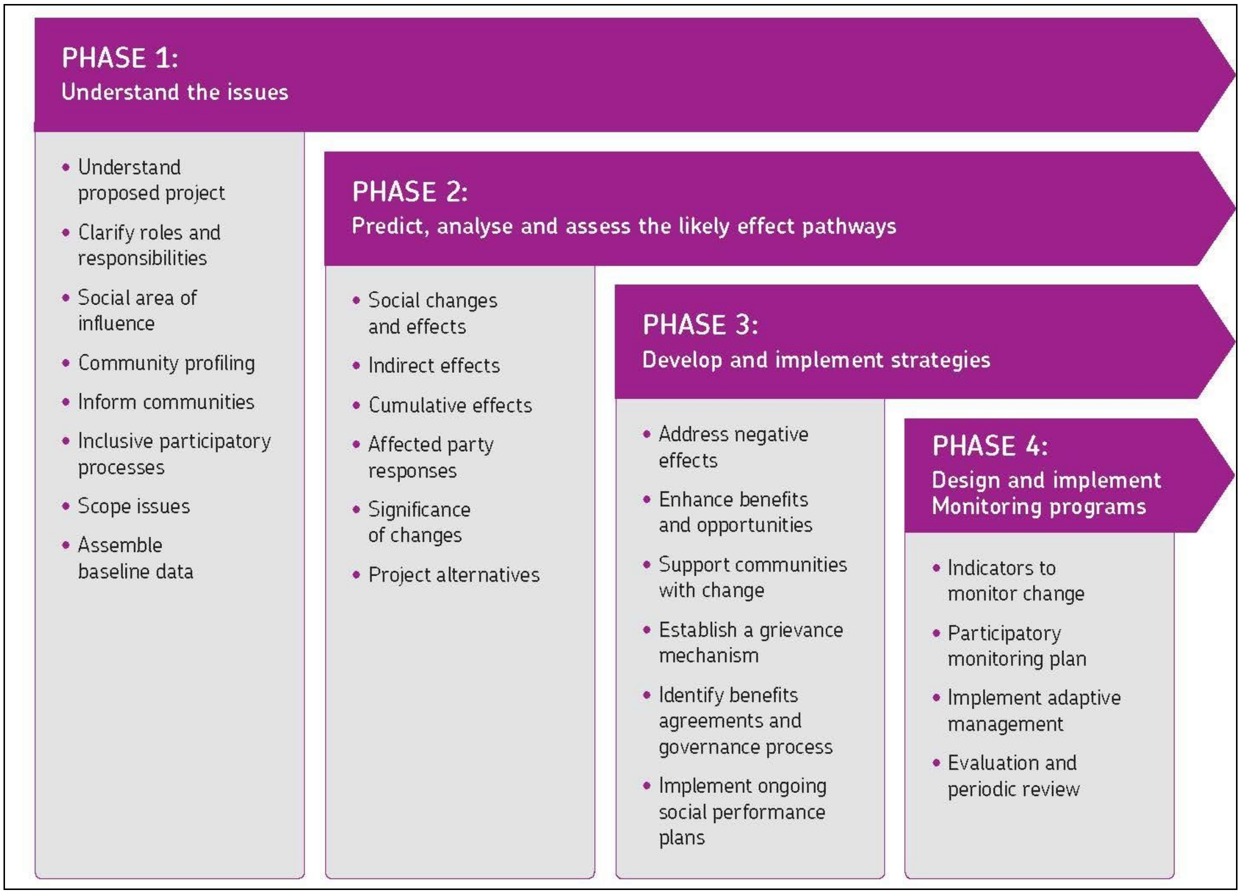
International Association for Impact Assessment (IAIA) recently updated guidance: *Social Impact Assessment: Guidance on assessing and managing social impacts of projects* (IAIA 2015).	The IAIA guidance promotes an increased focus in the assessment process upon enhancing the benefits of projects to impacted communities (via the use of Impacts and Benefits Agreements). Although the need to ensure that the negative impacts are identified and effectively mitigated remains, it recognizes the value in working with the project development team to deliver greater benefits to communities. This is necessary for the project to earn its '***social licence to operate'.*** The guidance states that enhancing benefits covers a range of issues, including: modifying project infrastructure to ensure it can also service local community needs; providing social investment funding to support local social sustainable development and community visioning processes; a genuine commitment to maximizing opportunities for **local content** (i.e. jobs for local people and local procurement) by removing barriers to entry to make it possible for local enterprises to supply goods and services; and by providing training and support to local people. The IAIA guidance also stresses that SIA is a process of management, not a product. Figure 1.1 illustrates the key considerations in each phase in the SIA guidance. Each of the steps is detailed in the guidance
EU EIA Directive (2014)	It was also hoped that the latest incarnation of the EIA Directive (EC 2014), to be implemented by Member States by 2017, would grasp the socio-economic impact initiative. Yet the revised Directive still maintains a very strong bio-physical focus, with the socio-economic content limited to population, human health and cultural heritage. In Europe at least, socio-economic good practice is likely to continue to outstrip legislative good practice.
Australian legislation/guidance	In Australia, at the federal level, the Environment Protection and Biodiversity Conservation Act 1999 does require that decision makers consider social and economic matters in deciding project approvals but, as reflected in the title of the act, it 'affords a high priority to environmental considerations' (Hawke 2009, p9). However there are some interesting innovations at the level of the state. For example in Queensland, since 2008, Social Impact Management Plans (SIMPs) are required for new resource projects, as an integral part of the Environmental Impact Statement (EIS) process (Holm et al, 2013).

1.4 The scope of socio-economic impact assessment

A consideration of socio-economic impacts needs to clarify the type, duration, spatial extent and distribution of impacts. In other words, the analyst need to ask: what to include, over what period of time; over what area, and impacting whom? The range of *what to include* has already been set out in Table 1.1. There is usually a functional relationship between impacts. For example, direct economic impacts will usually have a range of indirect (supply chain) and induced (worker expenditure) impacts. A project with a large number of in-migrant employees will have greater implications for local demography, the local housing market and local services.

The *timescale* of socio-economic assessment often raises, particularly for large infrastructure projects, the substantial difference between impacts in the construction and in the operational and maintenance (O&M) stages of the project lifecycle. There is also the pre- construction development stage, and the closure/decommissioning stage. SIA should be undertaken for all stages of the project lifecycle. Even within stages, it may be necessary to identify phases, for example peak construction employment, to highlight the extremes of impacts which might flow from a project.

Figure 1.1*: The phases of SIA as set out in IAIA guidance (IAIA, 2015)*



The *spatial scope* raises the often-contentious issue of where to draw the boundaries around impacts. For the construction stage, a regional/ sub-regional boundary may be appropriate reflecting the willingness of workers to travel long distances daily for short term, well paid employment. In contrast, permanent O&M stage employees are likely to locate much closer to work. Other spatial scope determinants may include the availability of data, and policy issues – providing spatial impact data to various levels of key decision makers (eg from local authorities to national governments).

The question of *who is impacted* is often the least well covered, but is vitally important. The distributional impacts of developments do not fall evenly on communities; there are usually winners and losers. Distributional effects can be analysed by reference to geographical areas and/or to groups involved (eg local and non-local, socio-economic groups, and age groups). This may raise important issues of environmental justice, allowing all to "define and achieve their aspirations without imposing unfair, excessive or irreparable burdens or externalities on others and their environments, now and in the future" (Scott and Oleofse, 2005).

In socio-economic impact assessment, these questions are considered through the various *steps in the assessment process*, as set out below, but with the major caveat that this is more a cyclical than a linear process, with considerable interaction, backwards and forwards between the steps. For example, public participation is of important at most stages of the process, and monitoring systems should relate to key parameters established in the initial project and baseline descriptions.

- baseline studies: understanding the socio-economic characteristics of the project
- baseline studies: understanding the socio-economic environment baseline
- scoping: clarifying the key socio-economic issues
- impact prediction
- assessing impact significance
- mitigation and enhancement of impacts
- monitoring of impacts, and associated measures

The various steps are now discussed separately for economic impacts and for social impacts. For each, this includes first a more generic discussion of good practice in relation to impacts for major projects in general (s 2&4), followed by secondly a focus in particular on offshore wind farm (OWFs) projects (s3&5). Section 6 then examines the evolving literature and guidance on the socio-economic impacts of OWFs, with particular reference to the nation and regions/local authority areas of Scotland.

2. Methodology: economic impacts and their assessment

This section draws in particular on the material in the publications by Glasson (2017), Rodriguez-Bachiller and Glasson (2004), which set out the key steps in socio-economic impact assessment methodology.

2.1 Introduction: baseline-project interactions; clarifying the key economic issues

Socio-economic impacts are the outcome of the interaction between the characteristics of the project and those of the "host" environment. Baseline information is needed on both sets of characteristics.

For the project what is important is the investment/expenditure and the associated human resources plans for the key stages of the project lifecycle—especially for the construction and O&M stages. Investment for infrastructure projects may be particularly large in the construction stage (CAPEX); but ongoing operational expenditure (OPEX) over many years may also be of considerable local and regional economic significance. Construction stage capital investment may involve a hierarchy of main (tier1) contractors, tier2 sub-contractors and tier 3 sub-sub-contractors, which can present considerable difficulties for the analyst. Understanding may also be complicated by rapidly changing technology in new and innovative areas. For example, work on major offshore wind farms has seen a rapid increase in the size of wind turbines, from 3MW to potentially 12MW in just a few years. As such there may be a need to allow for some uncertainty in analysis.

Figure 2.1 sets out the potential mix of useful quantitative and qualitative information in relation to the human resources impacts of the project. The anticipated labour curve over the construction and operational stages, showing especially the duration and skill categories of employee, is of particular value. For most large infrastructure projects, the key construction stage labour categories would include: technical/managerial; civil works operatives; mechanical and electrical works operatives; and various site services. Also of importance in terms of labour impacts are the developer's employment policies including, for example, the use/type of shift working, and approach to training of labour, accommodation policy and wage levels.

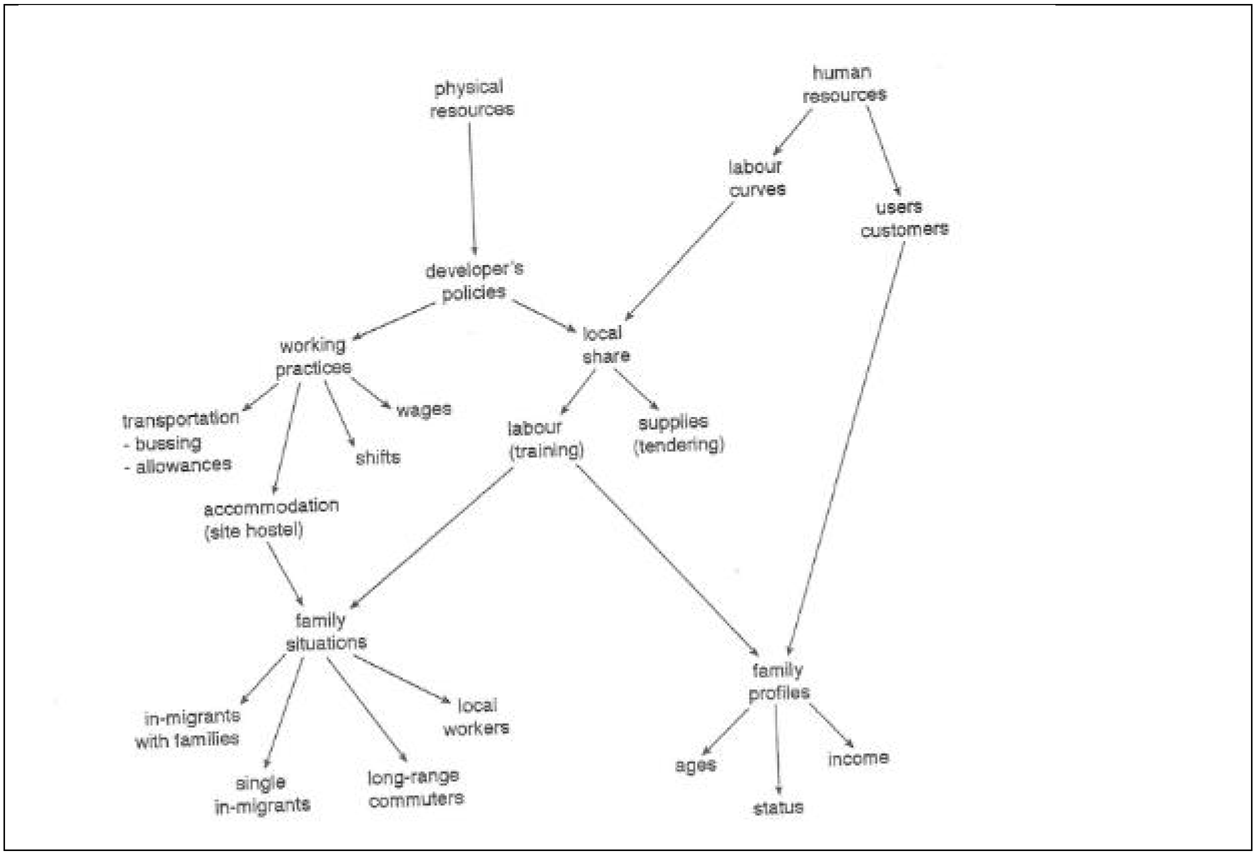
Defining the *host economic impact area* is influenced by the nature of the project. The Channel Tunnel project, for example, has implications on an international scale, well beyond Kent and SE England (Thomas and O'Donaghue, 2012); indeed most large scale infrastructure projects will have a range of economic impact areas, from local/regional to national, and often beyond. As noted earlier, short term construction stage impacts are likely to be spread more widely than operational stage impacts—with workers living more locally for O&M jobs which can stretch over several decades. Figure 2.2 similarly sets out some of the key economic host baseline data sources, but it should be noted that whilst studying the facts alone may allow the quantitative calculation of some key impacts, the study of local social/cultural factors may be needed to assess some of their significance (see s5, and Vanclay, 2003). Data on the labour force provides an initial guide to the ability of a locality to service a development. Information is needed on the economically active workforce, further subdivided into industrial groups (SIC –UN, 2008) and into occupational groups (ILO, 2008).

As for the project, so local economic impacts may be influenced by the policy stance(s) of the host area. The possibility of employment and local trade gains (both supply chain and local retail) may be the only perceived benefits for many localities. A local authority may therefore take policy positions on the percentage of local labour content for a project, and on the provision of training facilities to enhance the percentage, and seek to limit the leakage of multiplier benefits.

Such baseline analysis aids the *initial scoping/clarification of key economic impacts and issues.* The assembly and use of data should be complemented by key stakeholder interviews and public participation. The setting out of a community profile at an early stage in the assessment process can provide a useful step in identifying the relevant publics, and help in creating participation which is more meaningful than the limited "invitation to comment" on information which may be employed by some proponents (Esteves et al, 2012). While many economic impact issues may be specific to the case in hand, the following key issues often tend to be raised:

- **Local employment content/direct**: what proportions of project construction and operational jobs are likely to be filled by local workers as compared to in-migrants?
- **Local procurement**: what is the likely magnitude of the secondary (indirect and induced) local procurement resulting from the project development?
- **Local employment content/secondary**: what is the likely magnitude of the secondary (indirect and induced) employment resulting from the project development, and what proportion of these jobs will be filled by local workers?
- **Gross Value Added (GVA)**: what is the GVA economic impact of the project, at various spatial scales (from local to national)?
- **Local business affects**: will local businesses benefit from supply chain and retail opportunities flowing from the development, or will they suffer from competition for labour and local wage inflation?

***Figure 2.1**: Baseline project economic impacts information*

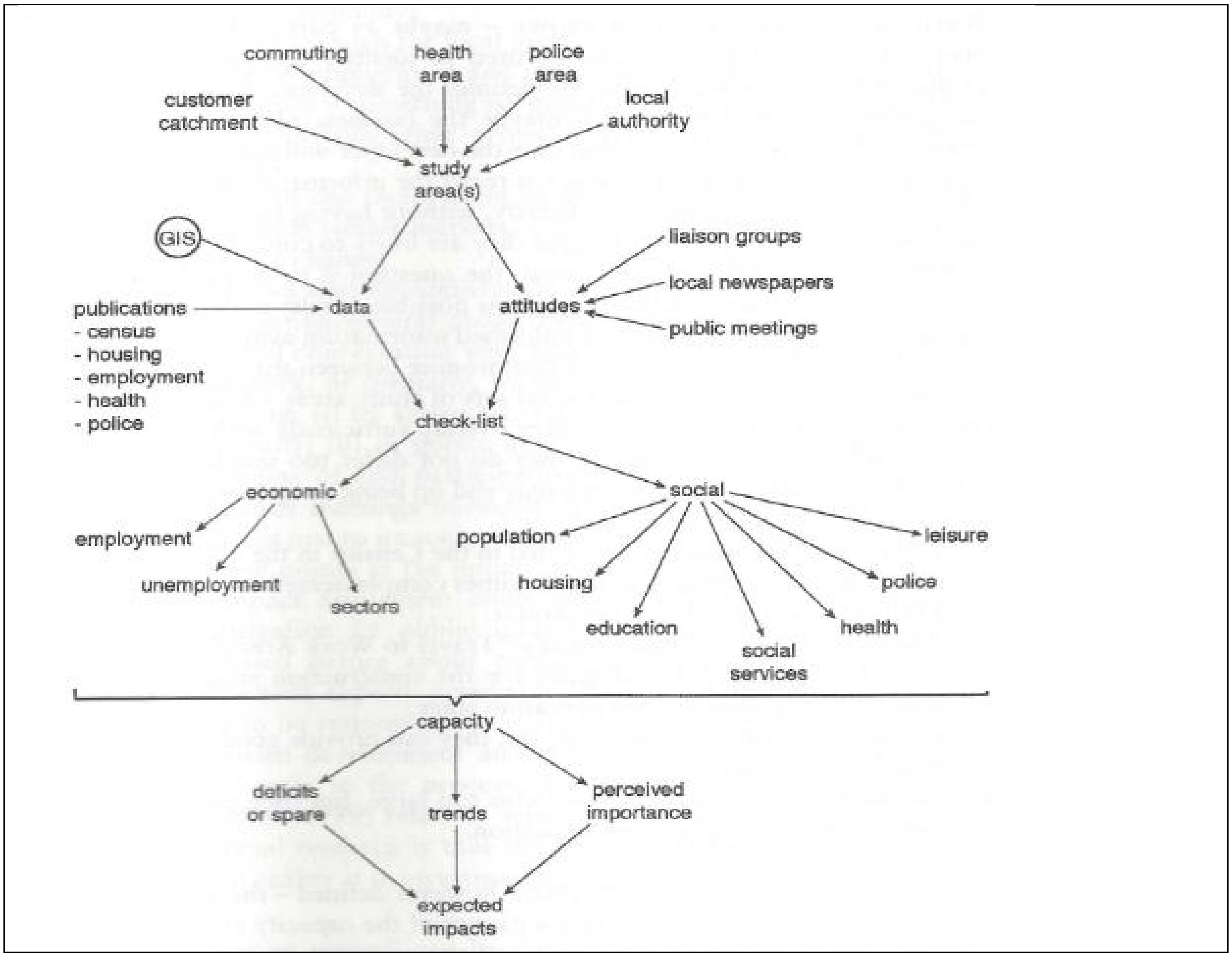


Source: Rodriguez-Bachiller and Glasson (2004)

2.2 Impact prediction

Prediction of the likely socio-economic impacts of a major project on various spatial areas is an inexact exercise. Ideally, with a good participative approach, there may be some agreement between key stakeholders on the appropriate methodology to be used in the assessment, on the project labour curve/skill requirements over time, on the scope of the local economy to meet some of the project requirements, perhaps with various enhancement training and other measures, and on agreed predicted outcomes on local content for various stages of the project. The methodologies may use extrapolative and comparative measures drawing on trends in relevant data, informed by examples of actual impacts from similar projects. Use may also be made of a range of economic impact models, such as multipliers and input–output (IO) models. Underpinning all prediction methods should be some clarification of the cause-effect relationships between the variables involved. Figure 2.3 provides a simplified flow diagram for the local socio-economic impacts of a power station development. Of crucial importance for the assessment of local content is the local labour recruitment ratio.

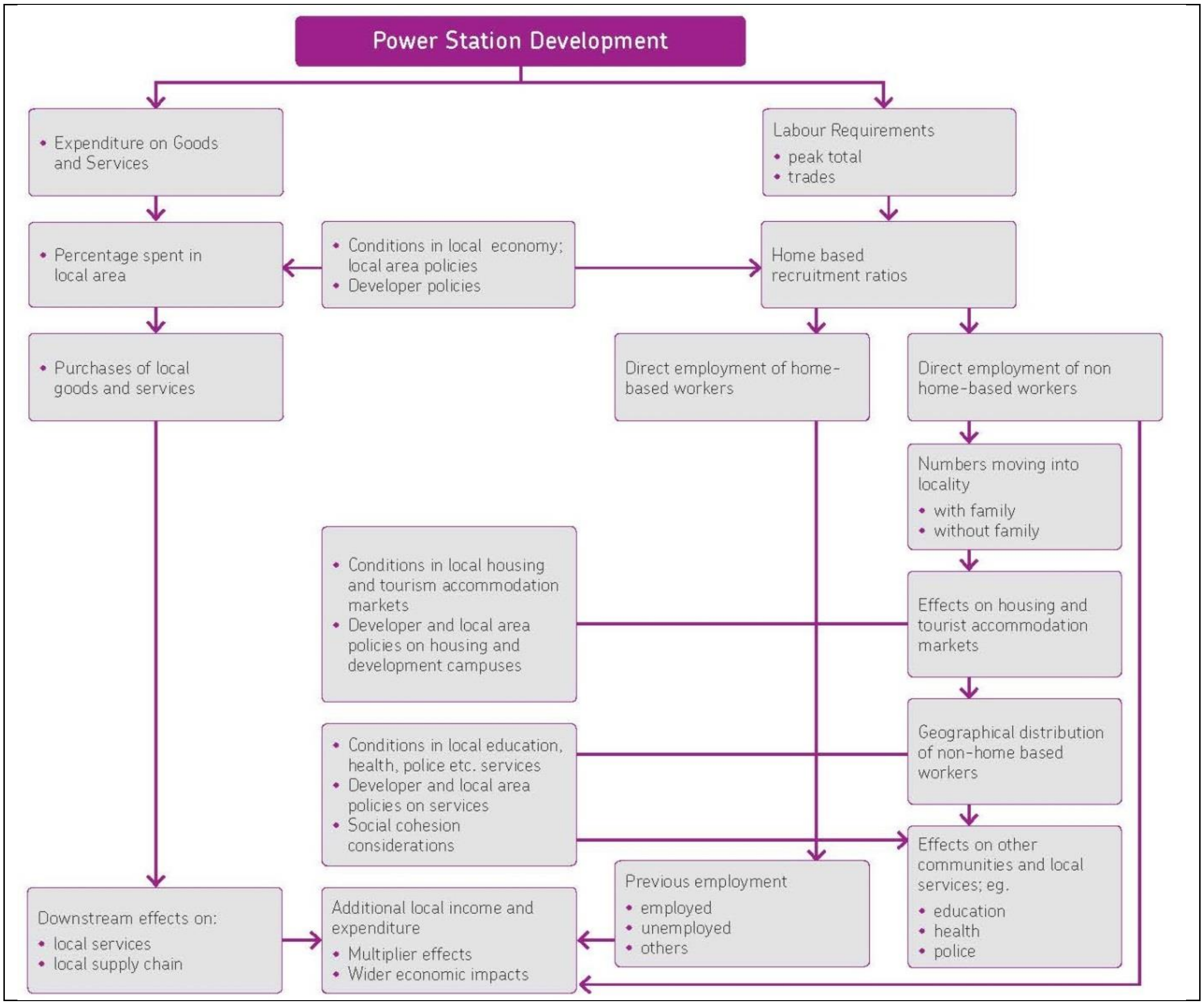
***Figure 2.2**: Baseline host area economic impacts information*



Source: Rodriguez-Bachiller and Glasson (2004)

By way of example, for the Hinkley Point C (HPC) nuclear power station development, it was finally estimated and agreed that there would be c34% local recruitment (from within 90 mins commute zone) at peak construction employment; for full operation, the local recruitment (from immediate local districts) was estimated at c52% (EDF, 2011). Such predictions were based on a methodology which involved detailed disaggregation of the project labour demands, detailed estimates of local supply capacity in a range of relevant construction skills, informed by comparative socio-economic monitoring data from the previous most recent nuclear new build at Sizewell B (Glasson and Chadwick, 1997), and from the sister new build station at Flamanville in France. Unfortunately there is very little similar monitoring data available on the actual socio-economic impacts of major projects and there will always be a degree of uncertainty attached to the predictions. This can be partly handled by the application of probability factors to the predictions, by sensitivity analysis, and by the inclusion of ranges in the predictions. The use of ranges in the estimates can provide approximate parameters for fuller ‘policy on-policy off’ scenarios, and other uncertainties, in relation to home-based recruitment. Thus, for HPC, there was a -/+ 10% range around the forecast local recruitment estimate, reflecting a no additional policy support position for local recruitment to a full-on policy position.

***Figure 2.3**: A cause–effect diagram for the local socio-economic impacts of a power station proposal. Source: Environmental Statement for Hinkley Point C nuclear power station (EDF, 2011), based on Glasson et al (1988).*



A host area is likely to be particularly concerned about the potential *local (and regional) direct employment impacts,* and to want to maximize such opportunities; although in extreme circumstances this could risk a local "boom-bust" scenario. Disaggregation of impacts into project stages, geographical areas and employment categories is the key to improving the accuracy of predictions. Table 2.1 provides an example of the sort of estimates that may be derived, illustrating lower local recruitment for the more specialist staff and much higher recruitment for local services staff, including security, cleaning and catering. A more detailed analysis might predict employment impacts for particular localities within a study area, for specific phases within key stages (eg civil works construction peak, and overall construction peak employment) and for particular groups such as the unemployed. A further level of macro-analysis might include the total person days of employment per year generated by the project (eg 2000 days in 2020).

***Table 2.1**: Example of predicted employment of local and non-local labour for the construction stage of a major project*

	Total labour requirements	*Local labour*		*Non-local labour*	
		%	*range*	*%*	*range*
Site services, security and clerical staff	300	90	250–290	10	10–50
Professional, supervisory and managerial staff	430	15	50–80	85	350–380
Civil operatives	500	55	250–300	45	200–250
Mechanical and electrical operatives	1520	40	550–670	60	850–970
Total	**2750**	**44**	**1100–1340**	**56**	**1410–1650**

Source: Glasson (2017)

There is also *a wider range of economic impacts*, which can have a multiplier effect on the initial project direct investment and employment. Secondary economic impacts include two main categories: indirect impacts and induced impacts. Indirect impacts result from the developer/main contractors requiring supplies ranging from components from local engineering firms to provisions for the canteen. Induced impacts result from the extra expenditure flowing into an area from the retail activities of, often well-paid, employees working on project main contracts and sub-contracts. Overall the net effect may be considerably larger than the original direct injection into the areas under study. Such wider impacts are usually seen as beneficial, but they may also bring some costs. Particular concerns about large projects, with large employment demands, are the potential inflationary impacts on various local markets, including housing and of course the labour market itself -- with the possible displacement of workers to the project at the expense of existing local businesses.

Modelling the wider economic impacts is becoming more used in economic assessment for larger projects. From economic theory we know that the economic effect of expenditure in an economic system is greater than the original amount because of the cascade effects it generates; it is as if the original injection has been multiplied by a factor greater than one. The calculation involves the original injection, the "multiplicand", and the greater-than-one multiplying factor, the "multiplier". At an aggregate level, the multiplicand injections for the construction and operational stages of a project could be total investments and jobs. A more sophisticated analysis would disaggregate these total categories. There are a range of modelling approaches to calculate the multipliers, each with its strengths and weaknesses. Such modelling tends to be used more for larger projects, but it is becoming more common (smaller projects may "borrow" multiplier values from comparable projects where possible). Two modelling approaches are noted here: the Keynesian multiplier and the I-O approach.

A Keynesian multiplier approach seeks to estimate how much of the original money injection from a project stays in the study area under consideration. If it all stayed in the area, the multiplier impact would be infinite. This is obviously not the case because there are major leakages out of the area, in particular: income saved, hence not spent; direct taxation, NI and indirect taxation on goods and services (especially VAT); and especially expenditure on goods and services imported into the area. The latter is a key leakage for major projects. The multiplier can be formulated mathematically (see Loveridge, 2004, Glasson, 2017). It can be calculated in income or employment terms. Leakages increase as the size of the study area declines, and (generally) decrease as the study area becomes more isolated. Local area (UK county scale) multipliers normally vary between 1.1 and 1.4; they are higher for a regional scale, but normally still well below 2. This multiplier approach has the advantages of relative simplicity, but is only as good as the information on which it is based and from which the multiplicand and multiplier are constructed. Estimating expenditure on imported goods and services is a particular challenge.

The input-output (I-O) approach is becoming a more commonly used economic impact model, advanced by UK consultancies such as SQW and Oxford Economics. It provides a more sophisticated and usually a more disaggregated approach (Batey et al, 1993; Miller and Blair, 2009; Oxford Economics, 2013). An input-output table is a balancing matrix of financial transactions between industries or sectors. As for the Keynesian multiplier, I-O analysis is used to calculate the wider impacts resulting from project construction and operational stage expenditure. Usual outputs are measures of Gross Value Added (GVA), and employment, from a project's expenditure/investment for a country, region and possibly for a more localised study area. GVA is the "value added" to an economy by an economic activity; it captures the difference between the value of output and the value of intermediate inputs, representing the unduplicated total value of economic activity that has taken place. Total employment impacts are often standardized as years of fulltime employment supported (eg 10 FT years could be 5 people each working for two years, 10 people each working for one year, or any other combination). The key to effective I-O analysis is the currency and level of disaggregation of the underpinning I-O tables. Unless an up-to-date I-O table exists for the host area under study, the start-up costs are likely to be too great for most socio-economic impact studies, and recourse must be made to the adaptation from national and regional I-O tables. For the UK these include UK-wide (ONS, 2010) and Scotland-wide (Scottish Government, 2012) tables. Further and more specific reference to the application of the I-O approach for OWFs is covered in section 3 of this report.

2.3 Assessing significance

Unlike many physical impacts (such as noise and air pollution) there are no recognised local socio-economic standards against which the predicted impacts of a project can be assessed. Whilst we may agree that a fall in unemployment is positive compared with, for example, an increase in crime, there are no absolute standards. Views on the nature of local benefits from a project may vary greatly between local stakeholders; they may be sometimes political; they may sometimes be arbitrary. However it may at times be possible to identify potential *threshold changes* in the socio-economic profile of an area; for example impacts which threaten to swamp the local labour market, or conversely employment opportunities which threaten to leak almost entirely from the host area.

While the attribution of significance in socio-economic impact assessment is an imprecise exercise, it is improving in practice. Rowan (2009) highlights the human elements in the variables influencing significance, namely magnitude and sensitivity criteria, and the importance of defining social receptors. Table 2.2 provides an example, from a wind farm project EIA, of an approach to defining sensitivity. A high-sensitive receptor will show evidence of severe socio-economic challenges, underperformance and vulnerability (eg: reflected in high unemployment), and may also be identified as a high ranking local authority policy priority. In contrast, a low –sensitive receptor will show good performance, capacity to handle change and will not be a policy priority.

***Table 2.2**: Definition of terms relating to the sensitivity of socio-economic receptors*

Sensitivity	Definition
Negligible	The receptor is not identified as a policy priority (as a result of economic potential and / or need). There is evidence of good overall performance and no particular weaknesses or challenges for the receptor in the impact area.
Low	The receptor is not identified as a policy priority (as a result of economic potential and / or need). There is evidence that the receptor is resilient and no particular weaknesses or challenges for the receptor in the impact area.
Medium	The receptor is not identified as a policy priority (as a result of economic potential and / or need). There is evidence of considerable socio-economic challenge or underperformance and vulnerability for the receptor in the impact area.
High	The receptor is identified as a policy priority (as a result of economic potential and / or need). There is evidence of major socio-economic challenges or underperformance and vulnerability for the receptor in the impact area.
Very high	The receptor is identified as the highest ranking policy priority (as a result of economic potential and / or need). There is evidence of severe socio-economic challenges, underperformance and vulnerability for the receptor in the impact area.

Source: RPS Hornsea 2 ES (2013)

Table 2.3 combines the magnitude of impact (for example scale and likely duration of local construction employment predicted to flow from the project) with the sensitivity of receptor. For the purposes of this assessment approach, those impacts identified as moderate, major or substantial are considered to be significant in EIA terms. Any impact that is minor or below is not considered significant in EIA terms.

***Table 2.3**: Matrix for assessment of significance showing the combinations of receptor sensitivity and magnitude of impact*

Sensitivity of receptor	Magnitude of Impact				
	No Change	***Negligible***	***Low***	***Medium***	***High***
Negligible	Negligible	Negligible	Negligible or minor	Negligible or minor	Minor
Low	Negligible	Negligible or minor	Negligible or minor	Minor	Minor or moderate
Medium	Negligible	Negligible or minor	Minor	Moderate	Moderate or major
High	Negligible	Minor	Minor or moderate	Moderate or major	Major or substantial
Very high	Negligible	Minor	Moderate or major	Major or substantial	Substantial

Source: RPS Hornsea 2 ES (2013)

2.4 Mitigation, enhancement and monitoring

For socio-economic impacts, and particularly for economic impacts, the focus in assessment is often more on enhancing beneficial impacts, rather than on mitigating adverse impacts. However there may be some instances of potential adverse impacts requiring some *mitigation measures*. For example, there may be some concern from local firms about the poaching of labour by major projects paying above local wage rates for substantial numbers of employees. In such cases there may be attempts to build in formal and/or informal controls, such as “no poaching agreements”. Concerns by local tourism businesses about, for example potential disruption from construction workers’ daily commute and in-migrant workers pressure on local tourism accommodation, may lead to specified commute routes and purpose-built worker accommodation. The local tourist industry may also be supported by developer-funded additional advertising stressing that “the area is open for business” – during what may be an intensive project construction period.

However, in contrast with most other types of project (physical/bio-physical) impacts, the focus is on measures to *enhance benefits* and, in economic terms, to enhance the benefits of local content. Increasingly, enhancement measures are being packaged in some form of plan. This might be a specific Employment and Supply Chain Plan, or a more--wide ranging Social Impact Management Plan covering a wider range of socio-economic issues and impacts (Holm et al, 2013). Some of the evolving economic impacts enhancement measures are set out in Table2.4. The related issue of Community Benefits Agreements is discussed in later sections of this report.

***Table 2.4**: Examples of evolving types of economic impact enhancement measures*

Type of measure	Key elements, and examples
Supply chain websites	Developer websites provide vehicles for local firms to check out supply chain opportunities and to register their interest. The UK Olympic Development Authority CompeteFor website provided a good early example.
Supply chain events	Developers provide open events setting out the project supply chain opportunities, well in advance of the project start, for interested suppliers.
Skills training programmes	This involves working with local education and training providers to help in the provision of appropriate training to equip local people with appropriate skills to work on the project.
Local recruitment targets	In addition to overall local recruitment targets, there may also be specific targets for employment from disadvantaged groups.

When positive enhancement measures are put in place, it is important that they do not become diluted and that they are implemented as intended. This is an important role for *monitoring systems.* Unfortunately, monitoring has been a particularly weak link in impact assessment to date, and has not been mandatory for EIA in the UK, nor in many other EU Member States and not under the EU EIA Directive. However, the omission was recognised in the latest review of the Directive (EC, 2014), and will become mandatory from 2017. Monitoring is invaluable in learning from practice. It allows the comparison of predictions with actual outcomes, and can aid fine-tuning of the project when some of the intended outcomes are not being fully achieved. Key indicators for monitoring direct economic impacts include, for example: levels and types of employment on the project, by local and non-local sources and by previous employment status; the output of training programmes and take-up by the project; distribution of contracts and sub-contracts; and workforce expenditure. Some information can be provided by the developer and tier 1 contractors; other information may benefit from some specific surveys (e.g. of the economic activities of the project employees).

Monitoring information can greatly assist future project planning. The work of the Impact Assessment Unit (IAU) at Oxford on monitoring the local socio-economic impacts of the construction of Sizewell B nuclear power station (Glasson, 2005) provides one of the few well documented examples of a longtitudinal study of socio-economic impacts in practice. It facilitated auditing of predicted impacts, improved project management during construction, allowing some issues to be nipped in the bud, and provided valuable input for the planning and assessment process for the next generation of nuclear stations (at Hinkley Point C, Sizewell C and Wylfa). The London Olympics project also had a construction monitoring programme, with monthly socio-economic returns on key characteristics of the workforce (ODA, 2011).

2.5 Summary—opportunities and challenges of assessing economic impacts

The following bullet points highlight some of the key opportunities and challenges emerging from the evolving literature on the assessment of economic impacts of major projects:

- there is a growing interest, literature and practice in socio-economic impacts of major developments;
- this interest is most well established for the economic impacts, which are seen as more quantifiable and positive, although the importance of the social dimension is being increasingly recognised;
- there can be major differences in economic impacts between the construction and operational stages of projects, with the former having the more intensive impacts, although the latter often have the more stable and longstanding impacts;
- the focus of economic issues and impacts for local areas is on: local employment content—direct and secondary, local supply chain procurement, and other potential impacts on local businesses (e.g. on tourism);
- the prediction of impacts faces a number of uncertainties, especially in relation to the specification, and interaction, of the characteristics and associated policies of the project and the host economy, with both known unknowns and unknown unknowns;
- there is a growing use of macro I-O approaches to predicting impacts, but with some limitations in currency and scale of data inputs; fine grain" bottom-up" data from the developer (e.g. on particular skill requirements reflected in project labour histograms) can however be more useful, and facilitate more stakeholder participation in the assessment process;
- assessing significance presents challenges as there are no "state of society standards", but approaches are evolving; for some capital intensive/off-site manufactured projects local economic impacts may have a relatively low significance; but for others with for example high employment intensive construction programmes, they can be the dominant impact category;
- enhancement of economic benefits is much more significant in the socio-economic field than the mitigation of adverse impacts, and there is considerable progress on approaches – including the use of Employment and Skills Plans; and
- the monitoring of impacts is still in its infancy; but much could be gained from the collection of evidence of economic impacts of projects in practice.

3. Economic impacts and their assessment, with particular reference to OWFs

3. Economic impacts and their assessment, with particular reference to OWFs	3.1 Introduction – from onshore to offshore 3.2 Baseline definition – what is local? 3.3 OWF project stages and components 3.4 Key economic issues – especially optimizing local content 3.5 Evolving methodological approaches 3.6 Mitigation, enhancement and monitoring in practice 3.7 Summary

3.1 Introduction – from onshore to offshore

Wind is a rapidly increasing energy sector. In Europe the wind energy sector increased from 2.5GW in 1995 to over 142GW of capacity in 2015 (EWEA, 2016). Over 80% of this capacity is in the form of onshore wind energy projects, but the offshore sector has been growing apace since 2000, especially in the North Sea (EC 2016). The UK is the global leader in offshore wind energy generation. In 2015 it had over 5GW in operation or under construction, and a further 14.3GW with consent and likely to move into construction by the early 2020s (Higgins and Foley 2014; UK Renewables 2015). Table 3.1a shows the dominance of the UK offshore energy sector in Europe, followed by Germany, Denmark, Belgium and the Netherlands. Table 3.1b provides a more updated picture from 2018

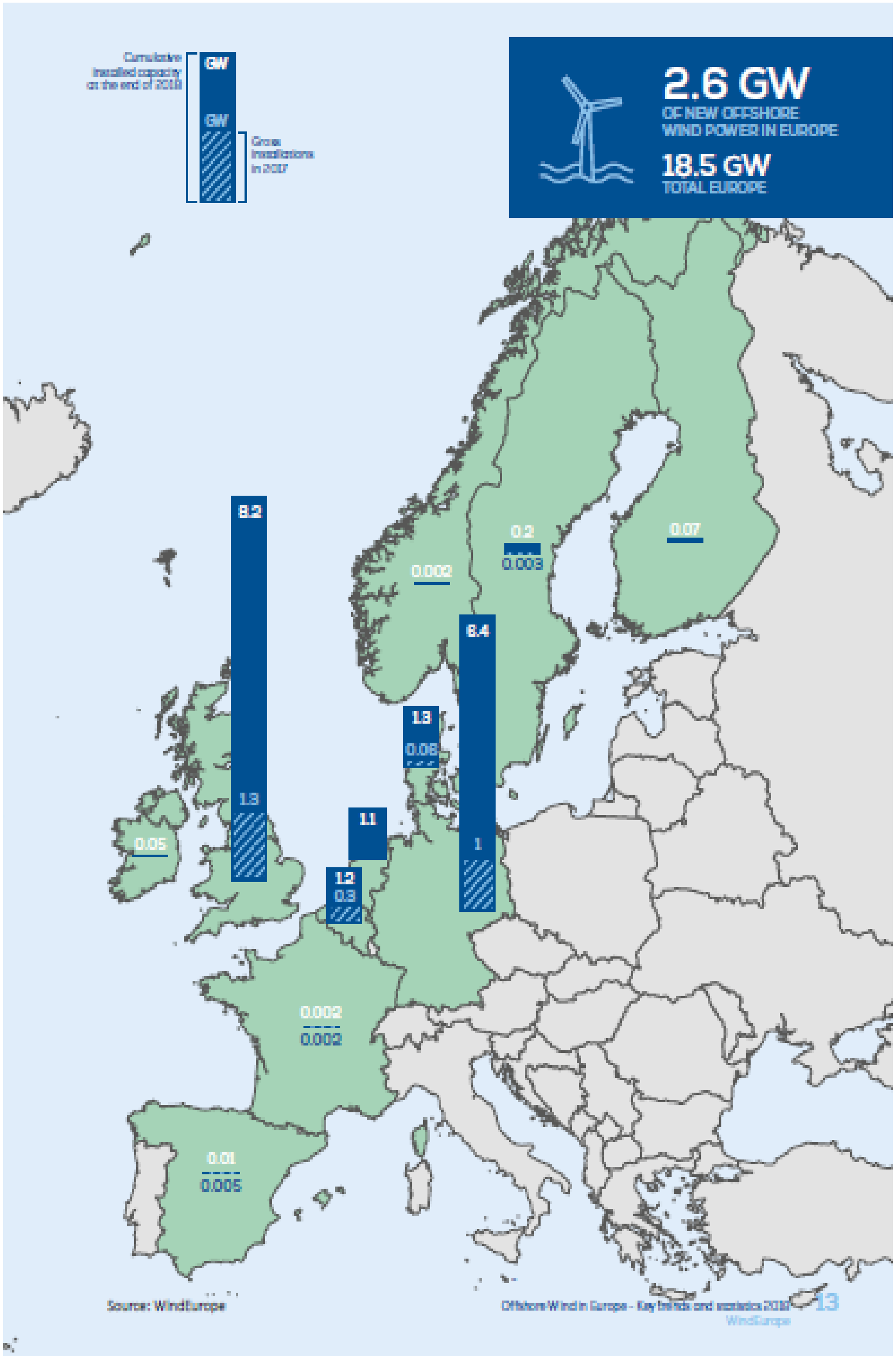
Table 3.1a*: Number of wind farms with grid-connected turbines, number of turbines connected and number of MW fully connected to the grid at end of 2015, per country* (Source: EWEA, 2016)

Country	BE	DE	DK	ES	FI	IE	NL	NO	PT	SE	UK	Total
No. of farms	5	18	13	1	2	1	6	1	1	5	27	**80**
No. of turbines	182	792	513	1	9	7	184	1	1	86	1,454	**3,230**
Capacity installed (MW)	712	3,295	1,271	5	26	25	427	2	2	202	5,061	**11,027**

***Table 3.1b**: Number of wind farms, MW capacity and number of turbines connected at end of 2018, per country* (Source: Wind Europe 2019)

COUNTRY	NO. OF WIND FARMS CONNECTED	CUMULATIVE CAPACITY (MW)	NO. OF TURBINES CONNECTED	NET CAPACITY CONNECTED IN 2018	NO. OF TURBINES CONNECTED IN 2018
TOTAL	105	18,499	4,543	2,649	409
United Kingdom	39	8,183	1,975	1,312	222
Germany	25	6,380	1,305	969	136
Denmark	14	1,329	514	61	42
Belgium	7	1,186	274	309	8
Netherlands	6	1,118	365	0	1
Sweden	4	192	79	-10	-7
Finland	3	71	19	0	0
Ireland	1	25	7	0	0
Spain	2	10	2	5	1
France	2	2	2	2	2
Norway	1	2	1	0	0

Figure 3.1*: Geographical distribution of cumulative and new (2018) MW capacity per country*
(Source: Wind Europe 2019)



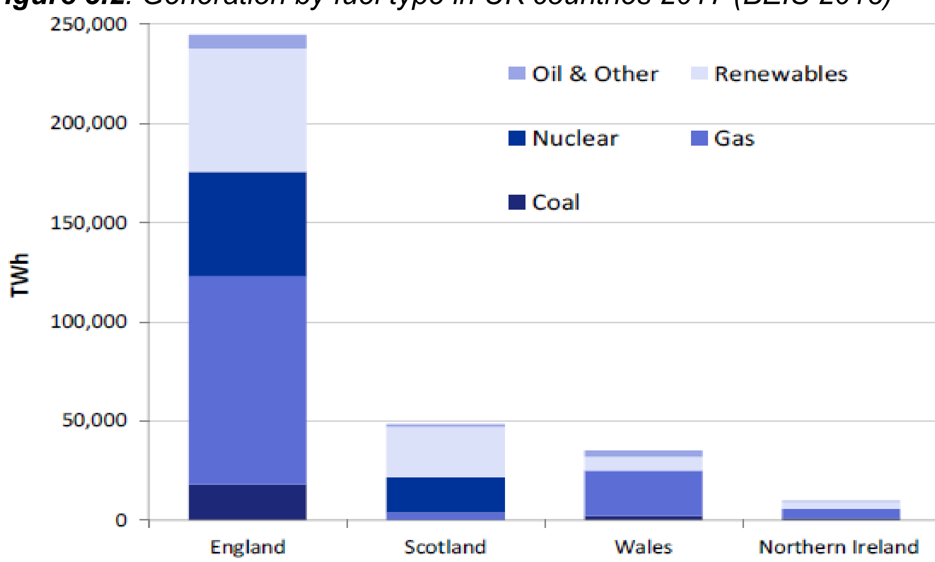
Tables 3.2 and Fig 3.2 show the growing significance of wind energy (onshore and offshore) in the total energy mix for the UK, already exceeding nuclear in terms of installed MW capacity. Yet despite this international advantage, there is concern that the UK offshore wind sector has not sufficiently capitalised on its lead to secure UK economic advantage, in terms of UK investment and UK jobs (Renewables UK, 2015). It is difficult to be accurate on jobs associated with the UK offshore sector. In 2008 Bain &Co were estimating 5,000 jobs for both onshore and offshore, which could grow to 50,000+ by 2020 (75% offshore). BVG (2016) estimated already 13,000 UK jobs in the offshore sector by 2015. The infrastructure value of UK offshore projects was estimated at c£10bn (2015), and could increase by +£ 20bn (2020), and +£30bn (2025).

There has been a rapid fall in the unit cost of delivering UK offshore wind, as exemplified by the fall in the Contract for Difference (CFD) price for offshore wind projects in 2017. By 2030 there could be up to 30GW capacity (BVG, 2016). Yet there is a concern that as an industry the UK offshore wind energy sector should take the delivering of UK content and UK economic success more seriously. Much of the CAPEX stage leaks overseas. Renewables UK now has a target, agreed with Government, to deliver 50% of UK content (by when?).

Table 3.2*: UK energy mix—installed capacity in MW (1995--2014) (*Source: EC 2016)

	1995	2000	2005	2010	2013	2014
Installed Capacity (GW)	**70.13**	**78.39**	**82.38**	**93.75**	**95.11**	**97.01**
Combustible Fuels	52.94	61.22	64.66	73.00	66.68	64.24
Nuclear	12.76	12.49	11.85	10.87	9.91	9.94
Hydro	4.22	4.27	4.29	4.39	4.45	4.47
Wind	0.20	0.41	1.57	5.40	11.22	12.99
Solar PV		0.00	0.01	0.10	2.85	5.38
Geothermal						
Tide, Wave and Ocean		0.00		0.00	0.00	0.00
Other Sources						

Figure 3.2*: Generation by fuel type in UK countries 2017 (BEIS 2018)*



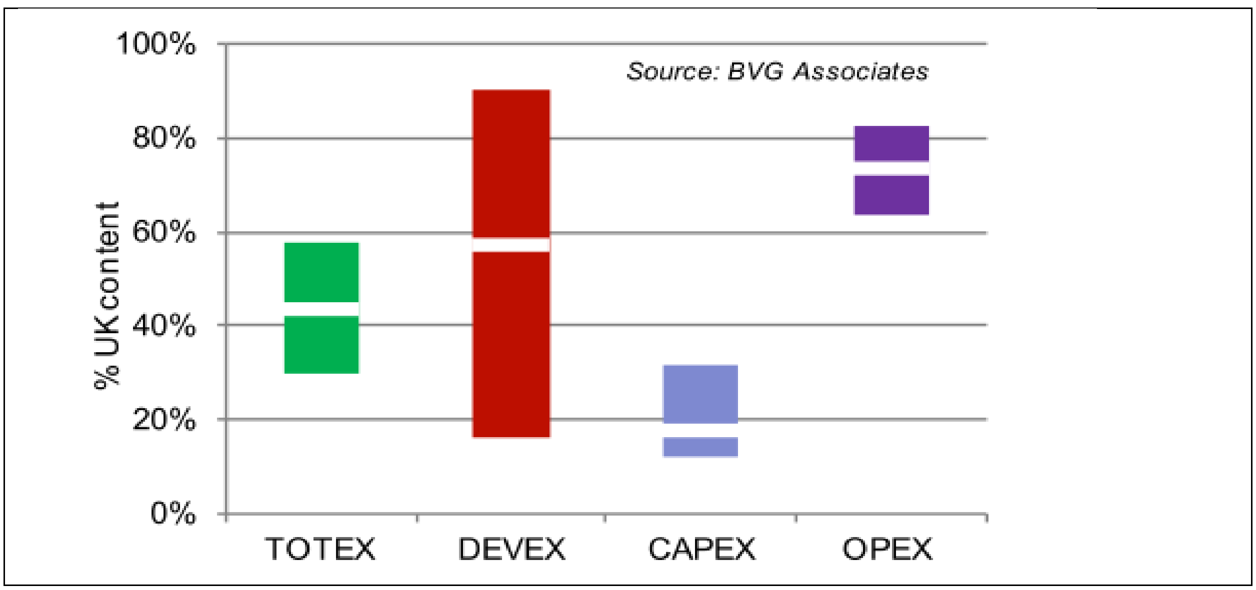
3.2 Baseline definition – what is local?

The 'local' in local content can mean several different things covering a range of spatial scales. In terms of maximizing national content, as largely referred to in s3.1, local is the UK. However, for example, if considering wind farms in Scotland, there would also be a concern to identify what percentage of economic benefit is staying within Scotland. But neither definition would be local for the host community. This would be much more specific, but again could range from daily commuting distance for the construction stage (sub-region wide) to much more local for the O&M scale, with workers much more likely to reside near the onshore/port facilities for a long term job.

3.3 OWF project stages and components

BVG Associates, for the Offshore Wind Programme Board, have attempted to disaggregate the likelihood of UK content for the main stages of offshore wind farm projects –DEVEX, CAPEX, and OPEX, and in total, TOTEX (BVG, 2015). Over the lifecycle of a typical project, DEVEX is estimated to be about 1.5 % spend, CAPEX 53% and OPEX 43.5%. Based on data collected from 10 wind farm projects (2009-2013) the BVG analysis presents a range of UK content (Figure 3.3 and Table 3.3). The weighted average for TOTEX is 43%. The lowest % local content, at 18%, is for CAPEX, which is the highest spend stage. However, this is closely followed in terms of local spend significance by the OPEX stage which has the highest weighted average UK content at 73%.

***Figure 3.3**: Range and average UK content in TOTEX, DEVEX, CAPEX and OPEX*



Source: BVG Associates (2015)

***Table 3.3**: The range of average UK content*

	UK content		
	Lower	Upper	Weighted average
TOTEX	30%	57%	43%
DEVEX	16%	90%	57%
CAPEX	12%	32%	18%
OPEX	64%	82%	73%

Source: BVG Associates (2015)

Detailed predictive work on the economic impacts of the O&M stage only was undertaken by Oxford Economics for Vestas (Oxford Economics, 2010). Some of the findings for employment effects are set out in Table 3.4. The predictions explore a range of 2020 total MW capacity scenarios. For the predicted likely scenario of 20,500 MW, the prediction is c7000 UK jobs, made up of c4000 from direct employment, and another 3000 from indirect and induced employment (i.e. a total multiplier impact of c1.75).

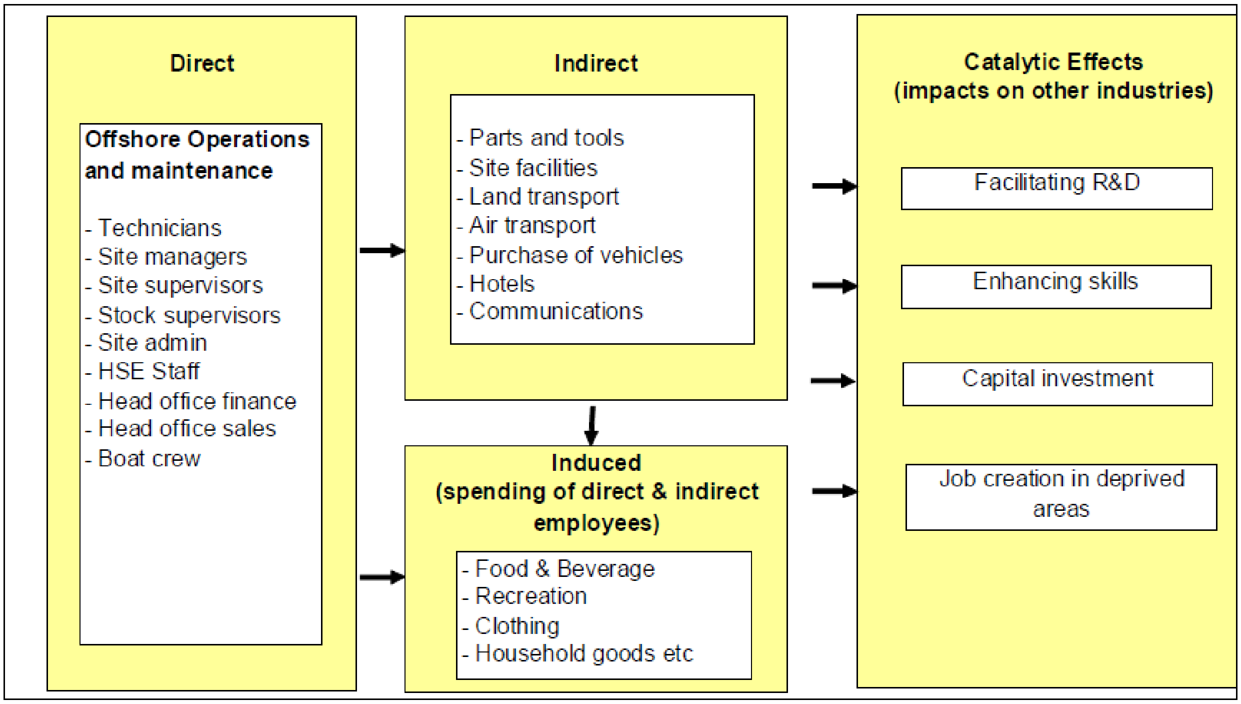
***Table 3.4**: UK Offshore O&M Employment Effects 2020*

	2020 Scenario		
	High Scenario	Low Scenario	Likely Scenario
MW Capacity	**47,500**	**14,100**	**20,500**
Direct employment	11,720	2,500	4,000
Indirect employment	3,910	1,130	1,660
Induced employment	4,490	980	1,570
Total Employment	**20,120**	**4,610**	**7,230**

Source: Oxford Economics

The various direct, indirect and induced components of Offshore O&M employment are illustrated in Figure 3.4. The figure also notes some wider catalytic effects on other industries, such as enhancing skills. Also, although the analysis focuses on the UK scale, the report also makes the point that much of this actual, and great potential, employment impact is in some of the most deprived communities of the UK. These are usually old coastal communities, which have suffered from their dependency on declining industries.

Figure 3.4: *The various components of Offshore Wind Farms' O&M employment (*Source: Oxford Economics (2010))



A Danish study (Ahsan et al 2018) sought to map the stakeholder groups involved in the O&M stage of OWFs to assess the identified stakeholder group's interest and power to influence. The results revealed that eleven key stakeholder groups were directly involved in the O&M phase. Among those, the stakeholder groups named investor/owner, turbine supplier, operator's own technicians, port facility and vessel supplier were the most powerful. In contrast, onshore service providers and component suppliers were considered less influential and the operator-subcontractor relationship was top-down.

3.4 Key economic issues – especially optimizing local content

A wide approach to the socio-economic impacts of Offshore Wind Farms is included in a study by Hattam et al (2015) for the Crown Estate. They developed a capital stocks approach which combines the five capitals model (Forum for the Future, 1990) and an ecosystem service approach (Millennium Ecosystem Assessment, 2003) with the Office for National Statistics well-being domains. The five capitals are as set out in Table 3.5. Three of these capital stocks relate to economic impacts. The more social dimensions are covered in a later section of this report. In Table 3.6 the summary and direction of change in the various economic domains are set out. For example, under financial capital investments one point noted, which reinforces a point made above by Oxford Economics, is that regional investments are made in areas which have been previously identified as Assisted Areas. Under human capital, the positive impacts for example on employment (direct, indirect and induced), on skills and wages are identified. 'Although not unequivocal (especially in the context of health), the impacts on financial, manufactured and human capital are primarily positive' (Hattam et al 2015). The impacts are seen as more mixed for the social impacts.

***Table 3.5**: The five capitals of the capital stocks approach*

Financial capital: derived from revenues generated through sales and is determined by production rates, market prices and costs of production (Moran et al. 2013).

Manufactured or engineered capital: comprising goods or assets that contribute to the production process or the provision of services, rather than being part of the output itself. It includes for example tools, machinery, buildings and infrastructure (Moran et al. 2013).

Human capital: constitutes health, knowledge, skills and capabilities of individuals, the workforce and related communities (Schultz 1961).

Social capital: refers to networks together with shared norms, values and understandings that facilitate cooperation within or among groups (Cote and Healy 2001).
Natural capital (also called environmental or ecological capital): encompasses natural resources as well as the processes needed to sustain life and produce goods and services (Forum for the Future 1990).

Source: Hattam et al 2015

***Table 3.6**: A summary of impacts of OWF developments on various economic capital stocks*

Capital stock	Relevant ONS Well-being domains	Summary and direction of change
Financial capital (e.g. investments)	The economy	**Positive impact** Investments in the region of £4bn to date in innovation support, supply chain programmes and financing but cou be higher if all on-going investments and unpublished investments were included. £2bn paid in price support and subsidies per year. Regional investments in areas which have been identif as Assisted Areas Stability in market providing an environment for further investment and long-term operation
Manufactured capital (e.g. infrastructure)	The economy	**Positive impact, although currently limited** Many turbine components are imported but supply cha support is seeing investment in turbine component manufacture. Investment is being made in port facilities to support th offshore wind industry, but in line with port investments made by other
	What we do	**Positive impact** Investments in turbine manufacturing and port facilities are bringing new jobs to areas where these investments a made.

	Where we live	**Impact unclear** The construction onshore of infrastructure relating to the offshore wind industry has implications for the communities where construction occurs. Whether this is positive or negative is not reported. Associated community projects can be assumed to have a positive impact on where we live.
Human capital (e.g. skills and education)	What we do	**Positive impact** 3,151 direct jobs created in the manufacture, construction, operation and maintenance of offshore wind turbines. An estimated 7,000 indirect jobs created along the offshore wind supply chain. Induced employment effects reported. Considerable investment in knowledge generation through R&D.
	Education/skills	**Positive impact** Jobs created in the offshore wind industry are reported to be high skilled. These skills are in demand outside the UK, allowing the export of skills and knowledge transfer. A number of dedicated training courses have been developed to meet the rising demand to appropriate skills.
	Personal finance	**Positive impact** Wage levels for jobs associated with the offshore wind industry range by skill with scope for career development.
	Health	**Impact unclear** There are concerns over the safety of offshore workers but protocols for offshore working are well established in the oil and gas industry and can be adopted. There are potential health gains resulting from the mitigation of CO2 emissions and future climate change. Mental health impacts related to offshore wind are uncertain but could be influenced by falling house prices, transient work force

Source: Hattam et al 2015

A recent example of the use of the capitals model is provided by South and Southern Electric (SSE, 2016). They have calculated the total value of SSE's human capital using an income-based approach which assumes that the value of each individual's human capital is equivalent to their discounted expected total lifetime earnings. The study also seeks to illustrate how the value of human capital can be grown through training and apprentice programmes.

The importance of local content is set out in a more geographically specific context in a valuable report by SQW (2011) --- *Phase 2 Socio-Economic Report, Argyll Renewable Communities.* In this report SQW note the increased focus on the local socio-economic effects of renewable energy developments, and that local employment opportunities are more likely in the O&M stage, and can be influenced by a proactive approach by both developers and communities. For their Argyll study they estimate one local O&M job for every 2-3 turbines as an approximate guide. They also note that whilst much of the offshore work will be outsourced from local area, there is more local potential with the onshore work (e.g. sub-station connections; local port improvements). The impacts of multiple OWFs 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). In terms of potential negative impacts of building OWFs on tourism, fishing and the local housing markets, SQW conclude that the evidence is mixed and inconclusive.

In one of the few studies of the actual local content impacts of an OWF project, SQW (2005), using a supply chain analysis, provide some estimates of local jobs in the East of England region for the relatively small scale (60 MW) Scroby Sands project. Figure 3.5 shows that whilst there are a higher number of local jobs for a couple of construction years, it is the O&M jobs which generate the largest number of local jobs over the lifetime of the project. The SQW study: also estimated a total spend of £80m (construction plus first five years of operation)—of which about £40m was sourced from UK companies, and £13m from the East of England region**.** By project stage, the region had c20% of the development stage, 10% of the construction stage and 75% of the operational stage.

In another ex-post supply chain study, a UK contents analysis of the Robin Rigg project in the Solway (EON 2011) provides a more disaggregated breakdown for this project which straddles the England-Scotland border. Again, as displayed in Table 3.7, the tendency for the O&M expenditure to be more heavily weighted to the local area is highlighted. It also highlights the importance of the O&M base, which in this case is located in Workington in Cumbria. Some findings documented in a recent study by BVG Associates for Scottish Power on their onshore wind farms in SW Scotland also reinforce the local significance of the O&M stage for wind power (BVG, 2017). These indicate 25% of OPEX expenditure in the local area (SW Scotland) and 67% in Scotland, compared to only 2% (local) and 25% (Scotland) for CAPEX.

Figure 3.5*: Estimated local jobs in stage years of the Scroby Sands development (*Source: SQW Analysis of Scroby Sands supply chain analysis (2009) in SQW (2011); DTI (2005)

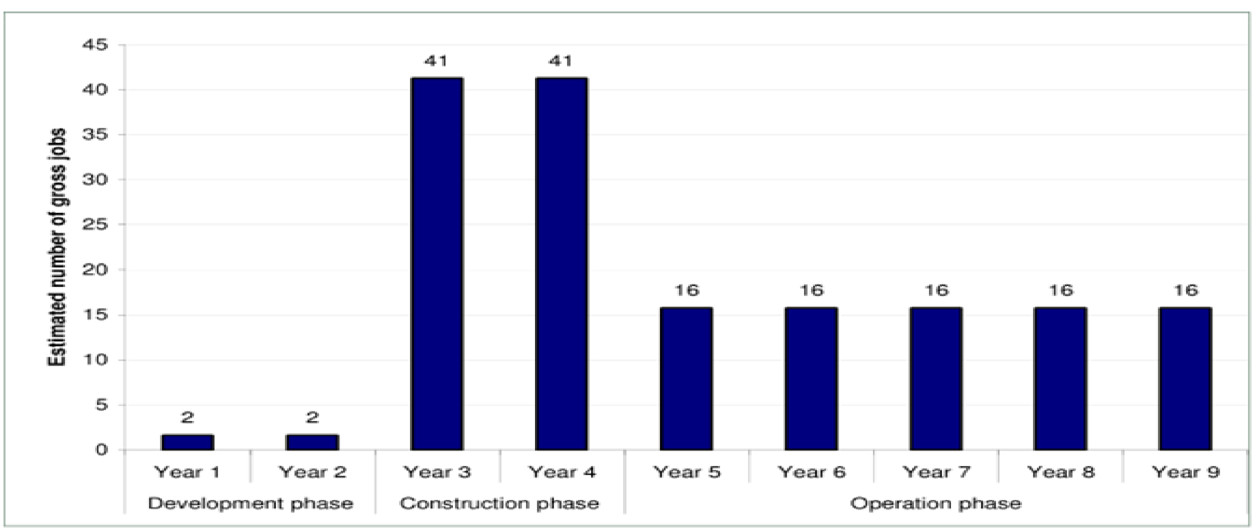


***Table 3.7**: Summary of findings from Robin Rigg OWF on local content (*Source: EON (2011)

	Cost (£m)	UK	Scotland	North West	Cumbria	Dumfries and Galloway
Construction Total	£381	32%	8%	4%	1.4%	0.2%
Project Management	£19	100%	5%	6%	4%	3%
Turbine Supply	£141	-	-	-	-	-
Balance of Plant	£84	31%	-	16%	4%	-
Installation & Commissioning	£137	56%	21%	2%	1.1%	0.2%
O&M Costs (Annual)	£9.4	86%	6%	39%	34%	4%
Fixed Costs and Overheads	£4.2	78%	3%	7%	5%	2%
Turbine Maintenance	£3.2	87%	-	75%	71%	-
Marine Operations	£1.1	100%	9%	50%	50%	-
Environmental Services	£0.5	100%	83%	16%	1%	83%
Balance of Plant	£0.4	100%	-	59%	15%	-

An early Danish monitoring study of the impact of the Horns Rev OWF (Ladenburg et al 2005) calculated the employment effects associated with the establishment and running of wind farms using input-output model data (see s3.5 re I-O studies). The calculations showed that the establishment of an OWF with 80x 2 MW turbines created a total of around 2,000 person years of domestic employment over the construction period. A *tentative estimate* indicated that up to one quarter of this will be at the local level. Operation and maintenance over the 20-year life time of the park was estimated to create an additional 1,700 person years of employment; *it was expected* that three quarters of this would be at the local level.

3.5 Evolving methodological approaches

As noted in s2, from economic theory we know that the economic effect of expenditure in an economic system is greater than the original amount because of the cascade effects it generates; it is as if the original injection has been multiplied by a factor greater than one. Direct economic impacts have a range of secondary impacts, in particular indirect and induced impacts. As for major projects more generally, so for OWFs there has been a growing interest and practice in modelling the wider economic impacts – both expenditure and employment.

A modelling trend, and one which has evolved in the OWF sector over the last decade, has been the development of an I-O approach, particularly advanced by UK consultancies such as SQW and Oxford Economics. However again as noted earlier: *the key to effective I-O analysis is the currency and level of disaggregation of the underpinning I-O tables. Unless an up-to-date I-O table exists for the host area under study, the start-up costs are likely to be too great for most socio-economic impact studies, and recourse must be made to the adaptation from national and regional I-O tables. For the UK these include UK-wide (ONS, 2019) and Scotland-wide (Scottish Government, 2016) tables.* These tables categorize industry sectors using Standard Industry

Classification (SIC) codes. For a new sector such as OWF there may not be adequate and appropriate codes, resulting in some generalization which may distort results. The use of higher/national scale data and multipliers can also over-generalize impacts, missing out the particular nuances of local economic bases. However, notwithstanding some limitations, there has been some interesting I-O work undertaken for OWFs, for research on local content in the sector at large (e.g. see Oxford Economic work on the impacts of the O&M stage, for Vestas—Oxford Economics 2010), and on some of the larger OWF projects. These studies show the significance not only of direct impacts, but also of the indirect and induced impacts, which are estimated to be together of the order of 75-80% of the direct impacts, although with variations between scales and project stages.

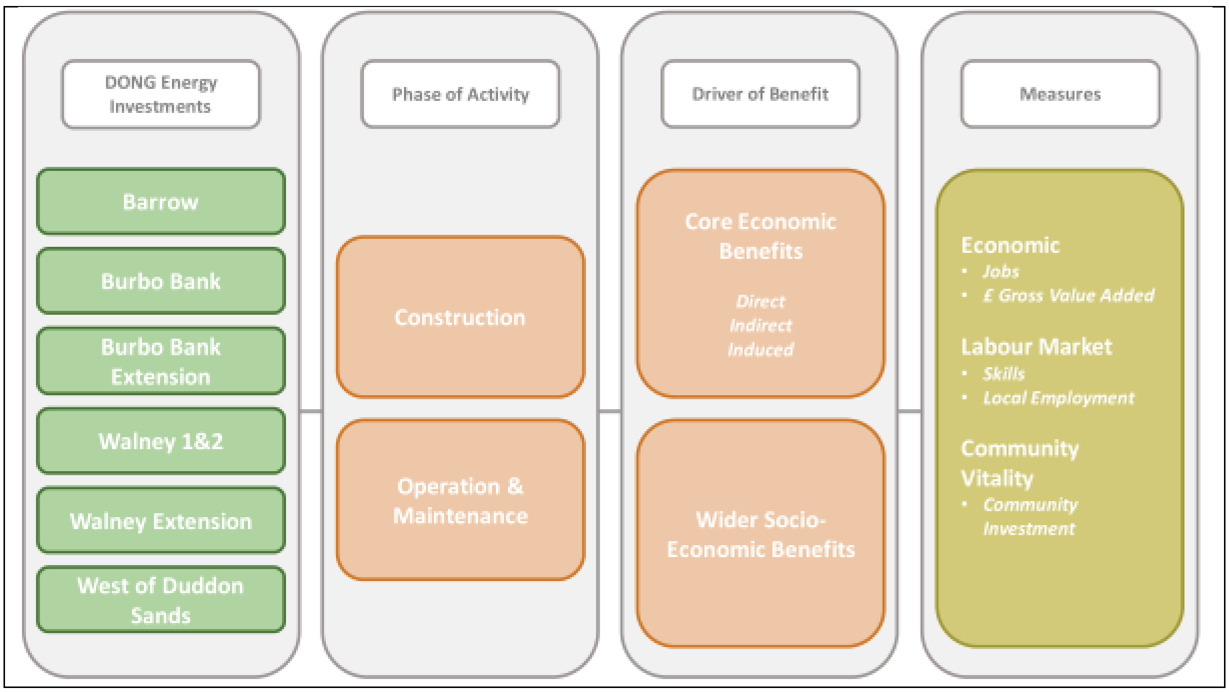
In addition to the I-O approach, and partly as a response to the I-O approach, a number of more hybrid and 'bottom-up' approaches have been developed. The Input-Output approach can seem complex and opaque to many interested parties, and less grounded in the actual details of the project and the host economy. Three alternative approaches, which seek to be more transparent and locally based, are set out in Table 3.8.

Table 3.8: *Some alternative 'more hybrid' modelling approaches*

Approach	*Key elements*
Oxford Brookes Impact Assessment Unit (IAU) approach, as used for other energy projects (e.g. EDF HPC (2011), and onshore wind farms)	• bottom up approach, for example for local employment prediction • disaggregating the employment demands of the project over the lifecycle of the project, into specific skill categories • detailing the employment characteristics of the host local area (e.g. wider commuting zone for construction) • use of monitoring data from comparative projects; gravity model analysis of likely local area skills supply and key stakeholder consultation, to produce set of predicted local employment impacts by skill group • application of limited sensitivity analysis (e.g. + /- 10% range) • application of generic secondary impacts multipliers
BVG Associates/UHI (2017)	• local content impact methodology, which seeks to be "*more robust and transparent to the industry lay-reader than existing economic analyses*" • captures local value added from the project investment, via collation of project data on employee earnings, self-employed profit and use of buildings, plant and equipment (direct and indirect impacts) • application of specific sector knowledge and data • application of induced expenditure multipliers • division of aggregate local value added by average annual wage plus other non-wage costs of employment, to arrive at estimate of FTE employment form the local value added

Regeneris/Dong approach as applied to Irish Sea and Humber cases (Regeneris, 2015, 2016)	• for Irish Sea study • desk based research and analysis of socio-economic impacts of Dong's investments in E. Irish Sea • analysis of contracts data and discussions with Dong's delivery team to understand project costs and likely geography of supply chain • development of robust socio-economic model to capture and quantify expected impacts for construction and O&M project stages • discussion with local stakeholders (e.g. LAs, trade bodies, local industries) to understand wider effects of wind farm developments in key areas (e.g. Cumbria) Fig 3.6 summarises the assessment framework that underpins the analysis.

***Figure 3.6**: Dong/Regeneris hybrid model – Irish Sea example*



Source: Regeneris Consulting (2015)

3.6 Mitigation, enhancement and monitoring in practice

The various approaches to the mitigation and enhancement of the impacts of OWF developments are as discussed above in s2.4, with the focus very much on the enhancement of local benefits—with local ranging from the immediate local authority/region to a national definition (e.g. UK and Scotland). When positive enhancement measures are put in place, it is important that they do not become diluted and that they are implemented as intended. This is an important role for *monitoring systems.*

UK Renewables (2015) has picked up on the monitoring issue: '*As an industry we have a positive story to tell about engineering process and innovation, de-carbonisation and cost reduction. We need to speak up more loudly to demonstrate that as an industry we also take delivering UK content and UK economic success seriously. Which is why the Offshore Wind Industry Council (OWIC) has agreed to begin monitoring and reporting on UK content. Working on behalf of the Offshore Wind Programme Board (OWPB) for OWIC, we will conduct an annual survey of offshore wind developers, and publish findings, to show how industry is progressing….Our target, agreed with Government, is to deliver 50% of UK content'.*

BVG Associates (2015) has developed a reporting process for monitoring local content of UK OWFs (see Figure 3.7 for an element in the process). This is very useful, but it is limited by the use of UK as the "local" in local content. There is need for a much more spatially disaggregated approach.

Figure 3.7*: Part of the BVG reporting format for monitoring UK content of OWFs (*Source: BVG (2015))

Table A.1 Example UK Content calculation for Supplier and Subsuppliers with a Contract value over £10 million. The numbers in italics indicate where a judgement of UK Content has been made without requesting further information from Suppliers. The darker shaded cells remain empty. Note that some figures have been rounded.

Supplier	Contract value (£million)	UK Content in Contract	% of base cost in Contract	Contribution of Supplier's Contract to UK Content	Subsupplier	Subcontract (£million)	% of base cost in Subcontract	UK Content in Subcontract
A	12	70.7%	15%	10.6%	A1	6	55%	*85%*
					A2	4	36%	*55%*
					A3	1	9%	*45%*
					Margin	1		
B	20	47.2%	25%	11.8%	B1	9	43%	*20%*
					B2	6	29%	*75%*
					B3	3	14%	*45%*
					B4	3	14%	*75%*
					Margin	-1		
C	15	32.1%	19%	6.1%	C1	7	52%	*25%*
					C2	4.5	33%	*50%*
					C3	2	15%	*20%*
					Margin	1.5		
D	11	21%	14%	2.8%	D1	4	45%	*40%*
					D2	3	33%	*5%*
					D3	2	22%	*5%*
					Margin	2		
E	8	*46%*	10%	4.6%				
F	7	*85%*	9%	7.4%				
G	4	*65%*	5%	3.3%				
H	3	*90%*	4%	3.4%				
Base cost	80							
Margin	20							
Total	**100**			**50.0%**				

3.7 Summary—some opportunities and challenges of assessing the economic impacts of OWFS

The following bullet points highlight some of the key opportunities and challenges emerging from the evolving literature on the assessment of the economic impacts of OWFs:

- Wind is a rapidly increasing energy sector and the UK is the global leader with more operational wind farms than the rest of the world put together. Yet there is concern that the UK offshore wind sector has not sufficiently capitalised on its lead to secure local content, in terms of UK investment and UK jobs (RenewableUK, 2015, 2019);
- The 'local' in local content can mean several different things covering a range of spatial scales from host community local authority area to the whole of the UK; much of the research to date has focused on the UK level;
- Economic leakage is greatest for the CAPEX stage, with only on average about 20% of expenditure staying in the UK; but in contrast around 70% of the OPEX stage stays in the UK, and this could be worth 7000 UK jobs by 2020 ;
- Whilst much of the offshore construction work will be outsourced from local areas, there is more local potential with the onshore work (e.g. sub-station connections; local port improvements);
- The impacts of multiple OWFs 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);
- The availability of a hub port, with modern and extensive facilities for large scale rigs and set down areas is very important for developing major supply chain economic benefits. Such hubs are exemplified overseas for example in the Dutch ports such as Den Helder, Vlissingen, Ijmuiden, Eemshaven (Figure 3.8) and Rotterdam.
- A Capital Stocks analysis suggests that the impacts on financial, manufactured and human capital are primarily positive' (Hattam et al 2015); for the human capital stock, the positive impacts for example on employment (direct, indirect and induced), on skills and wages are identified;
- A modelling trend that has evolved in the OWF sector over the last decade is the development of an Input –Output (I-O) approach to prediction of economic impacts. However, this "top-down" approach has some limitations. Partly in response, a number of more hybrid and "bottom-up" approaches have been developed which are more grounded in the actual details of the project and the host economy;
- The focus of mitigation and enhancement is very much on the enhancement of local benefits, for example via developer support to maximise local supply chain benefits and local employment via training and recruitment policies;
- Monitoring of actual, rather than predicted local impacts, is essential for the advancement of the planning, assessment and management of economic benefits in the interests of the local community. Yet such monitoring has been very limited to date, with a few rare exceptions, such as the Scroby Sands and Robin Rigg projects. Plans are now afoot to improve monitoring in terms of UK content, but this still leaves a large gap in terms of monitoring at more sub-national spatial scales.

Figure 3.8: *The Dutch Port of Eemshaven*

4. Social impacts and their assessment

Social impacts and their assessment	4.1 Introduction 4.2 Methodologies and stages of Social impact Assessment 4.3 Challenges of SIA methodologies 4.4 Summary

4.1 Introduction

The various dimensions and concepts relating to both the social and economic impacts of developments are set out in s1 of this report and are not repeated here, other than to note that the key social dimensions include: demography, housing, local services, socio cultural lifestyle and community issues, and distributional/equity issues.

In addition the discussion of emerging guidance and legislation discussed in s1 is equally relevant for social impacts -- especially the IAIA guidance (IAIA, 2015). The key steps in the impact assessment methodology are as set out in s2 for economic impacts, but they are discussed with particular reference to social impacts in this section of the report. The main discussion of social impacts and Offshore Wind Farms is covered in the following s5.

4.2 Methodologies and stages of Social Impact Assessment

A thorough overview of the methodologies related to social impact assessment (SIA) has been provided by Chadwick and Glasson (2017), which has formed the starting point for this review. One of the key components of the socio-economic impact of a major project such as an OWF relates to the employment needs of the development, usually resulting in an in-migration of workforce from outside commuting distance. These needs might be temporary related to the construction phase, or more long-term related to the operational phase. This in-migration has both direct and indirect social impacts locally, on the need for accommodation, the demand for public services, and concomitant potential impacts related to community cohesion due to the influx of new residents.

In order to assess these impacts, Chadwick and Glasson (2017) set out the different stages of a method to systematically analyse the potential social impacts of large developments, in this case, an OWF. The first stage is to *define a baseline of the profile of the likely affected communities*, including an estimation of the impact area, defined as where the new population will live, in order to delimit the baseline population. This will involve a thorough stakeholder analysis that covers local communities as well as incoming groups, agencies and supply chains (IAIA, 2015). It also entails understanding the socio-political context, issues of governance and trust, and previous experiences in the area that are likely to influence local reactions. One of the challenges in relation to OWF is in defining the impact area and related baseline population, given the offshore nature of the development, and different interpretations of where the ‘affected communities’ are located.

The next step in the baseline stage is to ‘stock-take’ the situation in relation to accommodation, including information on the current housing stock and availability, as a baseline for projections into the future about anticipated needs. The following step involves an inventory of local service provision, such as education, health, recreation, police, fire and social services. The baseline of capacity taken up in current circumstances can be used to assess the potential impact of in-migration. The final baseline step relates to 'social cohesion' including an assessment of sense of belonging to a community and well-being, that is, satisfaction with life, happiness and anxiety. Crime and in particular the fear of crime can also be a factor in social cohesion and sense of community.

Burdge (2015) also identifies a similar set of categories for assessment, defining five broad variables to structure an SIA:

- Population change (change in number, density and distribution);
- Community and institutional arrangements (changes in attitudes, values, and in government and employment);
- Communities in transition (alterations in power with the arrival of different groups and agendas);
- Individual and family impacts (changes in family life, individual relations and conduct of daily life); and
- Community infrastructure needs (changes in community services and the tax base).

Once the baseline has been established, the next stage is *impact prediction*, to compare the estimated in-migrant population, their predicted geographical distribution and needs, with the baseline population and current service provision. To assess the significance of predicted social impacts, a range of techniques have been identified (ICGP 2003), including: the comparative model, straight-line trend projections, population multiplier methods, statistical significance, scenarios, export judgement and calculation of 'futures forgone'. On the participatory side, Interactive Community Forums (ICFs) are a useful tool to capture the communities' perspective on potential social impacts (Arce-Gomez et al, 2015). While various methods can be employed, predicting impacts for issues related for example to accommodation is not a precise science, and an element of assessor judgement, informed by stakeholder consultation, is necessary.

Following the results of the social impact assessment, it may be appropriate to propose *mitigation and enhancement methods* in order to reduce some of the anticipated negative impacts and enhance some of the positive impacts. In contrast to economic impacts, where the focus is almost wholly on enhancement, for social impacts there may be more of a mix of mitigation and enhancement. For example to lessen population impacts, it might be possible to recruit the workforce from within commuting distance. To alleviate accommodation pressures, the developer could provide additional housing, particularly in the construction phase. The increased pressure on local services could be alleviated through developer provision of services such as a medical centre, for example. Alternatively, the developer could fund local community projects that are offered in partial compensation for the adverse impacts of the development, as is proposed by the Highland Council in the case of renewable energy schemes in Scotland (Highland Council, 2013). These can be informal compensation offers, or more formalised "Community Benefit Agreements" (CBAs), which are offered to the community in recognition of their participation in projects that are 'in the national interest', rather than specifically compensating for local impacts.

For example, onshore wind farm projects in Scotland currently pay £5000 per MW of power produced per year, index-linked, to communities affected by onshore or offshore renewable energy developments (Highlands Council, 2013: 7; Glasson, 2017).

Larsen et al (2015) explore three examples of energy projects in Denmark that have been characterised by debate and conflict related to social issues, to explore the treatment of mitigation of social impacts. They identify a hierarchy of five possible processes that can be applied related to mitigation (as described by Jesus, 2013): avoidance, minimisation, rectification, reduction and compensation. They found that mitigation rarely goes beyond reducing impacts, although they suggest that discussions of minimising and avoiding social impacts could take place outside the scope of the EA and would therefore not be documented.

A key component of assessing social impacts is *the monitoring stage* during construction and operation, to review the actual situation, compared to the population and social impacts predicted at the beginning, in order to make adjustments and provision for changes if necessary. Arce-Gomez et al (2015) suggest that monitoring should involve a number of components, including listing the key impacts, delineating targets against which performance can be measured or tracked, and drawing up a management plan detailing who is responsible for collecting information, and by when.

Chadwick and Glasson (2017) report that monitoring processes are not well developed in SIA, partly due to the systems that are needed to ensure accurate data collection, and to the resourcing needed. Administrative systems are needed to ensure a regular flow of information of key data, such as information from the developers' employment records. This could, for example, be complemented by an annual survey of the workforce, to capture information on family members, types of accommodation and local services that are being accessed. In parallel, there could be monitoring of contextual socio-economic trends in the impact area, such as house prices and rent levels, the volume of house building, school rolls, doctors' lists and crime levels, data which should be compared with appropriate comparator areas.

Arce-Gomez et al (2015) also support the establishment of an additional "Management and Evaluation" step, involving drawing up a "Social Impact Management Plan" (SIMP). The SIMP oversees the planned intervention to ensure that the project proceeds as envisaged, as well as evaluating the outcomes of the SIA process and how it could be improved in the future.

Vanclay has written extensively on social impact assessment, and in research related to the potential application of SIA in integrated coastal zone management, he highlights the key aspects of SIA, which are reproduced in Box 4.1. A number of the issues that he draws attention to relate to the importance of involving different communities and stakeholders in helping to define potential impacts. This aspect was also highlighted by a report commissioned by Marine Scotland and Sciencewise-ERC to develop a methodology for assessing the social impacts of marine renewables (Collingwood Environmental Planning Ltd, 2015; 2016). The key focus of the project was to assess the core 'elements' that members of the public value in their lives, and to explore how these social values might be impacted, either positively or negatively, through the development of offshore renewables.

Box 4.1: *The tasks of Social Impact Assessment*

- **Creating participatory processes and a deliberative space** to facilitate community discussions about desired futures, the acceptability of likely negative impacts and proposed benefits, and community input into the SIA process, so that they can come to a negotiated agreement with a proponent, preferably on the basis of the emerging legal principle of 'free, prior and informed consent' (FPIC);
- **Gaining a good understanding of the communities and stakeholders** likely to be affected by the policy, program, plan or project (i.e. profiling) including a thorough stakeholder analysis to understand the differing needs and interests of the various sections of those communities;
- **Identifying the needs and aspirations of the various communities**;
- **Scoping the key social issues** (the significant negative impacts as well as the opportunities for creating benefits);
- **Identifying key indicators and collecting baseline data**;
- **Forecasting the social changes** that may result from the policy, program, plan or project and the impacts these are likely to have on different groups of people;
- **Establishing the significance of the predicted changes**, and determining how the various affected groups and communities will likely respond to them;
- **Identifying ways of mitigating potential negative impacts and maximising positive opportunities;**
- **Developing a monitoring plan** to track implementation, variations from mitigation actions, and unanticipated social changes, especially negative impacts;
- **Facilitating an agreement-making process between the communities and the proponent** ensuring that FPIC principles are observed and that human rights are respected, which leads to the **drafting of an Impact and Benefit Agreement (IBA);**
- **Assisting the proponent in the drafting of a Social Impact Management Plan** (SIMP) that operationalizes all benefits, mitigation measures, monitoring arrangements and governance arrangements that were agreed to in the IBA, as well as plans for dealing with any ongoing unanticipated issues as they arise;
- **Putting processes in place to enable proponents, regulatory authorities and civil society stakeholders to implement arrangements implied in the SIMP and IBA** and to develop their own corresponding management action plans, establish respective roles and responsibilities throughout the implementation of action plans, and maintain an ongoing role in monitoring.

Source: Vanclay (2012: 150-151); adapted from Vanclay and Esteves (2011).

The method was driven by a 'public dialogue' approach with members of the public and experts engaging in in-depth deliberative discussions about their core social values, both quantifiable and qualitative, grouped into clusters. These values were then assessed against scenarios of offshore renewable developments, to explore the potential impacts of such projects on locally-held values. In relation to SIA, the dialogue phase was integrated into the Scoping and Assessment steps of an SIA, as illustrated in Annex 1. The method uses the value clusters (e.g. way of life, community, culture, politics, and environment) as a lens through which to assess the impacts of proposals for offshore renewable developments. An alternative approach to using 'value clusters' as a lens is provided by Hattam et al (2015) in their use of the five capitals model to frame impacts of renewable developments. This is further explored in s3.2 and s5.2

4.3 Challenges of SIA methodologies

A number of authors have identified the challenges presented by SIA methodologies, a key issue being to capture social and cultural values, and to predict the potential impact of a project on these issues that are harder to quantify. Arce-Gomez et al (2015) point out that the focus on quantifiable aspects of SIA risks overlooking the 'softer' social impacts, such as potential adverse impacts on local culture, which are harder to measure.

In research into community responses to an offshore 'carbon capture and storage' (CCS) project in Japan, Mabon et al (2017) use a qualitative methodology to develop in-depth understanding of the social and cultural factors which have influenced community attitudes. The research was not part of a formal SIA process, but a study into the social and cultural impacts of the project, and the potential implications for SIA procedures. The research highlights the importance of fisheries (socially, culturally and economically) to local people, and how this has impacted on the community's responses to the CCS project. Community responses are complex and nuanced, and require engagement with the social and cultural context to understand more fully the local responses and reactions, in order to incorporate them into an SIA.

The study also raises another challenging aspect of SIA, that is, the potential that changes in a landscape or seascape can have on culturally significant 'asset', for the local communities. Mabon et al (2017) raise the issue about traditional ideas of 'ownership' or stewardship of the sea held by communities, which can impact on the way that communities react to new offshore infrastructure development, with potential for hostility or suspicion if communities are not involved in discussions and decision-making from the beginning.

One of the key drivers for building support for the CCS operation in Japan was trust in the local government, in particular through personal contacts and engagement with local government personnel. Other research studies have also shown (Mabon and Kawabe, 2017) that as local government staff were also living and working in the community, they were seen as trustworthy and reliable in the information they provided, which helped to build confidence in the proposed development.

From these examples, we can see that qualitative and participatory approaches to SIA are essential, but also challenging. Recent studies advocate combining a technical with a participatory approach, which together have shown to result in more favourable development outcomes (Arce-Gomez et al, 2015). Harris et al (2003) illustrate how using Interactive Community Forums (ICF) have been beneficial in producing community-defined profile information, to use alongside published data, in order to develop a comprehensive community profile.

Esteves et al (2012: 40), in their recent State of the Art review of SIA literature, emphasised the need for a full understanding of the "theoretical bases for participatory approaches", and the importance of "proponent-led or community-led" participatory processes. This is supported by Larsen et al (2015) who explore three examples of energy projects in Denmark that have been characterised by debate and conflict related to social issues. Their aim was to analyse the Environmental Statements for each project to compare them with the public's concerns, to assess the scope and level of social impacts, the geographical distribution of social impacts (equality/inequality in distribution of impacts), and the mitigation of social impacts. In the three ESs analysed there was a lack of qualitative, non-physical impacts. They suggest that this inadequate assessment of social issues could lead to negative attitudes from the public in terms of frustration and opposition to the project. This could subsequently mean higher costs for the developer and potentially delays for the local planning authority. It is therefore in the interests of all stakeholders to provide a comprehensive assessment of social impacts for a project.

Vanclay (2012) summarises the challenges of undertaking SIA methodology (Box 4.2), highlighting the importance of participatory approaches to engage communities, in order to address differences and find solutions to potentially conflicting circumstances. He has also highlighted an extensive list of lessons for undertaking SIA, which are reproduced in Annex 2. Both these contributions relate to the context of Integrated Coastal Zone Management (ICZM), but can also apply to other situations, including the specific case of the construction of an Offshore Wind Farm.

Box 4.2: *Challenges of SIA methodology*

Challenge 1: Effective community engagement takes time, resources and professional skills.

Challenge 2: There is a huge range of stakeholders related to a project, including those who are impacted by, interested in, and influential for a project. The differences should be accepted, appreciated and respected.

Challenge 3: Conflict is inevitable and should be managed appropriately.

Challenge 4: It can be difficult to find creative solutions that address differences, using participatory and deliberative methods.

Challenge 5: It is important to create shared community visions and develop and utilise commitment to ensure that such visions are attained.

Challenge 6: Socially-constructed assessments of value are difficult to legitimise and gain acceptance in the community.

Challenge 7: Protecting cultural heritage, especially intangible cultural heritage, is difficult to effectuate.

Challenge 8: Legitimate ways to trade-off new opportunities against social impacts can be challenging.

Challenge 9: There is a need to ensure that vulnerable communities are safe-guarded from exploitation.

Source: Vanclay, 2012: pp153-155

4.3 Summary

Social impact assessment is a relatively new but expanding field. Methods to analyse social impacts, as well as mitigation and enhancement methods, are developing all the time, and there is a growing recognition of the value of SIA for outcomes on a number of levels. As Vanclay (2012: 151) states: “SIA improves the quality of decision making, it improves the legitimacy of decisions, it reduces harm experienced by communities, and potentially it increases the likely benefits that flow from the project or policy”.

There is common recognition of the need for a technical as well as a participatory approach to SIA, in order to capture the complexity and nuance of potential social impacts on a given community or group of communities. It is important to consider SIA right from the pre-development phase, given that social impacts can begin from the moment a project is in the pipeline. Early community engagement is crucial, in order to lessen the impact in relation to fear and anxiety (Gray et al, 2005). It is interesting to note that five of the seven steps in the IAIA guidelines on SIA (IAIA 2015) refer to the pre-operation phase. But Mabon et al (2017) also show that in addition to early community engagement, it is also important to ensure sustained engagement throughout the project’s lifetime, to order to mitigate or avoid longer-term social impacts.

This review has also demonstrated the importance of taking into consideration culturally meaningful aspects, which might have impacts on the community’s attitude and perception. Although these are more challenging to assess, they are crucial to understanding a community’s response to a major infrastructure project, particularly an offshore development where the cultural importance of the sea and seascape can play an important role in shaping communities’ responses.

5. Social impacts and assessment, with particular reference to OWFs

5. Social impacts and their assessment, with particular reference to OWFs assessment	5.1 Public attitudes to OWFs 5.2 Social impacts of OWFs 5.3 Equity, fairness and distributional issues 5.4 Community cohesion 5.5 Summary

5.1 Public attitudes to OWFs

The development of Offshore Wind Farms (OWFs) is a relatively recent phenomenon, compared to onshore wind farms. As such, there are considerably fewer empirical studies that explore attitudes and perceptions related to offshore developments. But as Ellis et al (2007: 536) point out "coastal communities are just as sensitive to threats to seascapes as rural society is to visual disturbances in highland areas".

Since 2009, there have been a growing number of studies, by for example Haggett (2011) and others, which demonstrate that many of the factors shaping public attitudes to offshore wind projects are similar to those related to onshore developments, that is: visual impacts and aesthetics, environmental impacts, local context and place attachment, the disjuncture between the local and the global, relationships with developers and 'outsiders', and issues around planning and participation. They argue that the mix of factors that influence public attitudes to both on and offshore development is linked to the local context and meanings attached to the land and the sea in particular areas. In their research review of the literature for the EC on the social acceptance of wind energy, with a focus more on onshore than offshore, Ellis and Ferraro (2016) set out a range of influences that can affect the social acceptance of wind energy projects. These are summarised in Table 5.1.

However, there are a number of factors specific to *marine environments* that have been highlighted by other authors; for example, by Wiersma and Devine-Wright (2014) in their comprehensive review of public engagement with offshore renewable energy (wind as well as tidal and wave energy). Firstly, public attitudes in an offshore context are influenced by issues specific to a marine environment, for example, the dynamic use of the sea by many users simultaneously, ownership of the sea (bed), marine decision-making processes, as well as conflicting perceptions of what the sea represents and what it should be used for. While marine spatial planning could address some of these governance issues, there is a perceived lack of established practice in that field which could impact on public opinion.

Secondly, perceptions of offshore wind developments are influenced by concerns about impacts, such as the loss of access to marine areas, and thus loss of livelihoods for fisher people, as well as concerns about marine wildlife. There are also studies that explore beliefs about the sea as being a place where human structures do not belong, with coastal community residents expressing attachment to an 'untouched seascape' (Kempton et al, 2005).

***Table 5.1**: Summary of influences on the social acceptance of wind energy projects*

Issue	***Key influences***
Individual attitudes	Age, gender etc. Strength of place attachment Political beliefs and voting preferences Emotional response Prior experience of wind turbines Attitudes to environmental issues Psychological factors including perception of social norms Individual roles (consumer, landowner etc.) Familiarity with wind energy
Relationships	Type and level of social capital Trust in government other public agencies and developers Proximity to, and visibility of, turbines Technology-society relationships Time, reflecting the dynamic nature of social acceptance National-local policy Regulator-developer links Discourses within and between communities
Contextual issues	Policy regimes Project design — turbine height, colour number and massing Place attachment Range and mix of actors Ownership of proposed project Specific siting issues Cumulative impacts
Perceived impacts	Noise Landscape Shadow flicker Property values Level of economic benefit Bio-diversity: bats, birds Infrasound Navigation lights Health concerns Levels of economic benefits Disruption of 'place' Efficiency of turbines and wind energy Distributive justice
Process-related issues	Trust in institutions involved Transparency and openness Procedural justice Expectations and aspirations of public participation Availability and quality of information Power in the participation process Value places on lay and expert knowledge Timing Discourses of community, developer, regulatory bodies Fait accompli

Source: Ellis and Ferraro (2016)

Thirdly, visual impact is also a key issue for public attitudes to offshore wind projects, although research has shown there is not a straightforward correlation between acceptance of wind turbines and their distance from the shore (Haggett, 2011). In Ladenburg's (2009) study of two offshore wind farms in Denmark, he showed that people with experience of OWF located far from the shore have a more positive perception of their visual impacts than people with experience of OWF located closer to the shore. However, Waldo (2012) has shown in the context of Sweden that wind power is viewed as a threat to landscape qualities regardless of proximity to the shore. A study by Bishop and Millar (2007) sought to analyse the perceived visual impact of offshore wind farms using simulations in Wales, and found that moving turbines promoted a less negative response than static turbines. Ladenburg and Möller (2011) have also found that OWFs with a large number of turbines generate more positive attitudes than OWF with fewer turbines. However, on balance, Wiersma and Devine-Wright (2014) conclude that coastal residents and tourists generally prefer wind turbines to be located at greater distances from the coast, although willingness to pay for siting turbines further out to sea decreases with distance from the shore.

Given the specificity of offshore contexts, it has been suggested (Wiersma, 2016) that in analysing attitudes towards OWF, it is important to move away from the factors relevant for onshore developments, and explore the uniquely marine characteristics of OWF and the importance of 'the sea' as an influence on local residents' identity. This may involve ethnographic work and other qualitative methods to explore people's experiential and symbolic connections with the sea, for example through the concept of marine citizenship (McKinley and Fletcher, 2012). Gee and Burkhard (2010) use the concept of cultural ecosystem services to explore the relationship with coastal communities and OWFs; these services include 'non-material benefits which people obtain from ecosystems through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences' (MA 2005). For example, people coming to the sea wanting to enjoy an un-degraded coastal setting, may feel an emotional loss of the open horizon and feel in some way a sense of being limited.

A longitudinal study on the attitudes to two proposed offshore wind projects provides insights into the changing views over time of local communities in the US (Firestone et al, 2012a). Using postal surveys of local residents in 2005/06 and 2009, they found that a desire for energy independence was an increasingly important factor over time in positive attitudes towards offshore wind development, causing some individuals to switch from opposition to support between the two dates. They also found that providing the local residents with the wider national context for the local project helped to increase support. Conversely, those who switched from support to opposition cited concerns about fishing, and the impacts on recreational boating. Other negative effects cited by respondents included the diminished aesthetics of the ocean view, as well as the negative effects on tourism, property values, as well as marine and bird life.

The authors argue for the importance of further public acceptance studies, to understand the factors behind local attitudes to offshore wind projects, as these social factors are likely to be the main determinants of the extent of offshore wind energy adoption in the coming decades. They suggest that exploring public perceptions, including delving into the specifics of incorrect beliefs (Kempton et al, 2005), can help to steer public awareness and communication campaigns related to specific OWF, in order to promote accurate public understanding.

Another study by Degraer et al (2013) on Belgian OWFs also recorded a shift in public attitude over time. Surveys between 2002 and 2009 showed increasing positive attitudes to OWFs, up from 53% to 68%, with only 8% negative compared with 21% negative in 2002. There does seem to be a habituation effect with objections softening over a time. Batel and Devine-Wright (2015) seek to gain a better understanding of people's responses to renewable energy technologies via an examination of social representations – which include attitudes, beliefs and practices. There is often a gap between attitudes and behaviour with regard to renewable energy technologies, with high support for the technology in general, but opposition to specific projects. Mass media are one of the most important actors in shaping people's representations and a relevant indicator of the cultural dimension of representation.

The role of uncertainty and its impact on public responses to marine renewal energy projects is also explored by Kerr et al (2014), with implications for early public engagement. Uncertainty around location and scale, visual appearance, the onshore land requirements and the potential need for exclusion zones can all feed into negative public perceptions. These uncertainties (and subsequent fears) can be addressed through early community engagement processes. Similarly, in Wiersma's (2016) study of public acceptability of three offshore renewal energy projects in Guernsey, including a wind energy development, he found that adopting an 'upstream' approach, engaging with local residents at an early stage in the project, in particular using visual, place-based methodologies, can contribute to more acceptable energy development practices in the future.

5.2 Social impacts of OWF

A study has been carried out on the impacts of OWF on well-being, commissioned by the Crown Estate, which highlights the complexity of SIA in relation to wind energy projects (Hattam et al, 2015). The project combines three different approaches to present a framework for assessing impacts: the five capitals model (with the addition of governance as a sixth 'capital') developed by the Forum for the Future (1990), an ecosystem service approach (Millennium Ecosystem Assessment, 2003), together with the well-being domains defined by the Office for National Statistics. Overall, the study indicates that on balance, at the regional/national level, the offshore wind industry has a largely positive impact on well-being, although the picture is complex, depending on the capital. The impacts are mixed for social and natural capital, and for governance, with both positive and negative impacts evident. The impacts on financial, manufactured and human capital, as discussed in section 3 of this report, are in the main positive. Examples of impacts detailed in the study, selected here as they relate to specifically social impacts of OWF, are provided in Table 5.2 (Hattam et al, 2015: v-vii).

***Table 5.2**: A selection of impacts of OWF highlighted by Hattam et al (2015) in relation to well-being*

Capital Stock	Summary and direction of change
Financial capital (e.g. investments)	**Positive impact:** • Investments in innovation support, supply chain programmes etc.
Manufactured capital (e.g. infrastructure	**Positive impact:** • Bringing new jobs to areas where investments are made **Impact unclear:** • The construction onshore of infrastructure relating to the offshore wind industry has implications for the communities where construction occurs. Whether this is positive or negative is not reported • Associated community projects can be assumed to have a positive impact on the communities where local people live
Human capital (e.g. skills and education)	**Positive impact:** • Creation of direct jobs in construction, operation and maintenance of offshore wind turbines, as well as indirect jobs in supply chain. • Induced employment effects. **Impact unclear:** • Mental health impacts related to offshore wind are uncertain but could be influenced by falling house prices [negative], transient work force [negative] and buying energy from green sources [positive].
Social capital (e.g. social networks)	**Mixed impact:** • Generally strong support for OWF, motivated by beliefs about environmental impact, job creation and local economic growth. • Opposition exists, motivated by concerns over profitability, decreases in property values and impacts on wildlife. • Community funds can have positive impacts, but some view such funds as bribes. **Impact unclear:** • Evidence is anecdotal and suggests tourism continues to exist alongside the offshore wind industry with some new recreation opportunities (e.g. boat trips to OWFs). • Effects on the view and the restorative nature of environment could affect engagement with the coastal environments and ultimately health. **Positive impact:** • Formation of opposition and supporter groups builds relationships and social capital within communities.
Natural capital (e.g. natural resources)	**Impact unclear:** • Data are limited but evidence suggests some commercial species negatively affected by EMF and noise, thus impacting on the fishing industry (with concomitant indirect impacts on well-being)
Governance (e.g.	**Mixed impacts:** • Opposition to OWF stems from distrust in government/local authorities and concern about erosion of the democratic process

participatory decision-making	• Community funds have been viewed as bribes • The fishing industry is unhappy with the consultation processes and relationships can be strained with both developers and regulators. • Community funds can have a positive impact on local communities, but the extent to which they compensate for visual impacts is unknown.

As part of their assessment of the social impact of an OWF in Taiwan, Shiau and Chuen-Yu (2016) applied a 'social sustainability assessment framework', which involved the definition and population of 35 social sustainability indicators. These were used to assess the social sustainability of the OWF, including indicators such as job creation, alternative energy and community acceptance. The analysis concluded that the OWF had a positive social impact overall, although the fishing community were still strongly opposed to the development. The authors suggest that such a social sustainability framework can be useful in negotiations between developers, decision-makers and the community.

5.3 Equity, fairness and distributional issues

In relation to equity, fairness and distributional issues, Rudolph et al (2017) explore community benefits in the context of debates on 'energy justice' for offshore renewables. They suggest that justice can be understood in a number of ways, with implications for procedural justice (decision-making processes), distributive justice (fair and equitable outcomes) and recognitional justice (who is represented or excluded, and how underrepresented groups can be integrated into the process) (Aitken et al, 2016; Jenkins et al, 2016). Each of these forms of justice is relevant for considering the social impact of OWF, social outcomes and potential community benefits.

In relation to procedural justice, Firestone et al (2012b) have explored the impact of a lack of institutionalised procedures for consultation around marine issues on procedural justice and fairness. They examined the relationship between perceptions of public procedures for engagement and consultation in relation to OWF and substantive support or opposition to the project, by assessing opinions of procedural fairness, local community voice and trust in developers. In relation to equity and fairness, their statistical modelling suggests that satisfaction with engagement processes and outcome may be mutually reinforcing or jointly determined.

In relation to community benefits, Rudolph et al (2017) note that there is limited experience of applying community benefits to OWF, partly due to the challenges of defining the relevant community, as well as the distance between the project and any beneficiaries, and the way in which impact is perceived. Their framework linking community, benefit and impact aims to present a more robust approach to developing community benefit models. They conclude that community benefit schemes need to be tailored to particular contexts, taking into account local circumstances. In an earlier article, Rudolph et al (2014) also recommends the avoidance of restrictive guidance for the relatively new, developing and risky by nature offshore renewables industry. While in general research notes that there is currently a lack of guidance for developers entering into negotiations with communities, it is noteworthy that the Scottish Government has produced a guide "Good Practice Principles for Community Benefits from Offshore Renewable Energy Developments" (Local Energy Scotland, 2015), which highlights principles and practices to follow in designing a community benefit package for offshore renewable energy projects.

In a study of a hypothetical future offshore wind farm in Exmouth, UK using three scenarios, Walker et al (2014) show that the proposed provision of community benefits is linked to stronger local support for OWF, compared to scenarios not mentioning community benefits, or discussing community benefits alongside critical perspectives (such as perceptions of 'bribery'). The authors link this outcome to residents' perceptions of procedural justice related to collective rather than individual outcomes. They suggest that emphasising the community benefits, rather than benefits to individuals, will garner greater support for offshore wind developments in the future.

5.4 Community cohesion

There is very little discussion of the issue of 'community cohesion' in the literature reviewed. Of the studies examined, only one mentioned community cohesion, Langbroek and Vanclay's 2012 case study of the social impacts associated with a proposed windfarm in the Netherlands. The project was cited near Urk, a former island in the Netherlands (population 18,000), where 86 turbines were planned, 48 offshore and 38 onshore. The project was strongly opposed by the community, but following rejection of an appeal, construction began in 2012. The research found that there were strongly held views about the perceived negative social impacts including a reduction in the aesthetic quality of the land- and sea-scape, and impacts on community identification, place attachment and cohesion. It was also felt that the windfarm would reduce leisure and recreation opportunities.

While the positive economic benefits such as employment opportunities were recognised, it was estimated that these would benefit temporary construction workers from elsewhere, as Urk is surrounded by bigger towns within easy commuting distance. Furthermore, this influx of workers was also thought to have potential negative impacts due to the particular social characteristics of the traditional fishing village, with its conservative religious community. There were fears of a loss of community cohesion due to the presence of construction workers, including a fear of crime among residents, which could generate feelings of hostility and resentment. The impacts on mental and physical well-being are also explored in the study, including residents' feelings of frustration and anger at the lack of consultation.

The research concluded that the process was characterised by poor community engagement processes and a lack of consideration of community concerns. The authors recommend that affected communities should be involved and engaged at the earliest stage possible, to achieve a 'social licence to operate'. In this way, outcomes can be discussed and negotiated that will minimise the negative social impacts, including on community cohesion, and maximise local community benefits.

5.5 Summary

While considerable work has been carried out to assess the social impacts of onshore wind projects, there are less empirical studies on OWF, given they are a relatively new development in energy transition as a response to the threat of climate change. Although there are similar attitudes and perceptions to onshore and offshore wind developments, recent studies suggest that the specific marine context of OWF should be taken into consideration when assessing the social impact of an offshore development. The meaning of the marine context and a community's attachment to the sea and seascape should be taken into account in assessing the social impact of OWF.

A study (Hattam et al, 2015) demonstrates that OWF overall have a positive impact on well-being, defined broadly in their review using the five-capitals model plus governance, although the specific impacts on social capital are mixed. Other research shows 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 can also be interpreted as 'bribes' to the community (Glasson, 2017).

Overall, there is an emerging literature on the social impacts of offshore wind developments, but more work is needed, in particular in relation to community cohesion and the potential impacts of such developments on the sense of community and belonging.

6. Socio-economic impacts of OWFs, with particular reference to Scotland

6. Socio-economic impacts of OWFs, with particular reference to Scotland	6.1 Introduction -- a growing sector 6.2 Policy/guidance context for Scottish Offshore Wind 6.3 Evolving scope of the Scottish Offshore Wind industry 6.4 Emerging socio-economic impacts/ issues in Scotland 6.5 Summary

6.1 Introduction -- a growing sector

As noted earlier, the UK is the global leader in offshore wind energy generation. This section focuses in particular on the Scottish element of this growing industry. Section 6.2 sets out the policy context; section 6.3 sets out the scope of the Scottish OWF industry now and forecast. This is followed in section 6.4 with an outline of emerging socio-economic impacts and issues of OWFs in Scotland.

6.2 Policy/guidance context for Scottish Offshore Wind

UK context: In 2013 the UK Department for Business, Industry, Innovation and Skills (BIS) produced a set of documents outlining the UK Offshore Wind Industrial Strategy, and providing an Overview of Support for the industry (BIS, 2013). The Strategy focused on industry and government working together to… “build a competitive and innovative UK supply chain that delivers and sustains jobs, exports and economic benefits for the UK…” The strategy document identified two new delivery bodies to implement the strategy: The Offshore Wind Industry Council (OWIC) and the Offshore Wind Programme Board (OWPB). The bodies bring together representatives of government, developers and supply chain to provide leadership in the sector and to remove barriers to offshore wind in the UK, reduce costs and build a competitive UK-based industry. The Overview of Support document identifies four main topics: supply chain, innovation, finance and skills. A few examples of support initiatives are noted below:

- Offshore Renewable Energy (ORE) Catapult Centre is one of a number of Catapults established and overseen by the Technology Strategy Board. Catapults are technology and innovation centres bringing together the best of UK businesses, scientists and engineers to work side by side on R&D. The ORE Centre has a budget of £54m.
- The National Renewables Infrastructure Fund (N-RIF) Scotland is a £70m fund to support the development of port and near port locations for the use of the offshore wind industry. The aim is to stimulate private sector investment in a number of sites, thus helping to attract offshore wind supply companies to those sites.
- Apprenticeship schemes, plus EPSRC centres for doctoral training to supply PhD-level wind energy researchers. Two of the centres are at Strathclyde University.

Additional to the range of many support initiatives is the vital support for wind farm finance through the Contract for Difference (CfD) system which aims to give the industry some certainty to invest by offering guaranteed price support. In 2018, there was also the launch of the new joint government-industry Offshore Wind Sector Deal with industry to invest £250 million including new Offshore Wind Growth Partnership to develop the UK supply chain as global exports are set to increase fivefold to £2.6 billion by 2030, and a third of British electricity set to be produced by offshore wind power by 2030 (see Box 6.1)

Box 6.1: *UK Government Sector Deal (BEIS 2019)*

Executive Summary

This Sector Deal builds on the UK's global leadership position in offshore wind and seeks to maximise the advantages for UK industry from the global shift to clean growth, consistent with the Clean Growth Grand Challenge. It will do this by:

1. Providing forward visibility of future Contracts for Difference rounds with support of up to £557m, with the next allocation round planned to open by May 2019, with subsequent auctions around two years thereafter.

2. The sector committing to increase UK content to 60 per cent by 2030, including increases in the capital expenditure phase.

3. Increasing the representation of women in the offshore wind workforce to at least a third by 2030.

4. Setting an ambition of increasing exports fivefold to £2.6bn by 2030.

5. The sector will invest up to £250m in building a stronger UK supply chain, establishing the Offshore Wind Growth Partnership (OWGP) to support productivity and increase competitiveness. With the largest installed offshore wind capacity in the world and the prices consumers pay for the energy the sector generates falling significantly (between the 2015 and 2017 Contracts for Difference auctions, support costs fell 50 per cent), a trend that is expected to continue.

Over the next decade, there will be a huge expansion of offshore wind around the world with some estimates envisaging a 17 per cent annual growth from 22GW to 154GW in total installed capacity by 20301. In the UK, this could see offshore wind contributing up to 30GW of generating capacity. The domestic opportunities are significant too. Building up to 30GW of offshore wind by 2030 could account for over £40bn of infrastructure spending in the next decade.

Scotland context: Scotland's Low Carbon Economic Strategy (LES) (2010) notes, inter alia:

- *"With as much as 25% of Europe's offshore wind and tidal potential, an estimated 10% of its capacity for wave power and the largest offshore CO_2 storage potential, Scotland has the natural resource base to become the green energy power house of Europe.*
- *… offshore wind alone could bring an estimated £30bn of inward investment, and up to 20,000 jobs*
- *….sales of offshore electricity could value £14bn by 2050, the equivalent of £2700 equivalent for each person in Scotland.*
- *Harnessing just one third of our offshore renewable energy potential could meet Scotland's electricity needs seven times over by 2050."*

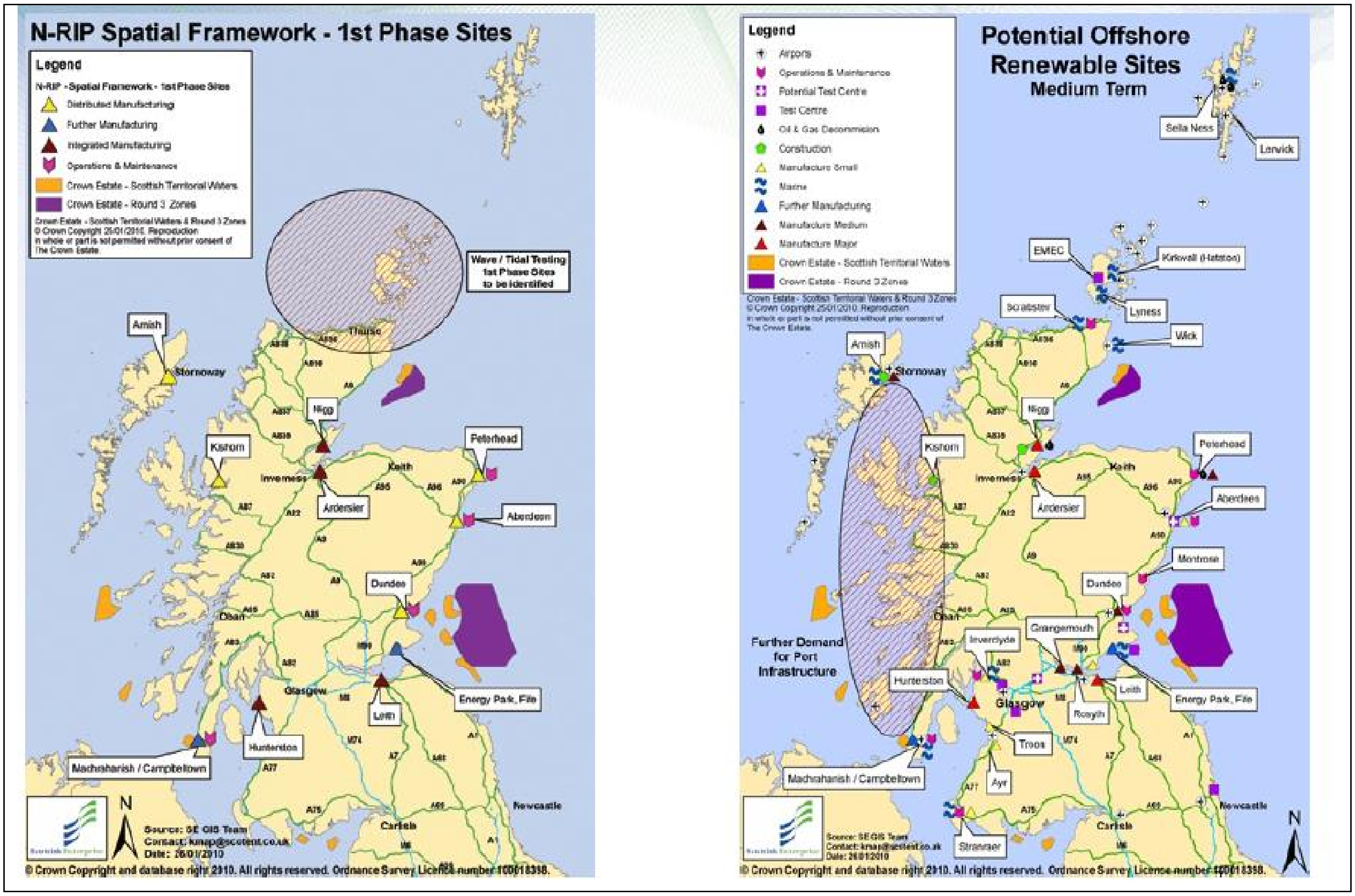
To maximise such opportunities the Scottish Government outlined a set of strategic objectives and immediate actions, including for example: support for the development of appropriate skills, for technological innovation and for securing funding and de-risking investment.

Subsequent to this study, and to the identification by the Scottish Government in its Government Economic Strategy (GES) of energy as one of the seven growth sectors offering significant potential to drive sustainable economic growth, there has been a whole plethora of reports by various bodies. These include EU Skills, RenewablesUK, Scottish Enterprise, Scottish Renewables and the Scottish Government, with reports on renewable route maps, skills plans, community benefits (see s5.3 of this report) etc, to deliver the growth of the renewable energy sector in Scotland.

In March 2011, The Scottish Government published *Blue Seas Green Energy – A Sectoral Marine Plan for Offshore Wind Energy in Scottish Territorial Waters.* The Plan contained 6 short-term options and a further 25 medium-term areas of search within Scottish Territorial Waters (0-12 nautical miles (nm)). This was followed up by the development of an Initial Plan Framework by marine Scotland (2013). Inter alia, the consideration of areas for development included a socio-economic assessment. The Socio-economic Impact Assessment aims to identify the extent to which existing marine activities may be affected by proposals for draft plan options for offshore wind energy, and to estimate the potential economic and social consequences arising from their potential interactions. However, site-specific or local impacts were not within the scope of the assessment, as these would be more adequately addressed through project-level analyses.

As noted above, under the UK context, the Scottish N-RIF is focusing investment at a number of port/near port sites. The fund is managed by Scottish Enterprise (SE) and Highlands and Islands Enterprise (SE, 2012). The Scottish National Renewables Infrastructure Plan (N-RIP) identified 11 locations that have been identified as offering the greatest potential for being involved in offshore wind manufacturing (HIE, 2012). Five of these are in the HIE area and are: Campbeltown, Kishorn, Arnish, Nigg and Ardersier (Figure 6.1). All 11 sites have had some interest from developers, although currently the strongest market interest is in the Forth and Tay cluster area, where Dundee, Leith and Methil are all considered prime locations, and Nigg in the Moray Firth. In 2018, a further study by Marine Scotland Science outlined 6 major areas of search within the Scottish EEZ (Figure 6.2)

***Figure 6.1**:* Scottish National Renewables Infrastructure Plan (N-Rip) *Spatial Framework (HIE 2012)*



Industry context: Industry is a partner in the various government initiatives noted above, such as OWPB. Recent industry activities, for example on supply chain initiatives, indicate growing support for more local content (at the UK scale) across the various stages of the OWF lifecycle. The 2017 report on *Offshore Wind UK Content* by Renewable UK for the OWPB shows an increase in UK content across all stages of the lifecycle. This may partly reflect some significant investments made by companies such as MHI Vestas, with its' Isle of Wight blade production facility for the new 8MW turbines, and Siemens' Greenport development on Humberside, which opened its blade factory in December 2016. Table 6.1 shows the latest estimate of UK content by RenewableUK (2017), using the methodology noted in s3.6 of this Oxford Brookes report, using aggregated data from those contracts over £10m submitted anonymously to the industry body by wind farm developers, including projects coming into Final Investment Decisions between 2010 and 2015.

***Figure 6.2:** Marine Scotland Science – Offshore Wind Farm Areas of Search (Scottish Government 2018)*

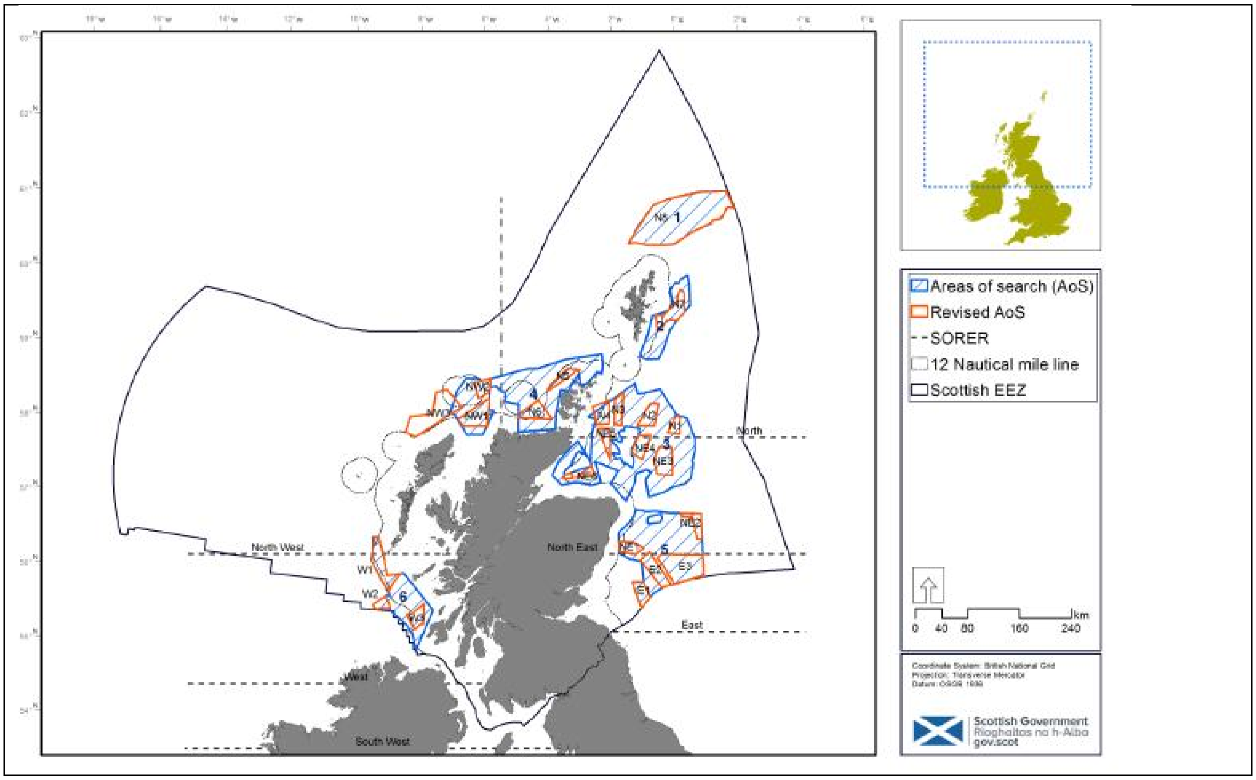


***Table 6.**1: 2017 Industry Report on UK Content*

	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%**

Source: RenewablesUK (2017)

Others: Some Scottish local authorities (LAs) are also proactive in supporting the offshore wind industry. For example, Moray Council's Policy ER1: *Renewable Energy Proposals* states that "renewable energy proposals will be considered favourably where they are compatible with tourism/recreational interest and facilities." In its 2015 unanimous support for the Beatrice offshore wind project, Moray Council highlighted the choice by SSE of Buckie Harbour as a contingency base for the O&M work and for the marine control coordination base. Confirmation of the harbour role is seen as bringing major benefits to the area in the lease of berths and the development of buildings for the use of vehicles, equipment and personnel. It is hoped that there will also be opportunities for local contractors and services with the increased business expected through the harbour.

6.3 Evolving scope of the Scottish Offshore Wind industry

Current scope and future plans: Although Scotland has over 5GW of installed onshore wind capacity, the development of installed offshore wind capacity is much more recent. Similarly, although the great potential for Scottish offshore wind energy has been identified for some time, actual OWF projects are currently less well developed than in England.

Scotland is home to the Beatrice Offshore Wind Demonstrator in the Moray Firth, which was the world's first deep-water project. There is also Robin Rigg which is E.ON's fully commissioned 180MW offshore wind farm in the Solway Firth. The Scottish Government has also granted offshore planning consent for over 4GW of new projects, including the Beatrice Offshore Wind Ltd (BOWL) and Moray Offshore Renewables Ltd sites in the Moray Firth which have a combined consented capacity of 1.86 GW, and the Neart na Gaoithe, Inch Cape and SeaGreen Alpha & Bravo sites in the Firth of Forth, which have a combined consented capacity of over 2.5 GW. Scotland also has plans for floating offshore wind developments, exemplified by the recent Statoil Hywind development near Peterhead and the Kincardine development further south, and has test and demonstrations sites at Aberdeen Bay (EOWDC), Hunterston and Methil.

Various other sites have been explored for their offshore wind potential. For example, there have been proposals for several major sites in the Western Isles, including Kintyre, Islay and the Argyll Array -- which in total would have over 2.5 GW capacity (SQW 2011). The Kintyre and Argyll proposals have subsequently been withdrawn, and the Islay project is dormant. However, the Scottish Government continues to explore potential new sites for future commercial development.

6.4 Emerging local socio-economic impacts/ issues and responses in Scotland

As noted in 6.2 above, in 2011 the Scottish Government published its Offshore Wind Plan. The Socio-Economic Impact Assessment element of the Plan covers only national and regional impacts, and is therefore of very limited value to individual communities. It also focused on the extent to which existing marine activities may be affected by proposals for draft plan options for offshore wind energy, and to estimate the potential economic and social consequences arising from their potential interactions. Site-specific or local impacts were not within the scope of the assessment.

In contrast, the SQW research report on the potential Argyll renewable projects focused very much on the local community socio-economic impacts (SQW, 2011). A key aim was to begin to identify the key potential socio-economic impacts (positive and negative) of the development and operation of the proposed wind farms. The research drew on community surveys in the potential Argyll OWF locations and on evidence from other OWFs. Some of the interesting findings from this report are noted below:

- *various process issues* including: poor understanding of the planning consent process at community level; absence of 'joined-up' thinking for related offshore and onshore developments; a need for a much greater emphasis on socio-economic impacts, especially at community level, reflected in a formal requirement with an agreed methodology for doing so; lack of clarity on the procurement strategy and a mechanism for local communities to have the opportunity to participate in the supply chain; and lack of a defined role for communities in the consenting process;
- *employment impact issues* including: findings that local employment opportunities are more likely in the O&M phase, and can be influenced by a pro-active approach involving developers and communities; one O&M job for every two to three turbines is suggested as an approximate guide;
- *some more social impacts issues* raised in community consultation in some quite remote communities include the potential impact of OWFs (especially workforce during construction), on community spirit, way of life, the Gaelic language, and various public services;
- *impacts on other sectors*, including: uncertain impact on fishing, from the (temporary) closure of fishing grounds, to the opportunities for vessels to participate in contract work; inconclusive evidence on impacts on tourism, and on local housing availability, which will be primarily based on developer employment policies and extent of local imported labour, and on house prices;
- *infrastructure issues*: among others the research refers to a report by DECC (2009) entitled *UK Ports for the Offshore Wind Industry: Time to Act* which outlined the required facilities needed at ports to support the offshore wind industry:
    - construction port requirements (e.g. at least 80,000 sqm suitable for laydown and pre-assembly of product)
    - manufacturing facility requirements (e.g. up to 500 hectares of flat land for factory and product storage, on North Sea coast)
    - O&M facility requirements (e.g. facilities for maintenance crew and vessels, plus storage and repair facilities; as wind farms get larger and further out to sea, the use of helicopters and offshore accommodation facilities for this function is likely to become more common)

The Scottish OWF industry can learn from evolving good practice from the relatively long standing and substantial Scottish onshore wind farm industry. Developers such as SSE and Scottish Power have promoted an array of measures to mitigate negative impacts and enhance positive impacts, many in the context of related Scottish Government/local and regional authority policy and guidance initiatives. For example, the Scottish Government and its local and regional authorities have developed approaches to community benefits (see Highland Council, 2013; Natural Scotland 2014) which have implications for approaches to such measures for offshore wind farms (see Local Energy Scotland, 2015). Scottish Enterprise (2016) produced an Offshore Wind: Seize the Opportunity Guide (SE, 2016) which sets out supply chain opportunities for Scottish oil and gas supply companies to diversify into the offshore wind industry.

SSE (Scottish and Southern Electric) has a long-standing commitment to community investment associated with its various renewable projects nationwide. In its' *Community Investment Annual Review 2016/17* (SSE, 2017) SSE reports that it delivered £4.9m in grants to community projects, with a model of 50% pa ring-fenced for local community and 50% pa allocated to a regional Sustainable Development Fund (SSE, 2017). SSE, and other developers including Vattenfall and Scottish Power, is also active in promoting the use of local supply chains. For example the £1.1 bn Caithness to Moray Transmission Project, delivered by SHET (Scottish Hydro Electric Transmission), which is part of the SSE Group, has strongly pursued local economic and social benefits. The project used the SSE Open4Business (O4B) portal to better enable local suppliers to access opportunities, supported by main contractors. Supply chain opportunities have also been reinforced through various events and meetings. It is estimated that approximately £643m of contract investment has been in the UK, with about half in Scotland—of which about 15% (£48m) has gone to local suppliers. It is also calculated that the project has delivered 144 locally resident workers on sites in Caithness and Sutherland, and 73 in Moray (SSE, 2016b). SSE is also a Living Wage employer, guaranteeing that all its employees receive a living wage as defined by the Living Wage Foundation.

6.5 Summary

The bullet points below set out a few summary points from this initial review of the Scottish context for offshore wind:

- Scotland has great potential for offshore wind energy development, with an estimated 25% of all of Europe's offshore wind and tidal potential;
- There is considerable government ambition for the industry at both UK and Scotland levels, with strong strategy positions and support initiatives, and also in local authorities and other Scottish agencies (eg SE and HIE);
- Industry is a partner in the various government initiatives, such as the Offshore Wind Programme Board, and is working with government to increase the UK share of OWF investment across all stages of projects;
- Yet the take-up of OWF projects in Scotland is currently low, compared with Scottish onshore wind and with English offshore wind;
- But, starting with the 580 MW Beatrice project, the number of major projects now in the pipeline could see Scottish offshore wind at least matching the 5 GW capacity of Scottish onshore wind by the early 2020s;

- Scotland is pioneering innovation in the offshore wind industry, exemplified by the turbine size (8.4MW) and suction bucket technology for the Vattenfall Aberdeen project, and the Statoil floating Hywind project;
- Research on socio-economic impacts and issues for offshore wind in Scotland identifies some process issues (e.g. how to improve community participation), economic issues (eg the potential from the O&M stage), social issues (e.g. on rural way of life), and impacts on other sectors, such as fishing;
- There is also the key issue of the importance of the provision of the required facilities needed at Scottish ports to support the offshore wind industry;
- However, there is growing good practice by developers such as SSE, Scottish Power and Vattenfall, who have promoted an array of measures to mitigate negative impacts and enhance positive impacts, especially on local employment and supply chain opportunities and with community benefits agreements.

7. Some emerging themes and trends from the literature on socio-economic impacts of OWFs

7. Some emerging themes and trends from the literature	7.1 Economic impacts and assessment 7.2 Social impacts and assessment 7.3 Socio-economic impacts of OWFs, with particular reference to Scotland

7.1 Assessing the economic impacts of OWFs – challenges and opportunities

The following bullet points highlight some of the key opportunities and challenges emerging from the evolving literature on the assessment of the economic impacts of OWFs:

- Wind is a rapidly increasing energy sector and the UK is the global leader. Yet there is concern that the UK offshore wind sector has not sufficiently capitalised on its lead to secure local content, in terms of UK investment and UK jobs;
- The ‘local’ in local content can mean several different things covering a range of spatial scales from host community local authority area to the whole of the UK; much of the research to date has focused on the UK level;
- Economic leakage is greatest for the CAPEX stage, with only on average about 20% of expenditure staying in the UK; but in contrast around 70% of the OPEX stage stays in the UK, and this could be worth 7000 UK jobs by 2020 ;
- Whilst much of the offshore construction work will be outsourced from local areas, there is more local potential with the onshore work (e.g. sub-station connections; local port improvements);
- The impacts of multiple OWFs 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);
- The availability of a hub port, with modern and extensive facilities for large scale rigs and set down areas is very important for developing major supply chain economic benefits. Such hubs are exemplified overseas for example in the Dutch ports such as Vlissingen, Ijmuiden, Eemshaven and Rotterdam.
- A Capital Stocks analysis suggests that the impacts on financial, manufactured and human capital are primarily positive’ ; for the human capital stock, the positive impacts for example on employment (direct, indirect and induced), on skills and wages are identified;
- A modelling trend that has evolved in the OWF sector over the last decade is the development of an Input–Output (I-O) approach to prediction of economic impacts. However, this “top-down” approach has limitations. Partly in response, a number of more hybrid and “bottom-up” approaches have been developed which are more grounded in the actual details of the project and the host economy;
- The focus of mitigation and enhancement is very much on the enhancement of local benefits, for example via developer support to maximise local supply chain benefits and local employment via training and recruitment policies;

- Monitoring of actual, rather than predicted local impacts, is essential for the advancement of the planning, assessment and management of economic benefits in the interests of the local community. Yet such monitoring has been very limited to date, with a few rare exceptions, such as the Scroby Sands and Robin Rigg projects. Plans are now afoot to improve monitoring in terms of UK content, but this still leaves a large gap in terms of monitoring at more sub-national spatial scales.

7.2 Assessing the social impacts of OWFs – challenges and opportunities

The following bullet points highlight some of the key opportunities and challenges emerging from the evolving literature on the assessment of the social impacts of OWFs:

- Social impact assessment is a relatively new but expanding field. Methods to analyse social impacts, as well as mitigation and enhancement methods, are developing all the time, and there is a growing recognition of the value of SIA for outcomes on a number of levels
- There is common recognition of the need for a technical as well as a participatory approach to SIA, in order to capture the complexity and nuances of potential social impacts on a given community or group of communities.
- It is important to consider SIA right from the pre-development phase, given that social impacts can begin from the moment a project is in the pipeline. Early community engagement is crucial, in order to lessen the impact in relation to fear and anxiety, which in turn has a positive effect on the social impacts of an offshore development. It is interesting to note that five of the seven steps in the 2015 IAIA guidelines on SIA refer to the pre-operation phase.
- But in addition to early community engagement, it is also important to ensure sustained engagement throughout the project's lifetime, to order to mitigate or avoid longer-term social impacts. Such engagement also contributes to equity and justice issues, with communities feeling that they are engaged in decision-making about their future
- This review has also demonstrated the importance of taking into consideration culturally meaningful aspects, which might have impacts on the community's attitude and perception. Although these are more challenging to assess, they are crucial to understanding a community's response to a major infrastructure project, particularly an offshore development where the cultural importance of the sea and seascape can play an important role in shaping communities' responses.
- While considerable work has been carried out to assess the impacts of onshore wind projects, there are less empirical studies on OWF, given they are a relatively new development in energy transition as a response to the threat of climate change. Although there are similar attitudes and perceptions to onshore and offshore wind developments, recent studies suggest that the specific marine context of OWF should be taken into consideration when assessing the social impact of an offshore development. The meaning of the marine context and a community's attachment to the sea and seascape should be taken into account in assessing the social impact of OWF.
- As noted in 7.1 research indicates that OWF overall have a positive impact on well-being, defined broadly in their review using the five-capitals model plus governance, although the

specific impacts on social capital are mixed. Mitigation and enhancement methods, such as offering community benefits are also seen as positive, although they can also be interpreted as 'bribes' to the community. Research suggests that emphasising the community benefits, rather than benefits to individuals, will garner greater support for offshore wind developments in the future.

- Overall, there is an emerging literature on the social impacts of offshore wind developments, but more work is needed, in particular in relation to community cohesion and the potential impacts of such developments on the sense of community and belonging.

7.3 Socio-economic impacts of OWFs, with particular reference to Scotland

The bullet points below set out a few summary points from this initial review of the Scottish context for offshore wind:

- Scotland has great potential for offshore wind energy development, with an estimated 25% of all of Europe's offshore wind and tidal potential;
- There is considerable government ambition for the industry at both UK and Scotland levels, with strong strategy positions and support initiatives, and also in local authorities and other Scottish agencies (eg SE and HIE);
- Industry is a partner in the various government initiatives, such as the Offshore Wind Programme Board, and is working with government to increase the UK share of OWF investment across all stages of projects;
- Yet the take-up of OWF projects in Scotland is currently low, compared with take-up for Scottish onshore wind and with English offshore wind;
- But, starting with the 580MW Beatrice project, the number of major projects now in the pipeline could see Scottish offshore wind at least matching the 5GW capacity of Scottish onshore wind by the early 2020s;
- Scotland is pioneering innovation in the offshore wind industry, exemplified by the turbine size (8.4MW) and suction bucket technology for the Vattenfall Aberdeen project, and the Statoil floating Hywind project;
- Research on socio-economic impacts and issues for offshore wind in Scotland identifies some process issues (e.g. how to improve community participation), economic issues (eg the potential from the O&M stage), social issues (e.g. on rural way of life), and impacts on other sectors, such as fishing;
- There is also the key issue of the importance of the provision of the required facilities needed at Scottish ports to support the offshore wind industry;
- However, there is growing good practice by developers such as SSE, Scottish Power and Vattenfall, who have promoted an array of measures to mitigate negative impacts and enhance positive impacts, especially on local employment and supply chain opportunities and with community benefits agreements.

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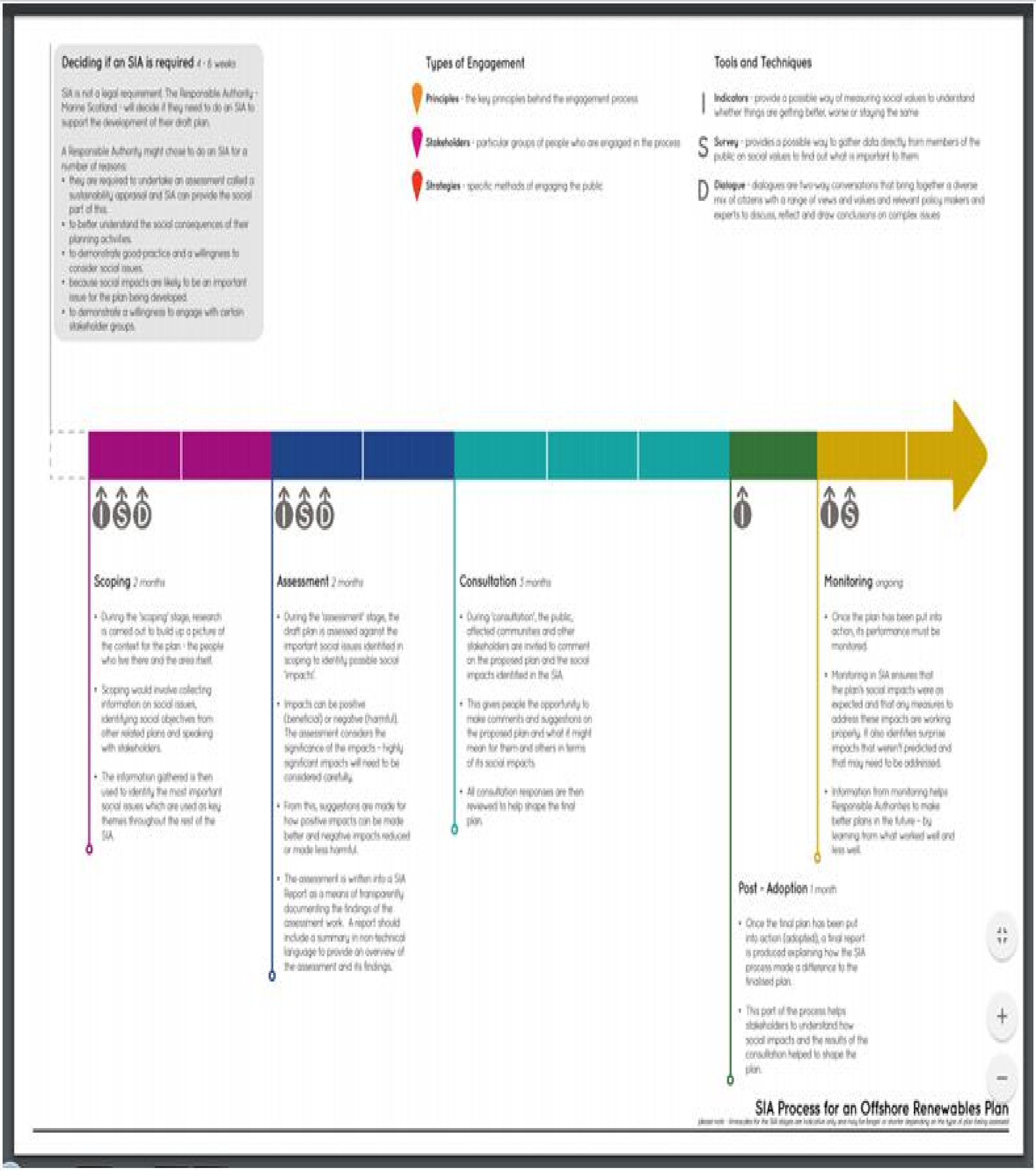
Annex 1: SIA process for an offshore renewable plan



Source: Collingwood Environmental Consulting (2016)

Annex 2: Lessons from the SIA field (Vanclay)

Lesson 1: The 'community' is never homogeneous. Every locality will always have multiple social subgroups, each of which will be affected in different ways and have different interests, and will need to be separately considered.

Lesson 2: The impacts of any planned intervention are always differentially distributed. Because of the diversity in any local community, and especially because different groups within an affected region are positioned differently, there is always a differential distribution of the benefits and costs associated with any planned intervention.

Lesson 3: The needs of the worst-off members of society must always be considered. They are typically never involved and therefore there is a special responsibility to ensure that their interests are considered.

Lesson 4: The environmental (biophysical) impacts only occur when the construction work begins. Social impacts occur the moment there is speculation or rumour that something will change.

Lesson 5: Even the act of carrying out a social or environmental impact assessment can create social impacts. The irony is that the social research being undertaken in support of the interests of the impacted communities may be a trigger for their fear and anxiety. Awareness of this possibility and appropriate remedies need to be considered by SIA practitioners.

Lesson 6: Often the biggest social impact is the fear and anxiety caused by the project or policy. These are real social impacts and should not be dismissed. Instead they need to be managed effectively.

Lesson 7: Process is everything. It is important to realise that the level and effectiveness of community engagement has a huge bearing on the amount of fear and anxiety experienced. The extent of social impacts felt is largely contingent on contextual factors such as the genuineness of any community engagement mechanisms and the extent to which the views of all stakeholders are considered and reflected in the outcome.

Lesson 8: Perception is reality. Perceived impacts are real social impacts. Although some scientists and engineers might discount people's perceptions because they are not real and may be based on incorrect information, the important social understanding is that, right or wrong, the way individuals perceive things affects their feelings. This needs to be taken into account.

Lesson 9: A key concept is trust. If the past experience of a community with projects has not been positive, new projects will be regarded sceptically, even if they are in fact beneficial and best practice. The fear and anxiety stakeholders experience is related to their perception of the trustworthiness of the proponent and of the various regulatory bodies and relevant government agencies.

Lesson 10: Second and higher order impacts tend to cause more harm than first order impacts. This makes prediction of social impacts difficult. It suggests that having an ongoing monitoring and adaptive management process is important to keep track of social impacts over time.

Lesson 11: Impacts can be both 'upstream' and 'downstream'. A thorough assessment of any project should not only be of the site itself, but of all the inputs into the site and project 'upstream', as well as of anything that leaves the site 'downstream'. For example, the labour input demands of a big project can have consequences for where the workers come from, as well as at the site and surrounding areas where they are located.

Lesson 12: Due to the unpredictable nature of impacts, it is important to have an ongoing monitoring process and a process of adaptive management to respond to any issues that emerge. Monitoring includes tracking pre-established and fit-for-purpose social indicators from various data sources, but also refers to having an ongoing process of community engagement where community observations about unexpected consequences can be raised. The corporate social responsibility obligations of proponents require that they allow for this as a project-related expense.

Lesson 13: It is important to monitor impacts to highlight benefits that haven't been obtained, or promised impacts that haven't been delivered. This can happen, for example, because the proponents fail to take account of likely new technological developments which can reduce labour requirements and therefore promised jobs to the local community don't materialise. When this happens, communities can feel cheated and deceived, lowering their trust in the proponent and in the regulatory bodies.

Lesson 14: Focus on what counts, not on what can be counted. Too often, especially in the selection of indicators for monitoring, there is a tendency to select indicators for which data are readily available, whether or not they are relevant to the real issues facing affected people. Because of the complexity of social issues, finding easily measurable indicators is difficult. Having a range of qualitative approaches to monitoring, evaluation and assessment might be more valid than focusing on quantification.

Lesson 15: Labelling local communities' opposition as 'NIMBY' is not helpful. Because there are different stakeholders with different motivations, values and interests, there will always be a degree of conflict over planned interventions. However, strong opposition will tend to occur because of the failure of the proponent to establish the social legitimacy of the project or policy, to gain a social license to operate. Use of the term NIMBY should be avoided.

Lesson 16: One size does not fit all. There are always local specificities that must be considered. Care should be taken to ensure that standard solutions are not rolled out uniformly. And even where there may be common solutions, people want to be involved in the decision-making processes that affect their lives. People in deliberative settings may well come to the same decisions as experts, but they needed to have that process of engagement in order to accept the outcome.

Lesson 17: Organisations may not be responsible, but they will be held accountable. Organisations often claim that certain things are not their responsibility and quite often they may not have legal responsibility for particular events. But if some groups feel that an organisation is in fact

responsible, this can have repercussions on their ability to operate. There is a strong business case for corporate social responsibility.

Source: Vanclay (2012)