



Cenos Offshore Windfarm Limited



# Cenos EIA

## Appendix 30 – Detailed Socio-Economic Methodology

<b>ASSIGNMENT</b>	A100907-S01
<b>DOCUMENT</b>	A100907-S01-A-ESIA-036
<b>CLIENT</b>	CEN001-FLO-CON-ENV-RPT-0073



Aberdeen

[www.xodusgroup.com](http://www.xodusgroup.com)

5th Floor Capitol Building  
429-431 Union Street . Aberdeen  
AB11 6DA . UK

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REV	DATE	DESCRIPTION	ISSUED	CHECKED	APPROVED	CLIENT
A01	16/12/24	Issued for Use	Glic	FdB	DB	Cenos
R01	04/12/24	Issued for Review	Glic	LD	LD	Cenos

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# Appendix 30: Detailed Socio-economics Methodology

## Supporting Study for EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation

### 1 Introduction

This document describes the economic effects associated with the Project during its development, construction, operation and maintenance. It considered the Study Areas<sup>1</sup> outlined in **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**, authored by Glic (the trading name of DWS Associates Limited). The methodologies and outputs inform in the assessment of significance of effects on socio-economics, tourism, and recreation receptors in **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**.

The report contains only the methodology for quantifying economic effects and does not describe those used to assess social, tourism, or recreation effects, or the methodologies used to assess the significance of effects on the receptors considered in **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism, and Recreation**.

### 2 Scoping and consultation

**Table 19.2 of EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation** outlines consultee comments on the 2024 Scoping Report. This report adheres to all such comments and guidance.

This report also adheres to all relevant guidance provided and other documentation referenced in the 2024 Scoping Report.

### 3 Project details and assumptions for economic assessment

#### 3.1 Project scenarios

For the purposes of this study, three indicative design options have been utilised to undertake the assessment:

- Option 1: 95 15MW Floating Turbine Units (FTUs); total installed capacity of approximately 1350MW;
- Option 2: 80 18MW FTUs; total installed capacity of approximately 1350MW; and
- Option 3: 68 21MW FTUs; total installed capacity of approximately 1350MW.

Project-specific costs for each option were provided by the Applicant in terms of Capital Expenditure (CAPEX), Development Expenditure (DEVEX) and Operational Expenditure (OPEX) (note it is currently too early in the Project phases to provide Project specific estimates for Decommissioning Expenditure (DECEX)). These are detailed in Table 1 to Table 3; CAPEX and DEVEX are presented as a lifetime total for the entire Project while OPEX is presented as an annual figure. All figures use 2024 prices.

Note that figures are rounded to the nearest £1 million, so values given as £0 million may not equal zero. The column sum totals may not sum exactly due to rounding errors.

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<sup>1</sup> Aberdeen City and Aberdeenshire, Highland, Rest of Scotland, Rest of UK

Table 1. CAPEX (lifetime total) (£M) <sup>2</sup>

	Option 1	Option 2	Option 3
Wind Turbine Generators (WTGs) (includes installation)	1,976	1,997	1,980
Inter-Array Cables (IACs)	214	216	214
Export/Import Cable	150	150	150
Floating substructure, including mooring system and anchors (includes installation)	2,518	2,544	2,523
Offshore Substation and Converter Platforms (OSCPs) (includes installation)	726	726	726
Onshore substation (includes installation)	338	338	338
IACs installation	175	158	140
Export/Import Cable installation	173	173	173
Total	6,270	6,302	6,244

Table 2. DEVEX (lifetime total) (£M)<sup>3</sup>

	Option 1	Option 2	Option 3
Total	313	315	312

Table 3. OPEX (Annual) (£M)

	Option 1	Option 2	Option 3
Operations	35	29	25
Maintenance	63	53	45
Offshore vessels and logistics	3	3	2
Operations and maintenance	1	0	0
Total	102	86	73

To establish the expected expenditure in each Study Area, assumptions were made about the location of the CAPEX, DEVEX and OPEX. Three cases (a mid case, low case and high case) were developed with assumptions provided by the Applicant.

<sup>2</sup> CAPEX associated with the categories Turbines; Floating substructure; OSCP; Onshore substation is inclusive of structure costs, installation and assembly costs, and all other related costs.

<sup>3</sup> DEVEX is assumed to be 5% of the total CAPEX.

### 3.1.1 Mid case

The core assumptions of the mid case are outlined below:

- DEVEK: assumes the use of consultants and contractors based in Europe and UK (with principal hubs in London), but with the Project team based largely in Aberdeen and the rest of Scotland;
- CAPEX: assumes that manufacturing of principle components (WTGs and substructures) will take place outside of the UK and that assembly will take place in Scotland with full use of the UK supply chain where viable; and
- OPEX: assumes that there will be an operations base in Aberdeenshire with the majority of spend occurring locally.

Table 4 outlines the percentage of expenditure expected in each Study Area<sup>4</sup>. All excess expenditure that is not included in the Study Areas is expected to occur outside of the Study Areas (outside of the UK, in this instance).

Table 4. Mid case expected expenditure

	Aberdeen City and Aberdeenshire	Highland	Rest of Scotland	Rest of UK
DEVEX	20%	5%	15%	30%
CAPEX	10%	15%	5%	20%
OPEX	70%	0%	15%	10%

### 3.1.2 Low case

The core assumptions of the low case are outlined below:

- DEVEK: assumes a more extensive use of consultants and contractors from outside of Scotland and the UK, but assumes that the owner's team is based in Scotland;
- CAPEX: assumes less use of the UK supply chain and the increased use of yards and vessels outside of the UK; and
- OPEX: assumes that there will be an operations base located outside of Aberdeenshire as well as increased use of vessels and contractors from outside of the UK.

Table 5 outlines the percentage of expenditure expected in each Study Area. All excess expenditure that is not included in the Study Areas is expected to occur outside of the study areas (outside of the UK, in this instance).

Table 5. Low case expected expenditure

	Aberdeen City and Aberdeenshire	Highland	Rest of Scotland	Rest of UK
DEVEX	10%	0%	10%	20%
CAPEX	5%	5%	5%	10%
OPEX	15%	0%	40%	20%

<sup>4</sup> As per estimations provided by the Applicant.

### 3.1.3 High case

The core assumptions of the high case are outlined below:

- DEVEX: assumes the use of consultants and contractors based in Europe and UK (with principal hubs in London), but with the Project team based largely in Aberdeen and the rest of Scotland, with an increased focus on the use of UK / Scottish consultants and contractors;
- CAPEX: assumes that manufacturing of principle components will take place outside of the UK and that assembly will take place in Scotland with maximised use of the UK supply chain; and
- OPEX: assumes that there will be an operations base in Aberdeenshire with the majority of spend occurring locally.

Table 6 outlines the percentage of expenditure expected in each Study Area. All excess expenditure that is not included in the Study Areas is expected to occur outside of the Study Areas (outside of the UK, in this instance).

Table 6. High case expected expenditure

	Aberdeen City and Aberdeenshire	Highland	Rest of Scotland	Rest of UK
DEVEX	20%	5%	15%	40%
CAPEX	10%	20%	10%	30%
OPEX	80%	0%	10%	5%

## 3.2 Expenditure timeline

Table 7 provides a Project timeline that shows periods of DEVEX, CAPEX and OPEX. Construction is expected to be completed five years after OPEX begins, with OPEX lasting a total of 39 years<sup>5</sup>.

Table 7. Project expenditure timeline

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	...
Phase	DEVEX (5 years; pre-construction)					CAPEX (6 years; construction)						OPEX (39 years; beginning in Y2 of construction, ending at the end of the 35-year operation and maintenance period)				

Table 8 shows how the total expenditure for each phase is distributed across the Project timeline. Year 7 is the year with peak expenditure. From year 9 and onwards, OPEX is expected to be a consistent expenditure value, noting that in year 7 and 8 OPEX is slightly greater than this due to start-up costs<sup>6</sup>.

<sup>5</sup> Note the Applicant is seeking a 35 year consent for the Project from Scottish Ministers

<sup>6</sup> As per OPEX estimations provided by the Applicant.

Table 8. Project expenditure by phase (%)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	...
DEVEX	5	15	20	30	30											
CAPEX						10	20	20	20	20	10					
OPEX							120	110	100	100	100	100	100	100	100	100

## 4 Methodology

This section describes the approach and methods used to ascertain the net economic effects that the construction, and operations and maintenance phases of the Project are expected to bring to Aberdeen City and Aberdeenshire (local), Highland (local), Scotland (national) and the UK (national).<sup>7</sup> Effects are measured in terms of employment, gross value add (GVA) and employee income. All effects are measured in pounds sterling (£) at 2024 prices. Employment is measured in full-time equivalents (FTEs), representing one full-time worker working for one full year. This assessment and methodology adheres to all relevant guidance.

The assessment considers the direct, indirect, and induced effects:

- Direct effects: those created by the Project expenditure within the developer organisation and on its directly procured contractors,
- Indirect effects: those created by the business-to-business transactions that are caused by the direct effects,
- Induced effects: those created as a result of increased household income (business-to-consumer transactions) caused by the direct and indirect effects.

Economic effects are calculated on the net level, which means that additionality is considered. Additionality refers to the extent to which an activity or intervention (such as the Project) produces benefits or outcomes that would not have occurred without it. Multiple factors are considered in establishing the levels of additionality associated with an intervention:

- Displacement: refers to the extent to which economic activity created by an intervention is offset by the loss of economic activity elsewhere in the Study Area;
- Leakage: refers to the extent to which economic activity created by an intervention flows out of the Study Area;<sup>8</sup>
- Substitution: refers to the extent to which an intervention causes one activity to replace another within the same Study Area; and
- Deadweight: refers to the economic activity or outcomes that would have taken place regardless of the intervention.

<sup>7</sup> Collectively these are referred to as the 'study areas'.

<sup>8</sup> Note that leakage can also occur as a result of benefits flowing away from a target population. This is not relevant for this assessment. Distributional effects are considered separately.



There are three main phases considered when estimating the economic effects of the Project:

- Pre-construction and construction: this includes DEVEX and CAPEX and generates short-term effects. This is presented as a total figure encompassing the impacts of DEVEX and CAPEX over the whole development and construction phase, because expenditure is not evenly distributed over the development and construction period;
- Operations and maintenance: this includes OPEX and generates long term effects. This is mainly presented as an annual figure representing the impacts of OPEX in a typical year of the operations and maintenance phase, because expenditure is expected to be evenly distributed over the operations and maintenance period; and
- Decommissioning: at this stage, figures for DECEX are not available. As such, economic effects during the decommissioning phase are not quantified in this report, although these impacts would be short-term. It should be further noted that even if DECEX figures were available, current data for industry interactions, intermediate demand, and employment (which drive much of the modelling) would likely not be accurate given that the decommissioning phase is not expected to begin until at least 46 years in the future.

Key secondary data sources used to quantify economic impacts include:

- Scottish Government Input-Output tables (including Direct Requirements tables and Supply and Use tables);
- Scottish Annual Business Statistics;
- UK Input-Output tables (including Direct Requirements tables and Supply and Use tables); and
- HM Treasury GDP Deflators.

It should be noted that the most recent publication of the Scottish and UK Input-Output tables provides data for 2020. However, there are challenges in the collecting and processing of the data sources that underlie the Supply and Use tables due to the COVID-19 pandemic, and the pandemic has created significant impacts on the structures and behaviours within the economy. Given the guidance provided by Scottish Government, the 2019 data has been used instead as a proxy for post-pandemic modelling. Employment metrics have been updated to 2024 prices using HM Treasury GDP Deflators.

A bespoke multi-regional input-output modelling approach has been used to quantify impacts. Three models were used:

- Model 1: to describe multi-regional effects in Aberdeen City and Aberdeenshire and the Rest of Scotland;
- Model 2: to describe multi-regional effects in Highland and the Rest of Scotland; and
- Model 3: to describe multi-regional effects in Scotland and the Rest of the UK.

All three models use a similar approach to represent the flow of goods and services between sectors and regions within the economy by estimating the coefficients of an input-output table (called the direct inputs table) on a multi-regional level. This is then used alongside data on employment, GVA, and earnings on the national and regional level to calculate direct, indirect, and induced metrics for the increase in GVA, employment, and earnings that would occur as a result of an increase in final demand.

Models 1 and 2 use the same methodology. The direct inputs table was taken from the Input-Output tables published by the Scottish Government. This is used as the starting point to estimate the direct inputs tables on the Aberdeen City and Aberdeenshire and Highland levels. The Scottish direct inputs table is first modified using Rounds' fabrication method to adjust for differences in regional and national proportions of intermediate demand.

This effectively scales the columns of the direct inputs table. To achieve this, regional economic data provided by the Scottish Annual Business Statistics is used. Further regional economic data provided by the Scottish Annual Business Statistics and national economic data provided by the Scottish Government Supply and Use tables is used to calculate cross-industry location quotients.

The cross-industry location quotients introduce cell-by-cell adjustments within the Scottish direct inputs table to begin the process of creating a direct inputs table for Aberdeen City and Aberdeenshire and Highland. One issue not addressed by the cross-industry location quotients is cross-hauling – when a region imports and exports the same goods. The Flegg Modification, which modifies the cross-industry location quotients, was used to address this issue.

Once the regional direct inputs table is constructed, a multi-regional direct inputs table is created. This combines the regional and national direct inputs tables and additional coefficients to model the flow of goods and services between the regional and national models.

The corresponding Leontief Matrix<sup>9</sup> is then calculated from the multi-regional direct requirements table. From this, Type I and Type II metrics for GVA, employment and earnings are calculated.<sup>10</sup>

Two sets of Type I and Type II metrics are created, one set corresponds to regional effects (Aberdeen City and Aberdeenshire for model 1 and Highland for model 2) and the other set corresponds to the national effects that occur as a result of increased demand in the specified region (Scotland for both model 1 and model 2).

As both Scotland and the UK have detailed supply and use tables, model 3 uses a different methodology. Both the Scottish and UK direct requirements tables (adjusted to ensure aligned Standard Industry Classification (SIC) codes) are used to create a multi-regional direct requirements table.

Additional coefficients are included to model the flow of goods and services between the Scottish and UK models based on imports and exports between the two regions. As with models 1 and 2, Type I and Type II metrics for GVA, employment and earnings are calculated.<sup>11</sup> Two sets of Type I and Type II metrics are created, one set corresponding to Scottish effects and the other set corresponding to UK effects.

Additionality is then considered in the form of displacement, leakage, substitution and deadweight to calculate net effects.

Type I and Type II metrics are created for each industry by SIC code. To apply the metrics modelled, the various categories of expenditure at the most granular level possible are assigned their most appropriate two-digit SIC code. Table 9 shows the two digit-SIC code assigned to each category of expenditure.

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<sup>9</sup> The Leontief Matrix is a foundational concept in economics, particularly in input-output analysis. It represents the interdependencies between different sectors of an economy, showing how the output of one sector is used as an input for others. This tool is widely used to study the structure of economies and predict how changes in demand affect overall production.

<sup>10</sup> <sup>7</sup> Multipliers and effects are calculated using the methodology described in the Scottish Government Input-Output Methodology Guide: <https://www.gov.scot/binaries/content/documents/govscot/publications/statistics/2019/08/input-output-latest/documents/sut-methodology-guide/sut-methodology-guide/govscot%3Adocument/SUT%2BMethodology%2BGuide%2Bv8.pdf>

Table 9. SIC codes for relevant expenditure categories

Expenditure category	SIC code
DEVEX	71
Turbines	28
IACs	27
Export/Import Cable	27
Floating substructure	25
Offshore substation	27
Onshore substation	27
IACs installation	41-43
Export/Import Cable installation	41-43
Operations	70
Maintenance	33
Offshore vessels and logistics	50
Operations and maintenance	52

## 4.1 Additionality assessment

### 4.1.1 Displacement

For this assessment, the following types of displacement may occur:

- Product market displacement: when increased output in one business leads to reduced output in competing businesses (e.g. shifting market share);
- Labour market displacement: when new jobs created by an intervention draws workers away from other organisations, leaving those organisations understaffed;
- Input market displacement: when increased demand for inputs (e.g. raw materials) for an intervention reduces their availability or increases costs for other organisations; and
- Spillover displacement: when an intervention influences the output of an activity not directly involved in, or competing with, the intervention.

Given the current composition of the energy market and policy objectives aimed at shifting away from oil and gas, it is not expected that this Project will lead to additional product market displacement in any of the Study Areas.

Labour market displacement may occur in all Study Areas as a result of multiple offshore wind projects competing for a limited pool of skilled workers. This is considered in **Section 19.7: Assessment of cumulative effects of EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**. These impacts may be mitigated over time if upskilling and training plans are implemented for the sector.

Similarly, input market displacement may occur in all Study Areas as a result of multiple offshore wind projects competing for materials from a supply chain with limited production capacity or for limited port access. This is considered in **Section 19.7: Assessment of cumulative effects of EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**. These impacts may be mitigated over time with investment in relevant supply chain industries and infrastructure.

Further input market displacement may occur as a result of competing for resources with other industries in the Study Areas. The commercial fisheries industry has been highlighted for potential interaction with the Project in

this sense. Displacement may occur as a result of the displacement of fishing vessels from waters used for fishing activities during the construction and operations and maintenance phases of the Project. This is considered in the Project stand-alone case in **Sections 19.6.1.6 and 19.6.2.6: Marine commercial activities** and in the cumulative case in **Sections 19.7.2.5 and 19.7.3.5: Marine commercial activities**, of **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**.

Spillover displacement may occur as a result of the Project negatively influencing the output of other industries in the Study Areas. The tourism industry and industries related to commercial fisheries have been highlighted for potential indirect effects from the Project. Displacement may occur in the tourism industry due to competition for temporary accommodation, with potential impact on the number of tourists visiting the study area and decreasing the output of other businesses selling to tourists. Displacement may also occur in the tourism industry because of reduced visitor perceptions of the study area that discourages potential visitors from coming to the study area and reducing output of related tourism businesses. This may be an effect of the interference of recreational activities, increased road and infrastructure usage or visual impacts. Displacement effects in the tourism industry are considered in the Project stand-alone case in **Sections 19.6.1.5 and 19.6.2.5: Tourism and recreation** and in the cumulative case in **Sections 19.7.2.4 and 19.7.3.4: Tourism and recreation**, of **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**.

Further spillover displacement may occur in the industries related to commercial fisheries, including both supply chain industries for commercial fisheries and processing and other value-adding industries. A reduction in output of commercial fisheries as a result of the Project may also lead to a reduction in the output of these associated industries. This is considered in the Project stand-alone case in **Sections 19.6.1.6 and 19.6.2.6: Marine commercial activities** and in the cumulative case in **Sections 19.7.2.5 and 19.7.3.5: Marine commercial activities** of **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**.

There are no further forms of displacement expected.

#### 4.1.2 Leakage

Only a proportion of the total expected DEVEX, CAPEX and OPEX is expected to occur in the various Study Areas, considered in **Section 3.2: Expenditure timeline** of this report and modelled using various scenarios. Beyond this, leakage may occur within the supply chain and induced effects (e.g. an indirect supplier for activities occurring in Aberdeenshire might be located elsewhere in Scotland, thus removing potential economic activity in the Aberdeenshire study area). Likewise, if an employee spends money on a product manufactured outside of the Study Area, this will represent a form of induced leakage.

All leakage effects of this type are fully encompassed and accounted for in the multi-regional economic modelling.

There are no further forms of leakage expected.

#### 4.1.3 Substitution

For this assessment, the following types of substitution may occur:

- **Product substitution:** when an intervention increases output in one area by directly diverting output from another area (e.g. a business introduces a new product line by diverting spending from existing products rather than increasing overall revenue) or by replacing activities that would have generated output anyway;
- **Labour substitution:** when an intervention hires new workers but does so by reallocating staff from other areas, resulting in no new job creation, or by replacing hires for others that would have been employed anyway.

It is assessed that this Project will not create any substitution effects as it is not directly replacing existing activities, nor is it expected that staff will be reallocated from other areas to fill the new posts created.

#### 4.1.4 Deadweight

None of the outcomes described as resulting from the Project are expected to occur otherwise and as such there are not expected to be any deadweight effects.

## 4.2 Quantification of effects

### 4.2.1 Direct effects

Direct effects are created by the Project expenditure that occurs within the developer organisation and on the directly procured contractors. Specifically, this is the economic activity generated by the Project expenditure in the first tier of the supply chain.

Direct metrics can be ascertained from the Type I metrics that are produced by the multi-regional input-output tables. The direct metric is equivalent to the Type I effect divided by the Type I multiplier.

Direct effects are calculated for each Project option in each expected regional expenditure scenario (nine scenarios in total). To achieve this in the regional Study Areas, Aberdeen City and Aberdeenshire and Highland, total expenditure by category is multiplied by the associated expected rate of expenditure in the corresponding Study Area. The corresponding metrics from the multi-regional modelling (matching SIC code and region) are applied to calculate the direct effects in terms of GVA, employment, and earnings.

On the Scotland level, total expenditure by category is multiplied by the associated expected rate of expenditure in the 'Rest of Scotland'. The corresponding metrics from the Scottish input-output tables (adjusted for matching SIC code with the UK tables) are applied to calculate the first part of the direct effects. As with the calculation of effects on the regional level, expected expenditure in Aberdeen City and Aberdeenshire and Highland is calculated. The corresponding metrics from the multi-regional modelling (Scotland-wide impacts occurring as a result of activity in a specific region) is then applied to calculate the second part of the direct effects. The sum of the first and second parts of the direct effects (i.e. the region-specific activity and the Rest of Scotland activity) gives the full direct effects on the Scotland level in terms of GVA, employment and earnings. Direct effects on the UK level are calculated similarly.

The direct effects calculated using this methodology are presented for each of the nine scenarios in Table 10 to Table 18. DEVEX and CAPEX figures are presented as the total for the whole development and construction phase; OPEX figures are presented on an annual basis. Figures are rounded to the nearest whole number and thus values given as 0 may not equal zero. The column sum totals may not sum exactly due to rounding errors.

Table 10. GVA – Option One (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	16	31	31	0	11	11	35	71	71	65	117	131
CAPEX	135	270	270	147	441	589	426	856	1,147	696	1,391	1,943
OPEX	8	39	45	0	0	0	33	48	51	38	61	69

Table 11. GVA – Option Two (£M)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	16	31	31	0	11	11	35	71	71	66	118	122
CAPEX	136	272	272	148	444	591	428	860	1,152	699	1,399	1,954
OPEX	7	33	38	0	0	0	27	41	43	32	51	58

Table 12. GVA – Option Three (£M)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	16	31	31	0	10	10	35	70	70	65	117	121
CAPEX	135	269	269	147	440	586	424	852	1,142	693	1,387	1,936
OPEX	6	28	32	0	0	0	23	35	37	27	44	49

Table 13. Employment – Option One (FTEs)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	196	393	393	0	133	133	467	932	932	1,140	1,981	2,279
CAPEX	1,348	2,697	2,697	1,259	3,778	5,037	4,273	8,140	11,065	8,339	16,678	23,351
OPEX	114	532	607	0	0	0	340	616	664	403	665	786

Table 14. Employment – Option Two (FTEs)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	197	395	395	0	134	134	470	937	937	1,146	1,991	2,155
CAPEX	1,353	2,706	2,706	1,262	3,786	5,048	4,287	8,164	11,099	8,377	16,753	23,457
OPEX	96	448	512	0	0	0	286	519	559	340	560	662

Table 15. Employment – Option Three (FTEs)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	196	391	391	0	133	133	466	929	929	1,135	1,973	2,135
CAPEX	1,340	2,681	2,681	1,250	3,749	4,999	4,247	8,087	10,994	8,298	16,597	23,238
OPEX	82	380	435	0	0	0	243	441	475	289	476	562

Table 16. Earnings – Option One (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	8	17	17	0	6	6	21	41	41	47	82	93
CAPEX	85	169	169	80	240	320	268	512	695	487	975	1,359
OPEX	4	20	22	0	0	0	20	26	26	26	41	47

Table 17. Earnings – Option Two (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	8	17	17	0	6	6	21	41	41	47	83	87
CAPEX	85	170	170	80	241	321	269	515	699	490	981	1,367
OPEX	4	17	19	0	0	0	17	22	22	22	35	39

Table 18. Earnings – Option Three (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	8	16	16	0	6	6	21	41	41	46	82	87
CAPEX	84	169	169	80	239	319	267	511	693	486	973	1,356
OPEX	3	14	16	0	0	0	15	18	19	18	29	33

#### 4.2.2 Indirect effects

Direct economic activities have knock-on effects within the supply chain. The indirect effects capture effects that occur as a result of the business-to-business transactions derived from direct effects.

It should be noted that whilst some elements of the supply chain may be located geographically close to the direct economic activity, elements (particularly further down the chain) could be located further afield and potentially out of the Study Area.

This is a form of leakage. The input-output modelling and metrics recognise these leakage effects as an integral part of the model.

Indirect metrics can be ascertained from the Type I metrics included in the multi-regional input-output tables. The indirect metric is equivalent to the Type I effect subtracted by the direct effect.<sup>12</sup>

The remainder of the process involved in calculating the indirect effects is the same as with the direct effects.

The indirect effects calculated using this methodology are presented for each of the nine scenarios in Table 19 to Table 27. DEVEX and CAPEX figures are presented as the total for the whole development and construction phase; OPEX figures are presented on an annual basis. Figures are rounded to the nearest whole number and so values given as 0 may not equal zero. The column sum totals may not sum exactly due to rounding.

Table 19. GVA – Option One (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	2	3	3	0	1	1	10	20	20	42	73	84
CAPEX	24	48	48	32	97	129	149	299	400	434	868	1,215
OPEX	1	6	7	0	0	0	8	16	17	17	28	33

Table 20. GVA – Option Two (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	2	3	3	0	1	1	10	20	20	42	73	80
CAPEX	24	48	48	32	97	130	150	300	402	435	870	1,219
OPEX	1	5	6	0	0	0	7	13	14	15	24	28

<sup>12</sup> Equivalently this is also the same as Type I effect – Type I effect/Type I multiplier.



Table 21. GVA – Option Three (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	2	3	3	0	1	1	10	20	20	42	73	79
CAPEX	24	48	48	32	97	129	149	297	398	431	861	1,206
OPEX	1	4	5	0	0	0	6	11	12	13	20	23

Table 22. Employment – Option One (FTEs)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	19	37	37	0	18	18	141	270	270	610	1,057	1,219
CAPEX	279	558	558	309	927	1,236	1,709	3,281	4,437	5,626	11,252	15,764
OPEX	15	69	79	0	0	0	110	201	217	230	374	430

Table 23. Employment – Option Two (FTEs)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	19	37	37	0	18	18	142	271	271	613	1,062	1,154
CAPEX	281	562	562	311	934	1,245	1,716	3,295	4,456	5,640	11,279	15,803
OPEX	12	58	66	0	0	0	93	170	183	194	315	362

Table 24. Employment – Option Three (FTEs)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
DEVEX	18	37	37	0	18	18	140	269	269	607	1,052	1,144
CAPEX	279	557	557	309	926	1,234	1,699	3,264	4,412	5,577	11,154	15,627
OPEX	11	49	56	0	0	0	79	144	156	165	267	308

Table 25. Earnings – Option One (£M)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	1	1	1	0	1	1	6	12	12	27	47	55
CAPEX	13	25	25	14	42	56	81	156	210	261	523	732
OPEX	1	3	3	0	0	0	5	8	9	11	17	20

Table 26. Earnings – Option Two (£M)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	1	2	2	0	1	1	6	12	12	27	48	52
CAPEX	13	25	25	14	42	56	81	156	211	262	525	735
OPEX	1	2	3	0	0	0	4	7	8	9	15	17

Table 27. Earnings – Option Three (£M)

	Aberdeen City and Aberdeenshire			Highland			Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	1	1	1	0	1	1	6	12	12	27	47	51
CAPEX	12	25	25	14	42	56	81	155	209	260	519	727
OPEX	0	2	2	0	0	0	3	6	6	8	12	14

For complex developments and at this stage of the procurement process, it is not possible to ascertain accurately which roles will be undertaken by direct contractors and which will be sub-contracted. For the purposes of assessment in **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**, direct and indirect effects have been combined as a single figure.

#### 4.2.3 Induced effects

Employment will be created and household earnings will increase as a result of the direct and indirect effects. This will increase consumer spending which will in turn create additional economic impacts. These are the induced effects.

As with the indirect effects, it should be noted that whilst much consumer spending is likely to be local to the household, many consumer goods may not necessarily be produced locally or within the Study Area. Furthermore, elements of the supply chain for consumer goods and services may also not necessarily be located geographically close to the consumer businesses themselves. This represents a form of leakage and is represented as an integral part of the multi-regional input-output model.

Induced metrics can be ascertained from the Type I and Type II metrics that are produced by the multi-regional input-output tables. The indirect metric is equivalent to the Type II effect subtracted by the Type I metric.

The remainder of the process involved in calculating the induced effects is the same as with the direct and indirect effects.

The induced effects calculated using this methodology are presented for each of the nine scenarios in Table 28 Table 36. DEVEX and CAPEX figures are presented as the total for the whole development and construction phase; OPEX figures are presented on an annual basis. Figures are rounded to the nearest whole number and so values given as 0 may not equal zero. The column sum totals may not sum exactly due to rounding.

Table 28. GVA – Option One (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	1	2	2	0	1	1	9	17	17	39	68	78
CAPEX	11	21	21	9	26	34	111	209	286	396	791	1,104
OPEX	1	2	3	0	0	0	8	11	11	19	31	35

Table 29. GVA – Option Two (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	1	2	2	0	1	1	9	17	17	39	69	73
CAPEX	11	22	22	9	26	35	111	210	288	398	795	1,110
OPEX	0	2	2	0	0	0	7	9	9	16	26	30

Table 30. GVA – Option Three (£M)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	1	2	2	0	1	1	9	17	17	39	68	73
CAPEX	11	21	21	9	26	34	110	208	285	394	788	1,100
OPEX	0	2	2	0	0	0	6	8	8	14	22	25

Table 31. Employment – Option One (FTEs)

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	14	27	27	0	8	8	95	183	183	414	729	827
CAPEX	146	292	292	112	336	448	1,192	2,239	3,073	4,224	8,447	11,773
OPEX	7	34	39	0	0	0	90	114	118	208	335	379

Table 32. Employment – Option Two (FTEs)

	Aberdeen City and Highland Aberdeenshire						Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	14	27	27	0	8	8	95	184	184	416	733	777
CAPEX	147	294	294	113	338	451	1,198	2,251	3,090	4,245	8,491	11,834
OPEX	6	28	33	0	0	0	76	96	99	175	282	319

Table 33. Employment – Option Three (FTEs)

	Aberdeen City and Highland Aberdeenshire						Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	13	27	27	0	8	8	95	182	182	412	726	770
CAPEX	146	291	291	112	335	447	1,188	2,231	3,063	4,208	8,415	11,729
OPEX	5	24	28	0	0	0	65	82	84	149	239	271

Table 34. Earnings – Option One (£M)

	Aberdeen City and Highland Aberdeenshire						Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	0	1	1	0	0	0	4	7	7	17	30	34
CAPEX	5	11	11	4	11	15	44	82	113	173	346	482
OPEX	0	1	1	0	0	0	3	4	4	8	14	15

Table 35. Earnings – Option Two (£M)

	Aberdeen City and Highland Aberdeenshire						Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	0	1	1	0	0	0	4	7	7	17	30	32
CAPEX	5	11	11	4	11	15	44	83	114	174	348	485
OPEX	0	1	1	0	0	0	3	4	4	7	11	13

Table 36. Earnings – Option Three (£M)

	Aberdeen City and Highland Aberdeenshire						Scotland			UK		
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
DEVEX	0	1	1	0	0	0	4	7	7	17	30	32
CAPEX	5	10	10	4	11	15	44	82	113	172	345	481
OPEX	0	1	1	0	0	0	2	3	3	6	10	11

#### 4.2.4 Pre-construction and construction phase

The figures presented above are spilt by DEVEX, CAPEX, and OPEX. However, for the purposes of assessment in **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**, effects are considered for each discrete phase. The pre-construction and construction phase includes the entirety of DEVEX and CAPEX effects, but also some OPEX effects. This is because OPEX begins in year 2 of the construction phase. **Section 3.2: Expenditure timeline** details the expected Project timeline and expected distribution of spend each year. This shows a highly uneven distribution of expenditure in the pre-construction and construction phase, with associated uneven distribution of economic impacts. For the purposes of assessing the significant of effects on receptors in **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**, the economic impacts in the 'peak' year have been considered, defined as the year in the pre-construction and construction phase where economic impacts are at their highest.

The peak year is year 7, where there is expected to be 20% of the total CAPEX spend and 120% of the typical annual OPEX spend.

It is not expected that there will be major OPEX occurring in the Highland spatial area; Highland has not been scoped into the assessment of operations and maintenance effects.

This follows the spatial scoping exercise undertaken as part of **EIAR Vol. 3, Chapter 19: Socio-economics, Tourism and Recreation**. However, it has been recognised that there may still be some elements of OPEX that occur in Highland. Due to this, and because Highland is scoped into the assessment of the pre-construction and construction phase, for the purposes of assessing the peak year of the pre-construction and construction phase, a proportion of OPEX has been assumed to occur in Highland. This proportion has equally been subtracted from the Rest of Scotland number to ensure that double counting does not occur. The adjusted expected OPEX in the Highland and Rest of Scotland spatial area for the low, mid, and high case is:

- Low: Highland – 10%; Rest of Scotland – 30%;
- Mid: Highland – 5%; Rest of Scotland – 10%; and
- High: Highland – 5%; Rest of Scotland – 5%.

The total effects calculated for the peak year in the pre-construction and construction phase are presented for each of the nine scenarios in Table 37 and Table 38. Figures are rounded to the nearest whole number and so values given as 0 may not equal zero. The column sum totals may not sum exactly due to rounding.

Table 37. GVA (£M)<sup>13</sup>

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High	Low	Mid	High
Option One	519	1,478	1,588	453	1,066	1,403	2121	3,877	4,941	4,658	8,940	12,110
Option Two	495	1,360	1,452	435	1,061	1,398	2,018	3,706	4,761	4,512	8,706	11,846
Option Three	471	1,256	1,335	417	1,044	1,378	1,918	3,536	4,571	4,347	8,425	11,502

<sup>13</sup> As per OPEX estimations provided by the Applicant. Peak year includes considerations for OPEX expenditure, hence why option 1 has higher impacts than option 2.

Table 38. Employment (FTEs)<sup>14</sup>

	Aberdeen City and Highland Aberdeenshire			Scotland			UK					
	Low	Mid	High	Low	Mid	High	Low	Mid	High			
Option One	46	126	134	46	117	155	197	363	462	396	756	1,018
Option Two	45	117	124	45	117	155	188	351	449	383	736	996
Option Three	43	109	115	44	116	153	180	337	434	369	712	967

#### 4.2.5 Operations and maintenance phase

A 'peak' year is not required for the operations and maintenance phase of the Project because OPEX is expected to be evenly distributed between each year of the phase. Effects are presented as the typical expected annual effects and equate to the typical annual OPEX effects calculated in Sections 4.2.1 to 4.2.3. earlier.

Highland is not scoped into the operations and maintenance phase. Typical annual OPEX effects on the Highland level calculated above (Sections 4.2.1 to 4.2.3) are zero.

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<sup>14</sup> As per OPEX estimations provided by the Applicant. Peak year includes considerations for OPEX expenditure, hence why option 1 has higher impacts than option 2.