

EMEC Socio-Economic Report

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Document History

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Executive Summary

1.1 Document Purpose

In February 2016, the economist Steve Westbrook produced an economic impact assessment for Highlands and Islands Enterprise to assess the impact of the European Marine Energy Centre (EMEC) since its establishment to 2015, and the report was later partially updated in-house by HIE to include impacts arising from 2016 to 2017. This document summarises the findings from the two reports to provide a socioeconomic look at EMEC's impact, in support for a Section 36 Consent for the Billia Croo test site.

1.2 Summary

The European Marine Energy Centre began operation in 2003 with the opening of the wave site at Billia Croo near Stromness, which was followed in 2006 by the opening of the tidal site at Fall of Warness off the island of Eday. EMEC is the world's only grid connected, full scale wave and tidal energy converter testing and accreditation centre. It provides a 'plug and play' facility in real sea conditions and independent accreditation of device performance to facilitate the development of new wave and tidal industries.

The socio-economic impacts of the marine renewable industry have been continuously predicted by various sources in order to promote the financial and social interest required to further marine renewable energy.

Economic impacts are estimated for the Orkney Islands, the Highlands and Islands area, Scotland, and the UK; with EMEC's wider international role also highlighted.

The following aspects of economic impact are assessed in this report:

- the cumulative capital expenditure incurred in developing EMEC's test and operational infrastructure;
- other capital expenditure incurred in enhancing infrastructure primarily related to wave and tidal testing and, eventually, deployment of operational devices;
- EMEC's annual operation, including its purchases of supplies and services;
- local supply chain;
- the impacts generated in Orkney through the activities of Orkney-based marine renewables related businesses and organisations in as far as these can be attributed to EMEC; and,
- indicative impacts beyond Orkney generated by the expenditures of the businesses that have used EMEC's facilities, customers, and suppliers, in developing the experimental and prototype devices that have been tested at EMEC, and in manufacturing, installing and maintaining trial arrays and commercial scale devices.

Wider local, regional, UK and international benefits that are also covered in this report include:

- population and demographic benefits to Orkney;
- other benefits that have been generated through enhanced infrastructure that was provided primarily to meet current or anticipated wave and tidal related developments and for supply chain maximisation;
- the acceleration of international wave and tidal R&D and development facilitated by EMEC, with work generated for Orkney's supply chain;
- applied and academic research generated;
- EMEC's role in hydrogen development projects; and,
- a planned new research campus in Stromness.

The table below summaries the total quantifiable impact (between 2003-2017) attributable to EMEC, combining impacts associated with EMEC-related infrastructural developments in Orkney; EMEC’s operations; marine energy device development; and other academic-related and public sector-related employment impacts in Orkney.

Table 1. Quantifiable employment impact of EMEC (between 2003-2017) per area

	Cumulative FTE years	Cumulative Earnings (£m)	Cumulative GVA (£m)
Orkney	1,653	55.9	98.3
Highlands & Islands	1,969	65.0	116.3
Scotland	3,244	113.9	213.6
UK	4,227	149.8	284.7

The overall employment impact in Orkney (as of 2017) of 1,650 full time equivalent (FTE) job years equates to an average of 110 FTEs annually over the 15 year period (2003-2017); in the Highlands and Islands as a whole 131 FTEs annually; in Scotland 216 FTEs per year; and in the UK 282 FTEs per year.

It should be noted that the term ‘supply chain’ includes work that contractors may sub-contract to other companies; with the term “indirect impacts” relating to all links in the supply chain (as conventionally in input-output analysis). It is not appropriate to separate out direct and indirect impacts for development stage impacts, spend from visits, and device development due to a lack of information. For example, a construction firm (tier one contractor) may carry out the vast majority of the work on a particular project onsite themselves, subcontracting a small number of workers to do specialist tasks. However, another tier one contractor working on the same hypothetical project may employ a small number of staff and subcontract the bulk of the work; and therefore figures for direct and indirect impacts for the same project could be vastly different. For this report, the overall impact was of relevance, not the breakdown between direct, indirect and induced. Induced impacts are applied to direct plus indirect impacts in the report using assumptions that are specified.

2 Introduction

The decision to site EMEC in Orkney was announced by the Scottish Government in July 2001 with the intention that “Scotland would become a world leader in energy production from wave and tidal power as a result”. Four other sites were examined as potential test centres for marine energy; however, it was concluded that the site was best in terms of the available resource – wave power and tidal currents; a short distance offshore to exploit these resources; there was available onshore facilities such as offices, storage and harbour capacity; and suitable connection to power lines. With Scapa Flow in close proximity to the Billia Croo test site, the sheltered water would support construction of any experimental devices.

Construction work began in 2003 and Pelamis Wave Power tested their Pelamis 750 device at the Billia Croo test site in 2004, to become the world’s first floating wave device to generate electricity to the National Grid. OpenHydro began installation of their open-centred turbine at the Fall of Warness site in 2006 – and in 2008 became the first tidal turbine to generate successfully to the grid in the UK. Orkney-based tidal developer, Scotrenewables Tidal Power, had selected its own site at the Fall of Warness prior to the development of EMEC’s test berths, but the grid connection offered by EMEC has been important to the company, together with certification opportunities.

In Stromness, EMEC has a suite of offices and data acquisition facilities, including areas dedicated to specific developers, and HIE has built six industrial units at Hatston, Kirkwall that offer workshop, storage and office accommodation and provide a logistics base for developers testing at EMEC’s sites.

2.1 Public Sector Assistance

The impacts generated by EMEC have largely been stimulated by public sector assistance. Funding sources have included the UK Government, the Scottish Government, Highlands and Islands Enterprise, Scottish Enterprise, local authorities (principally Orkney Islands Council), the Carbon Trust, and the EU (through the European Regional Development Fund).

2.2 Study Methodology

The 2016 impact assessment drew from a range of sources, and discussions held with representatives of organisations and businesses to obtain information on expenditures, supply chains, direct employment, and plans.

A variety of documents produced by EMEC and other material on its website informed the analysis, and its annual accounts and lists of suppliers provided by EMEC gave data on salaries paid to staff, EMEC’s indirect impacts through the supply chain, and company-by-company impacts. Eight device developers supplemented information.

Various reports, including those by *The Carbon Trust* and *UK Government Energy and Climate Change*, were carefully analysed and used in this assessment. Care was taken in interpreting the impacts given in these reports, as robustness of the analysis in these reports varies, as well as definitions and categorisations of direct/indirect jobs.

Input-output tables for Orkney informed assumptions on induced impacts. Induced impacts arise through the additional spending of the employees of businesses that benefit directly and indirectly (through the supply chain) from the economic activity generated by the expenditure / investment that an impact study is examining.

The average assumed induced employment multipliers for the four areas for which quantified impacts are assessed in this report are as follows – although higher multipliers are assumed where direct or indirect full time equivalents (FTEs) pay more than the average FTE.

	Average Induced Employment Multipliers
Orkney	0.15
Highlands & Islands	0.2
Scotland	0.25
UK	0.3

The categories of economic impact were analysed principally in terms of FTEs and associated earnings generated, with Gross Value Added (GVA) impacts also estimated. GVA is broadly equivalent to salaries plus other employment costs plus operational profit (excluding depreciation). Employment impacts were measured in FTE years, and impacts to date relate to the 2003-17 period.

3 Orkney Infrastructural Development Impacts

The impacts estimated below relate to public sector or public sector supported projects in Orkney that have been completed since 2004. Other planned but not yet fully funded infrastructure development projects, including grid upgrades, are not covered. There has also been a range of minor projects and infrastructure improvements in Orkney funded by the public sector not included in the table that could be at least partially attributable to the development, operation or existence of EMEC. Thus, the impacts from infrastructural developments in Orkney to date will be somewhat greater than indicated in the analysis in this Section.

	Cost at Original Price £m	Cost at Current Price £m
EMEC Wave (2004)	5.559	7.970
EMEC Tidal (2007)	7.200	9.110
Systems / Soft Infrastructure (2004-07)	1.754	2.280
Cable Ends (2010)	1.935	2.280
Additional Cables / Scale Sites (2010)	8.000	10.250
WATES Projects (2008)	4.260	5.700
EMEC Energy Conversion (2015/16)	3.000	3.110
Hatston Pier Extension & Working Area	8.000	9.110
Lyness, Hoy, Service & Supply Base	2.975	3.420
Stromness Marine Renewables Service Base	7.500	8.540
HIE Hatston Units (2011)	2.950	3.420
Dedicated Office Space, Stromness	1.043	1.140
Hatston Enterprise Area Roads & Services	2.100	2.280
Total	£56.326m	£68.610m

After adjusting for increases in out-turn project costs (where known or anticipated), the development stage impacts for those projects for which impact analysis for Orkney and the Highlands and Islands as a whole, was previously carried out is shown in the following table. These impacts include indirect (i.e. supply chain) and induced impacts through the multiplier.

Table 2. Employment impact analysis for three infrastructural development projects

	Orkney FTE years	Highlands & Islands FTE years	Scotland FTE years	UK FTE years
Hatston Pier Extension & Working Area	86	105	116	126
Stromness Marine Renewables Service Base	80	97	107	116
HIE Hatston Units	54	68	75	82

The impacts from the overall expenditure on EMEC-related infrastructure developments to date in Orkney would be as follows:

	FTE years	Earnings (£m)
Orkney	443	11.075
Highlands & Islands	564	14.100
Scotland	715	18.253
UK	820	21.403

The types of job represented by the FTE years of work shown above (which are mainly in the construction sector) are assumed on average to pay £25,000 per annum in Orkney and the Highlands and Islands, the additional jobs in Scotland are assumed to pay £27,500 (10% more) on average, and the further additional jobs held by people whose normal residence is elsewhere in the UK are assumed to pay £30,000 on average. This reflects generally higher earnings in Scotland and the UK (in comparison to the Highlands and Islands area), and the relatively specialist work that many of the staff living outwith the Highlands and Islands will have undertaken in the course of their companies' contracts.

4 EMEC's Operational Impacts

The direct jobs at EMEC represent high value employment. In 2017, the average full-time salary for EMEC staff was around 40% higher than the median for the Orkney and Highlands and Islands economies¹.

EMEC's operational impacts are generated through its expenditures that create or support employment. Other than direct staffing, operating expenditures that relate to capital developments are excluded. Sources of income are thus not material to the calculation of impacts, but it is useful to appreciate how income is generated and how this has grown, as shown by the graph below. The x-axis relates to EMEC's financial years, which run from July to June.

¹ Regarding this figure, the Office for National Statistics (ONS) publishes income figures through their Annual Survey of Hours and Earnings. Figures are often patchy for Orkney as sample sizes are small. 2015 was the most recent figures available at the time the study was done. This shows FT median annual earnings of £25,891 for Orkney. Separate figures provided by ONS to HIE show similar earnings of £25,972 in the Highlands and Islands overall. The £38,000 figure for EMEC is more than 40% higher than the median income for both Orkney and the Highlands and Islands.

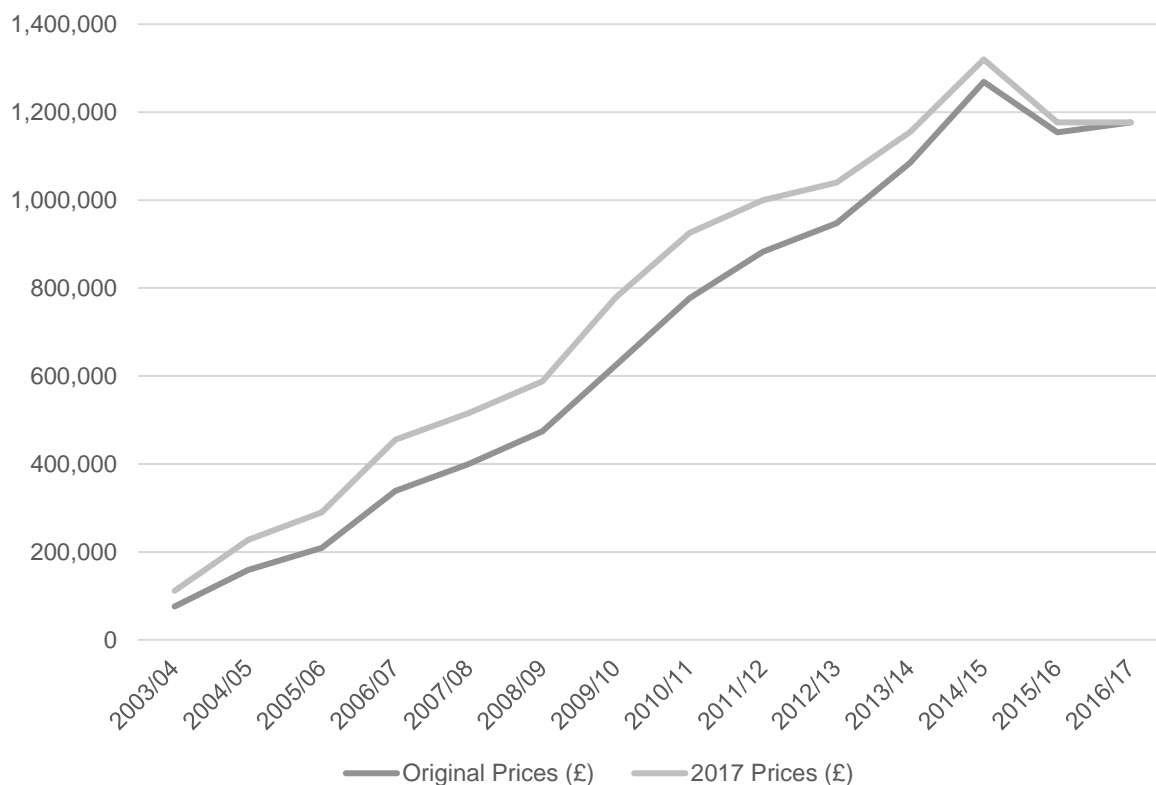


Figure 1. Gross earnings from 2003 – 2017, including 2017 prices estimates to account for inflation.

It is assumed that cumulative GVA is half of the level of cumulative earnings over the period due to operational deficits prior to 2010/11. Whilst considering the above, cumulative direct impacts for the period 2003 to 2017 have been estimated as follows:

Table 3. Cumulative direct impacts (between 2003 – 2017)

	Cumulative Direct FTE years	Cumulative Earnings (£m)	Cumulative GVA (£m)
Orkney	193	8.9	4.4
Highlands & Islands	200	9.2	4.6
Scotland	217	10.0	5.0
UK	235	10.8	5.4

4.1 Supply Chain Impacts

EMEC has strived to support the local supply chain through its daily operations. Approximately a half of EMEC's operating expenditures other than staffing costs would have supported employment in the Orkney economy in 2013/14, although this dropped to a third in 2014/15. Cumulative supply chain impacts (inclusive of the multipliers) arising from EMEC's operational expenditure since 2003 to 2017, are summarised in the following table.

Table 4. Cumulative supply chain impacts from EMEC operational expenditure (between 2003 – 2017)

	Cumulative FTE years	Cumulative Earnings (£m)	Cumulative GVA (£m)
Orkney	28	0.9	1.7
Highlands & Islands	38	1.2	2.3
Scotland	55	1.7	4.3
UK	90	2.7	6.8

4.2 Visits to EMEC

Information provided by EMEC and other research for this study indicates that visits to Orkney to see EMEC’s facilities and the support services available in Orkney² have totalled around 5,250 visitor nights over the 2003-17 period. This has generated visitor expenditure not already incorporated in the impact calculations above for EMEC or Orkney’s supply chain. Assuming an average spend per night in Orkney by visitors to be £100, this would have generated £525,000. Cumulative impacts arising from visits to Orkney since 2003-2017 are summarised in the following table.

Table 5. Cumulative impacts from visits to Orkney associated with EMEC activities (between 2003 – 2017)

	Cumulative FTE years	Cumulative Earnings (£'000)	Cumulative GVA (£m)
Orkney	11	210	420
Highlands & Islands	11	210	420
Scotland	6	126	252
UK	4	84	168

5 Wider Economic Impacts

The wider economic impacts include impacts generated through the development of the prototype devices that have been tested at EMEC and associated developers’ expenditure in Orkney (excluding their payments to EMEC); impacts of the wider marine energy sector development fostered by, or otherwise attributable to, EMEC.

5.1 Impacts from Device Development Attributable to EMEC

More marine energy devices have been tested at EMEC than at any other single site in the world. EMEC has hosted 20 wave and tidal energy clients (with 31 marine energy devices) spanning 11 countries. It is worth noting that due to the fact that the industry is at a critical testing stage, devices are not permanently deployed at EMEC’s test sites, and their location is dependent on a number of factors including the developers’ testing schedules and the weather. Table 1 Table 6 provides a list of clients that have deployed at EMEC’s test sites as of 2018.

² discuss new initiatives, negotiate potential new business with Orkney’s specialist suppliers, etc

Table 6. EMEC wave and tidal clients as of 2018

	Country of origin	Developers	Device name	No of devices
Wave clients	UK	Aquamarine Power	Oyster 1 & Oyster 800	2
	UK	E.ON/Pelamis Wave Power	P2 001	1
	UK	Pelamis Wave Power	P1	1
	UK	Scottish Power Renewables	P2 002	1
	UK	Seatricity	Oceanus	1
	Finland	AW Energy	WaveRoller	1
	Finland	Wello	Penguin	1
	Sweden	CorPower	C3	1
Tidal clients	UK/Singapore	Atlantis	AK1000 & AR1000	2
	UK	EC-OG	Subsea Power Hub (SPH)	1
	UK	Nautricity	CoRMaT	2
	UK	Orbital Marine Power	SR250 & SR2000	2
	UK	Sustainable Marine Energy	PLATO	1
	France	Alstom (formerly TGL)	DeepGen	2
	Germany	Voith	HyTide	1
	Ireland	OpenHydro	Open Centre Turbine	7
	Netherlands	Tocado	T2	1
	Norway	Flumill	Flumill	1
	Norway/Austria	ANDRITZ Hydro Hammerfest	HS1000	1
	Spain	Magallanes	ATIR	1

Total cumulative impacts (direct, indirect and induced) arising from device development attributable to EMEC between 2003 and 2017, are summarised in the following table.

Table 7. Cumulative impact associated with device development at EMEC (between 2003 – 2017)

	Cumulative FTE years	Cumulative Earnings (£m)	Cumulative GVA (£m)
Orkney	673	26.2	52.4
Highlands & Islands	839	31.3	62.7
Scotland	1907	73.8	147.7
UK	2698	104.0	208.0

5.2 Other Employment Impacts in Orkney

As highlighted by the Orkney Renewable Energy Forum³, there are around 40 marine renewables-related businesses in Orkney employing approximately 250 people. The Energy of Orkney website gives 30 different Orkney businesses and organisations involved in marine renewables under the following categories:

- agents and brokers;
- regulation and control;
- surveys and consents;
- work planning;
- cable laying;
- construction management;
- fabrication and assembly;
- lifting;
- marine engineering;
- site surveys;
- underwater services;
- anchor handling;
- experienced mariners;
- harbours and services bases;
- monitoring and inspection;
- navigation maintenance;
- operational control;
- towage;
- training;
- vessels and craft;
- debris clearance;
- pollution clean-up;
- salvage and recovery; and,
- search and rescue.

Orkney’s academic centres of excellence include ICIT (the International Centre for Island Technology operated by Heriot-Watt University in Stromness) and Orkney College (a partner college of the University of the Highlands and Islands). ICIT has led strategic research programmes, including a case study of Pentland Firth and Orkney Waters as part of a major international EU-funded project and now offers an MSc in Marine Renewable Energy as well as specialist programmes tailored to marine renewables. There are five MSc programmes

³ Orkney Renewable Energy Forum (OREF). <http://www.oref.co.uk>.

offered by ICIT which attract students from around the world to Orkney across a variety of disciplines. Orkney College has a Marine Archaeology Unit at its Kirkwall Campus which is involved in marine renewables related research. It was estimated that the proportion of these jobs plus that of ICIT's staff and PhDs (plus the indirect and induced employment that they generate), which could be attributed to the activities of EMEC since 2004 and were not included in the impacts assessed elsewhere, would be approximately 20-25 FTEs. This accounts for a cumulative impact since 2004 of approximately 100 FTE years in Orkney (multiplier inclusive).

Further impacts that were attributed to EMEC included public sector jobs associated with marine renewables; Orkney Islands Council employment supported by income from EMEC clients from harbour dues, rentals of buildings and land, tug services, etc; and Orkney College staff. In 2011, this direct employment overall was estimated as:

Orkney - 7 FTEs
 Highlands and Islands – 8 FTEs
 Scotland – 10 FTEs
 UK – 11 FTEs

In order to derive approximate cumulative impacts, the FTE figures can be multiplied by 5.

Total cumulative impacts (direct, indirect and induced) arising from academic-related employment and public sector jobs attributable to EMEC are summarised in the following table.

Table 8. Cumulative impacts arising academic-related employment and public jobs attributable to EMEC (between 2003 – 2017)

	Cumulative FTE years	Cumulative Earnings (£m)	Cumulative GVA (£m)
Orkney	257	7.7	15.4
Highlands & Islands	257	7.8	15.6
Scotland	268	8.3	16.5
UK	286	8.8	17.5

5.3 Wider Research and Development Impacts

A variety of European funded projects have examined the socio-economic impact of marine renewables on Orkney and Caithness, with most of the evidence relating to EMEC activities. These have provided revenue to university faculties and to private consultancies whilst increasing the body of knowledge available for future wave and tidal developments.

As of 2017, the total value of the R&D projects that EMEC has been involved in as a partner is around £50 million, with around £5 million of this accruing to EMEC from its inputs. Other businesses and organisations, locally and nationally, will have obtained significant income from participation in these projects as partners or through the supply chain.

5.4 Cruise Ship Impacts in Orkney

Although the pier extension at Hatston was funded to support the marine renewable industry in Orkney, the development has made it possible for Orkney to host some of the largest cruise ships. Whilst large cruise ships can anchor out in sheltered bays and tender passengers

ashore, cruise liners prefer to moor alongside. Prior to the Hatston pier development, Orkney already had a healthy share of the cruise market, with ships using Stromness and Kirkwall Harbour piers as well as the original Hatston Pier. Therefore, in order to evaluate to what degree the increased volumes can be attributed to the new infrastructure built to support the marine renewable sector, the recent growth needs to be considered in the context of general market growth in the UK and Ireland and against facilities that feature in the same itineraries and have not had comparable investment.

The Cruise Lines International Association figures for the UK and Ireland show a plateau in passenger number growth from 2011, with a fall between 2013 and 2014 of 5%. Invergordon has experienced patchy growth of 9% in 2012 and 16% in 2013, with a drop in 2014 of 20% and resumed growth of 24% in 2015. In contrast, Orkney's growth has been consistently strong with an annual growth of 40% in 2016.

Looking forward, the 2019 Orkney season looks to be hugely successful, with 170 port calls planned compared to 140 booked for 2018 and over 100 cruise ship port calls booked already for 2020. The 2019 season will also see considerable growth in the smaller explorer ship market with 71 vessels having under 500 passengers (compared to 54 in 2018) and fewer large ships carrying over 3000 passengers (down from 8, in 2018, to 4). This demonstrates the value of the Hatston pier extension and other pier infrastructure improvements.

The revenues in port dues from cruise ship visits exceeded £1 million in 2014. Economic impact in Orkney was estimated at £3.1 million in 2013, the first fully operational year of the upgraded facilities at Hatston.

6 Other Impacts

The following wider impacts have also been attributed to facilities and services developed at EMEC and associated marine energy development:

- population growth related to the employment growth, sustaining services in Orkney's rural communities;
- an increase in average earnings, encouraging young people to stay in Orkney or return;
- diversification from agriculture and fishing;
- substitution of private sector jobs for jobs being lost in the public sector, which are proportionately important to Orkney;
- benefits to other users from harbour developments and to other renewable energy producers from grid upgrades; and,
- a raised profile for the University of the Highlands and Islands in Orkney and Heriot-Watt's International Centre for Island Technology campus.

The 2011 Census recorded the population of Orkney at 21,349, an increase of 10.9% from 2001 and the third largest increase of the local authority areas in Scotland. Between 2011 and 2014, it is estimated that the population of the area increased further by 1.1% to 21,590. Between 2004 (when EMEC became operational) and 2014, it is estimated that the population increased by 8.9% (1,760 people). It is believed a significant proportion of this can be attributed to employment at EMEC and related activities, as professional and other well paid jobs help in attracting and retaining young families.

7 Summary

EMEC has prompted considerable impact in Orkney and throughout the UK in terms of investment and job creation. EMEC's total local spend in Orkney has been over £16 million (50% of all EMEC spend 2005 - 2017). Approximately 200 people are currently employed in Orkney in the marine renewables sector. To date, £23 million has been invested by Orkney Islands Council and Highlands and Islands Enterprise (HIE) in supporting infrastructure for the sector in Orkney. The HIE commissioned economic impact assessment⁴ estimates that EMEC has generated a GVA to the wider UK economy of £249.6 million, with 3,801 FTE job years up to 2015.

⁴ From "European Marine Energy Centre Economic Impact Assessment", Steve Westbrook. 18 February 2016. Highlands and Islands Enterprise.

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