BiGGAR Economics

Economic Impact Assessment of the Billia Croo Proposals at EMEC

A Report to

European Marine Energy Centre Ltd

June 2021

Executive Summary

This section outlines the key findings of the economic impact analysis.

Key Findings

- In the Balanced Pathway Scenario, the granting of the S36 Extension to EMEC will generate **£40 million GVA** for Scotland each year and **support 270 jobs**.
- If the S36 Extension is not granted, the annual economic impact of EMEC will **decrease by £10 million GVA** in Scotland and it will **support 60 less jobs** by 2040.
- Most scenarios for the UK achieving Net Zero in the Sixth Carbon Budget assume that wave and tidal energy will be commercially viable by 2050 and have an installed capacity of over 1 GW.
- The majority of the economic impact of EMEC occurs within the sectors it supports, by enabling wider R&D spend and the commercialisation of devices or components.
- Marine energy testing sites in other European countries are investing in their facilities and Scotland is at risk of losing its current position as the market leader in wave and tidal development.
- The economic impact of EMEC could be even greater, if the UK follows the innovation focused Widespread Innovation scenario described in the Sixth Carbon Budget. However tis would only occur of the S36 Extension is granted.
- In the most conservative scenario, Headwinds, the granting of the S36 Extension to EMEC will generate **£10 million GVA** for Scotland each year and **support 70 jobs**.

Contents

The remainder of this report is structured as follows:

Project background

This section outlines the background to the EMEC S36 Extension application

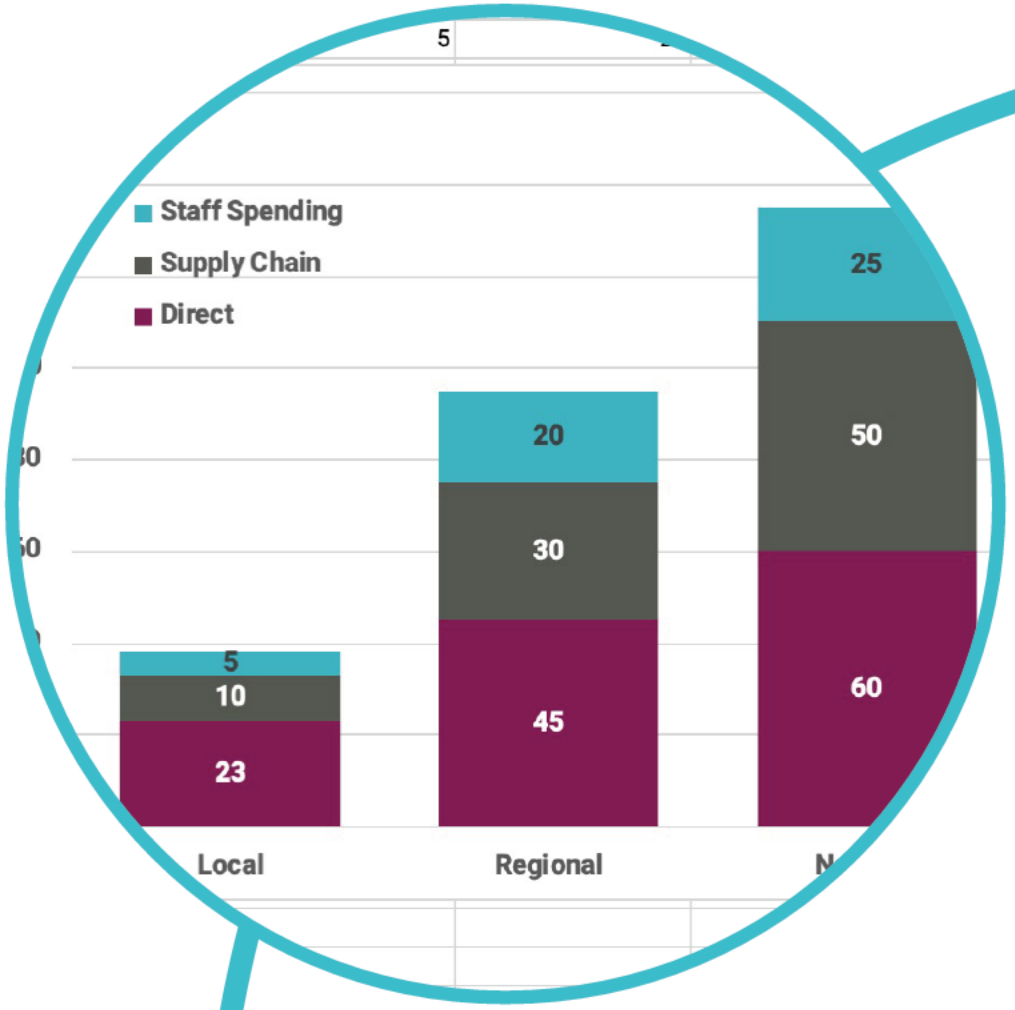
European Marine Energy Centre – Background

- EMEC was established in 2003
- EMEC is currently pursuing a Section 36 application for a testing site at Billia Croo, this will expand the capabilities of the grid connected testing site.
- This will support the development of:
  - wave and tidal technologies;
  - hydrogen creation and storage; and
  - offshore wind technologies.
- Without the new facility at Billia Croo, Orkney risks losing its international reputations as the leading place for marine energy R&D.
- 40% of recent devices tested at EMEC were developed by Scottish companies.

EMEC
THE EUROPEAN MARINE ENERGY CENTRE LTD

Approach

This section considers the approach that we have taken to modelling the impacts of the EMEC Billia Croo facility in the future



Core Economic Impacts at EMEC

The core economic impacts, including employment and supply chain spending impacts, were calculated using ratios for the previous (2020) EMEC impact study.

The core economic impacts were assumed to directly related to the income to EMEC, from all sources.

In particular:

- the turnover per job at EMEC is £80,000;
- the average salary per job is £28,000;
- supply chain expenditure accounted for 63% of turnover;
- 27% of supplies were purchased from Orkney; and
- 69% of supplies were purchased from Scotland.

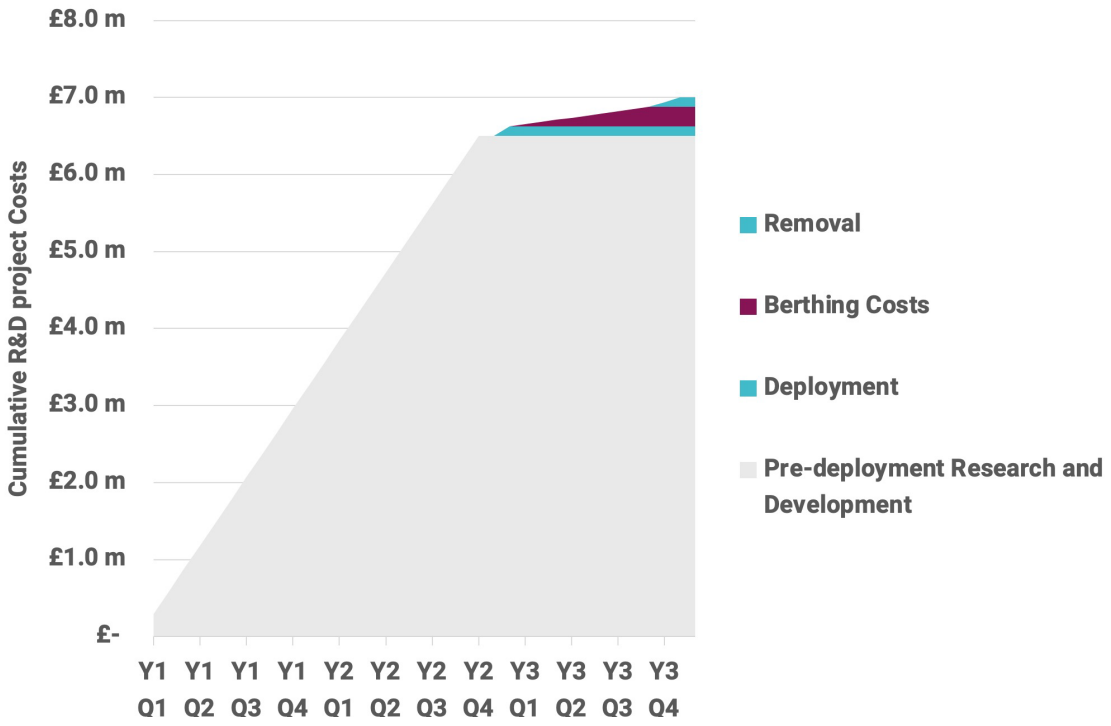
Upstream R&D Activity

The berthing and testing of a marine energy device at EMEC will represent the cumulation of years of previous research and development

The economic activity associated with the pre-deployment research and development can be attributed to EMEC as this activity is unlikely to occur in Scotland, without the presence of a testing facility such as EMEC.

The deployment, berthing and removal costs for a prototype device will account for around 10% of the total R&D investment required to develop the prototype. For an illustrative £7 million R&D project (right), over £6 million will have been spent before the device is deployed at EMEC.

This expenditure supports employment in the scientific services, engineering and manufacturing sectors.



Downstream R&D Impacts

The companies that invest in R&D at EMEC do so with the expectation that their devices will generate income and economic activity in the future.

The scale and likelihood of returns to investment will vary significantly between each project. Some devices may never achieve commercial success, whereas others will led to large scale deployments.

The potential opportunity from successful development of marine devices at EMEC will include the market for installing and operating the marine energy capacity that is described in the Sixth Carbon Budget. The devices will also be marketed globally and the export market will present further opportunities for these developers.

The successful research and prototype testing at EMEC by companies will be fundamental in achieving the economic benefits of the marine and tidal energy sector in the UK. Estimates for the sector's size in 2040 are shown below.

Scenario	UK GVA	UK Jobs
Balanced Pathway	£267m	8,140
Headwinds	£-	-
Widespread Engagement	£267m	8,140
Widespread Innovation	£334m	4,210
Tailwinds	£289m	3,650

BiGGAR Economics Estimates, based on OREC Study and installed capacities in Sixth Carbon Budget Scenarios

Downstream R&D Impacts

The companies that invest in R&D at EMEC do so with the expectation that their devices will generate income and economic activity in the future.

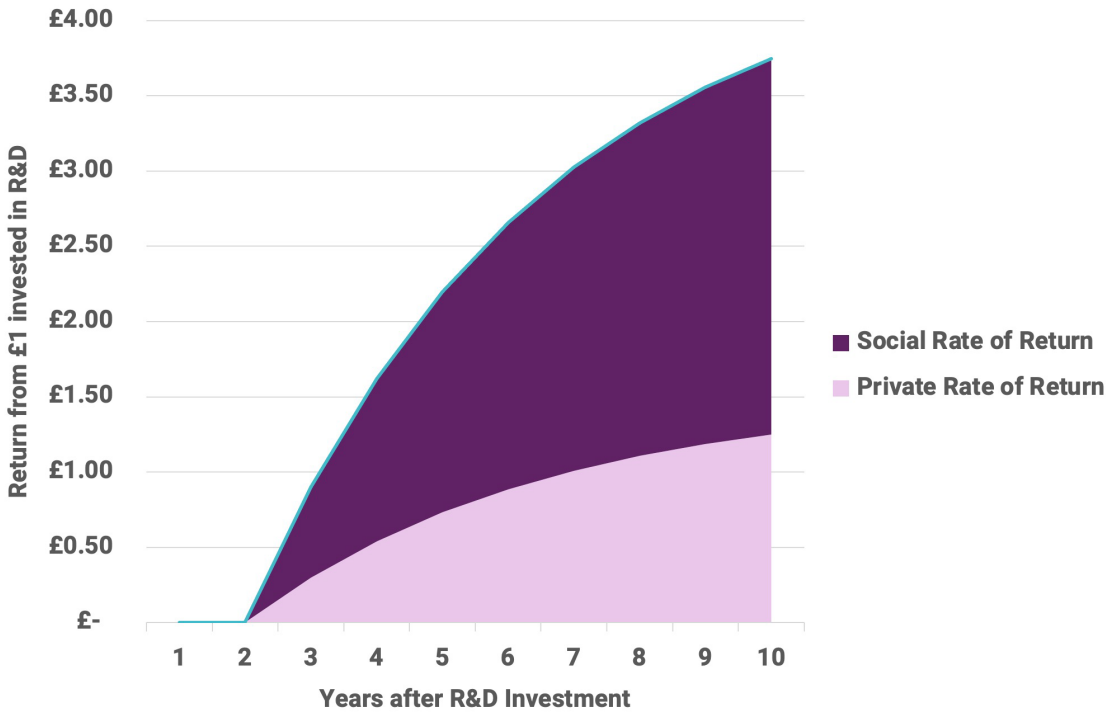
The economic impact of device testing at EMEC was based on the rate of return from industrial R&D and the total cost the developer has invested in the device testing.

The benefits of business R&D accrue privately to the company (private returns) that invested in the R&D and also to the wider sector (social returns) as information disseminates.

A study by Frontier Economics (2014) estimated that;

- on average private rates of returns to these investments are 30%; and
- social returns are typically 2 or 3 times larger.

This return on investment applied to all upstream R&D investment costs associated with device testing at EMEC.



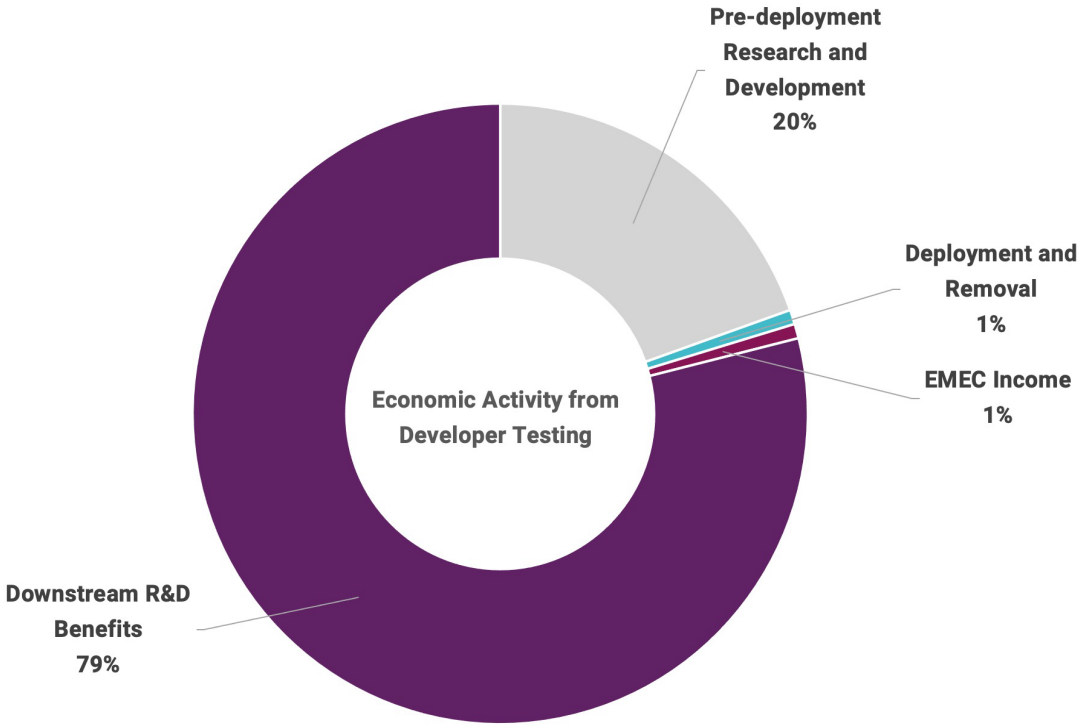
The Scale of Impact of Device Testing at EMEC

The income to EMEC from the berthing of devices for testing only accounts for a small proportion of the economic impact of developing this device.

When pre-deployment R&D and downstream economic benefits from testing are considered, the income to EMEC will account for around 1% of the economic activity associated with testing a device.

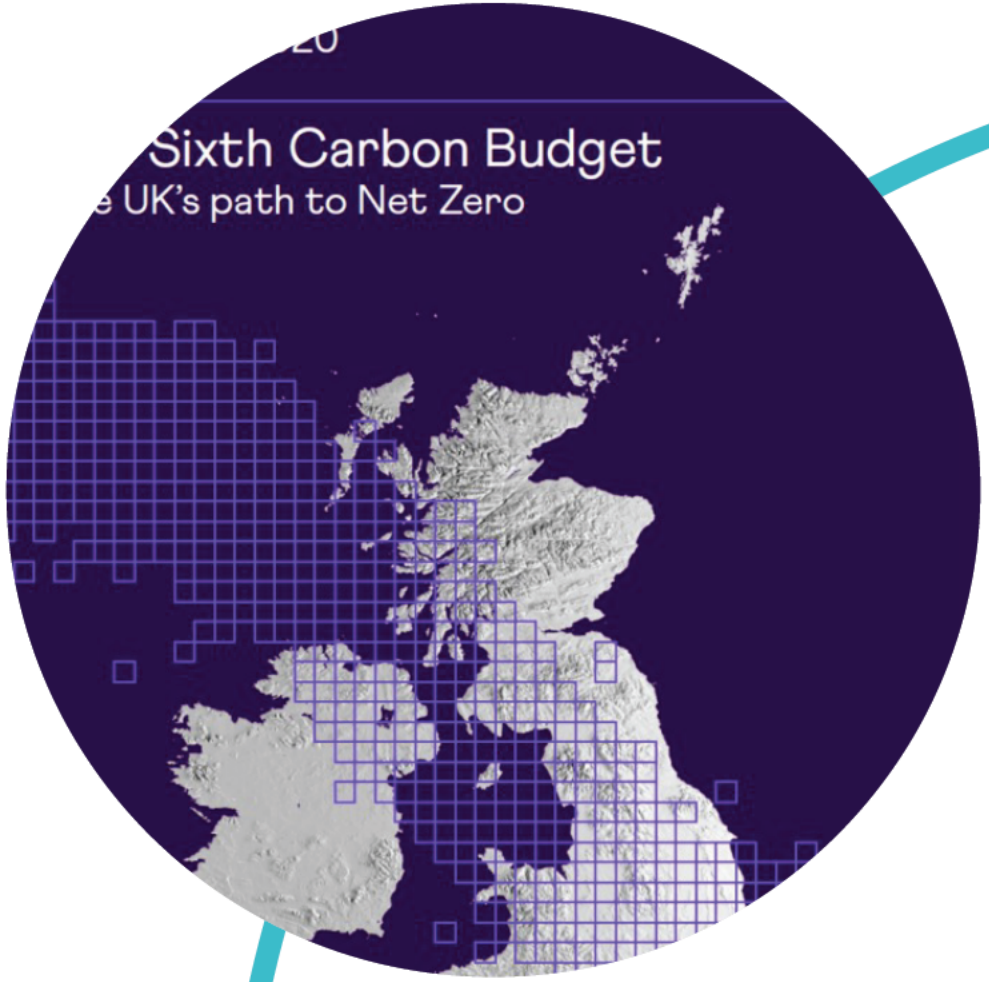
The testing enabled at EMEC is fundamental for all other elements of activity to occur and therefore it is reasonable to attribute this economic activity to the services provided by EMEC.

However, not all of the activity is additional because it is possible that developers could use the testing facilities elsewhere in Europe. To account for this it was assumed that **50% of testing activities would have occurred anyway**.



Future Scenarios

This section considers the approach that we have taken to modelling the impacts of the EMEC Billia Croo facility in the future



The Sixth Carbon Budget

The Sixth Carbon Budget describes 5 scenarios through which the UK could progress towards net Zero.

The future economic impacts of EMEC will be dependent on a number of factors including:

- the level of investment in the UK marine energy sector;
- the future success, or failure, of marine and tidal energy becoming commercially viable; and
- the level of deployment of marine and tidal energy in UK waters.

The scenarios in the Sixth Carbon Budget outline answers to these questions and therefore the future impacts of EMEC were modelled, based on these scenarios.

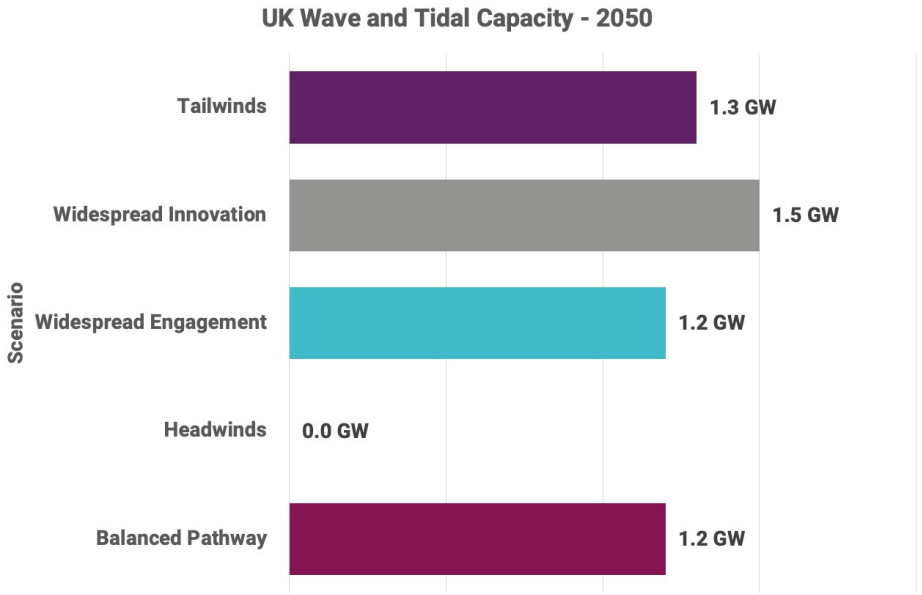
The Five Scenarios

The outcomes of wave and tidal energy testing varies between scenarios.

The central scenario, which is focus of the Sixth Carbon Budget, is the Balanced Pathway. In this scenario there is 1.2 GW of wave and tidal energy connected to the UK grid by 2050

In addition, the Sixth Carbon Budget also defines four exploratory scenarios, which have different levels of industrial innovation, investment and changes to consumer behaviour. These are also considered in this report and they are:

- **Headwinds** which has low levels of innovation and changes to consumer behaviour;
- **Widespread Engagement** which has lower levels of innovation but significant changes to consumer behaviour;
- **Widespread Innovation** which has high levels of innovation and higher changes to consumer behaviour; and
- **Tailwinds** which has higher levels of innovation and significant changes to consumer behaviour.



The Counterfactual

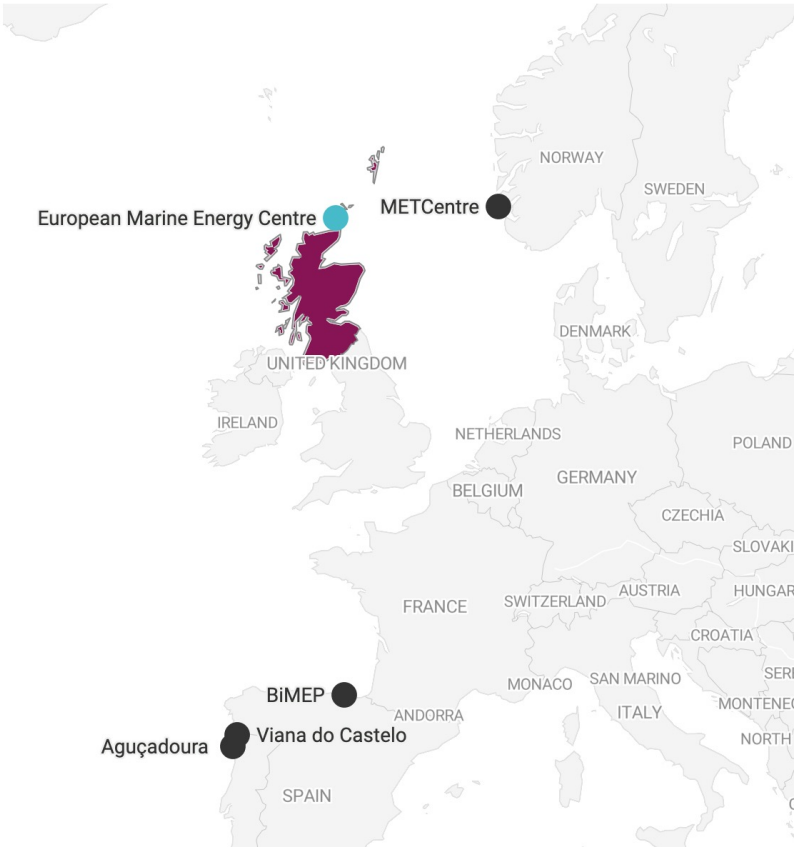
The economic impact of the S36 application is measured against what is likely to happen if the application is not awarded.

Loss of competitive edge

EMEC is currently considered a market leading marine testing facility, but this position is not guaranteed.

Across Europe there are multiple other testing facilities that allow developers to test and refine their devices in a grid connected research environment. These sites are investing in their facilities and will also be attractive to developers. The sites include:

- **BiMEP** in the Basque Country, which was recently granted permission to test floating wind devices with a combined capacity of 10MW;
- **METCentre** in Norway, which has recently been selected as the testing location site for a €25 million FLAGSHIP Horizon 2020 offshore wind testing project;
- The **Aguçadora** test site in Portugal which has a 3MW grid connection and is near the **Viana do Castelo** site, for more advanced machines and has a capacity of 80MW.



Counterfactual Assumptions

The level of activity at EMEC is expected to decline if the Section 36 is not awarded

Within the counterfactual Scenario it is assumed that:

- a lack of investment and constraints on operational activity mean the relative reputation of EMEC declines compared to other testing centres in Europe;
- the reputational damage hampers EMEC's ability to win research contracts. It is assumed that by 2030 EMEC will see a 50% decrease in contract research income;
- testing will continue but will be more constrained and less able to react to the needs of the market. On average 2 berths will be filled; and
- no cable extensions will be required.

The Sixth Carbon Budget does not assume a particular level of activity at EMEC. However, the resulting lack on investment in innovation for marine renewables is most closely aligned with the least ambitious *Headwinds* scenario. Therefore it has been assumed that in the counterfactual, there will be no commercial deployment of wave and tidal capacity in the UK by 2050.

Variable	Assumption
Research Activity (change from 2020)	50% decrease
Average Berth Occupancy	20%
Cable Extension? (Y/N)	No
Wave and Tidal Capacity in UK (2050)	0.0 GW

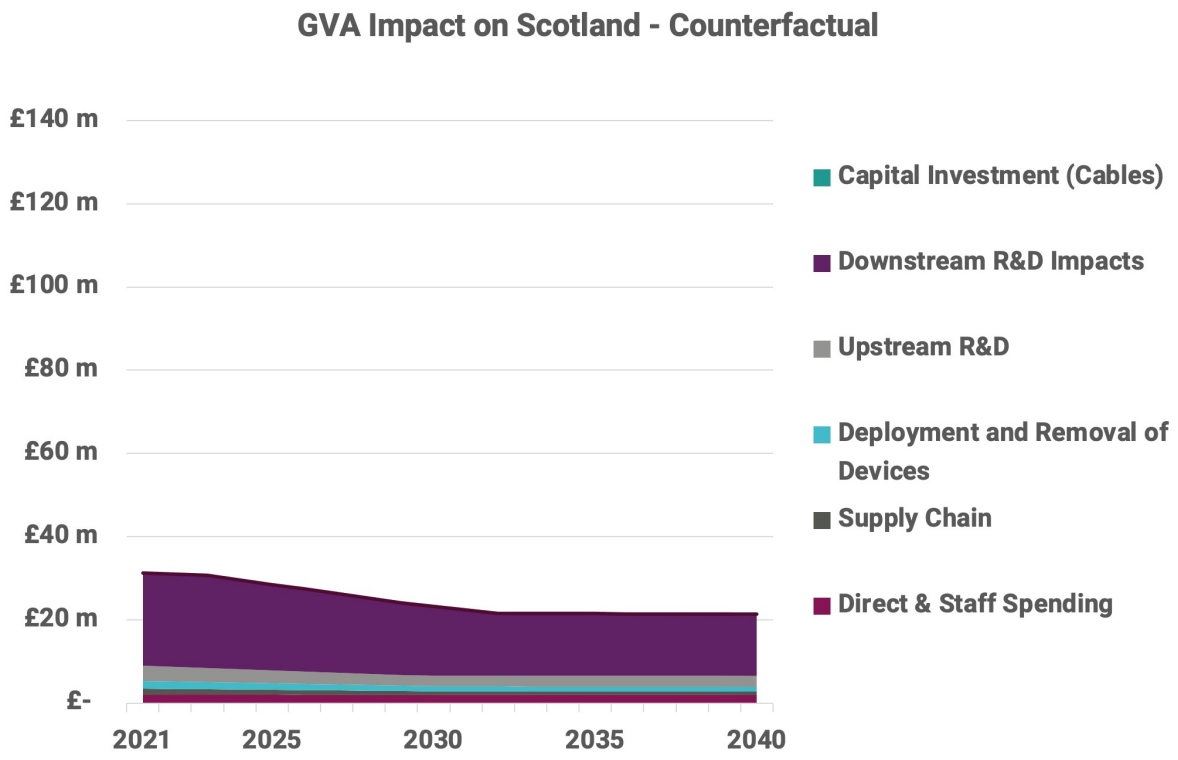
Economic Impact of Counterfactual

The economic impact of EMEC will decline if the Section 36 is not awarded.

The economic impact of EMEC in Scotland is expected to decrease from approximately;

- £31 million GVA and 240 jobs in Scotland in 2021 to
- £21 million GVA and 177 jobs in 2040.

The largest decrease in economic impact will result from the downstream benefits of the research and development supported by the facilities at EMEC. The testing that will occur at EMEC is likely to be related to components of offshore wind and hydrogen systems, rather than wave or tidal devices. The testing of full sized, complete devices for offshore wind and hydrogen systems will occur at other marine testing facilities across Europe.

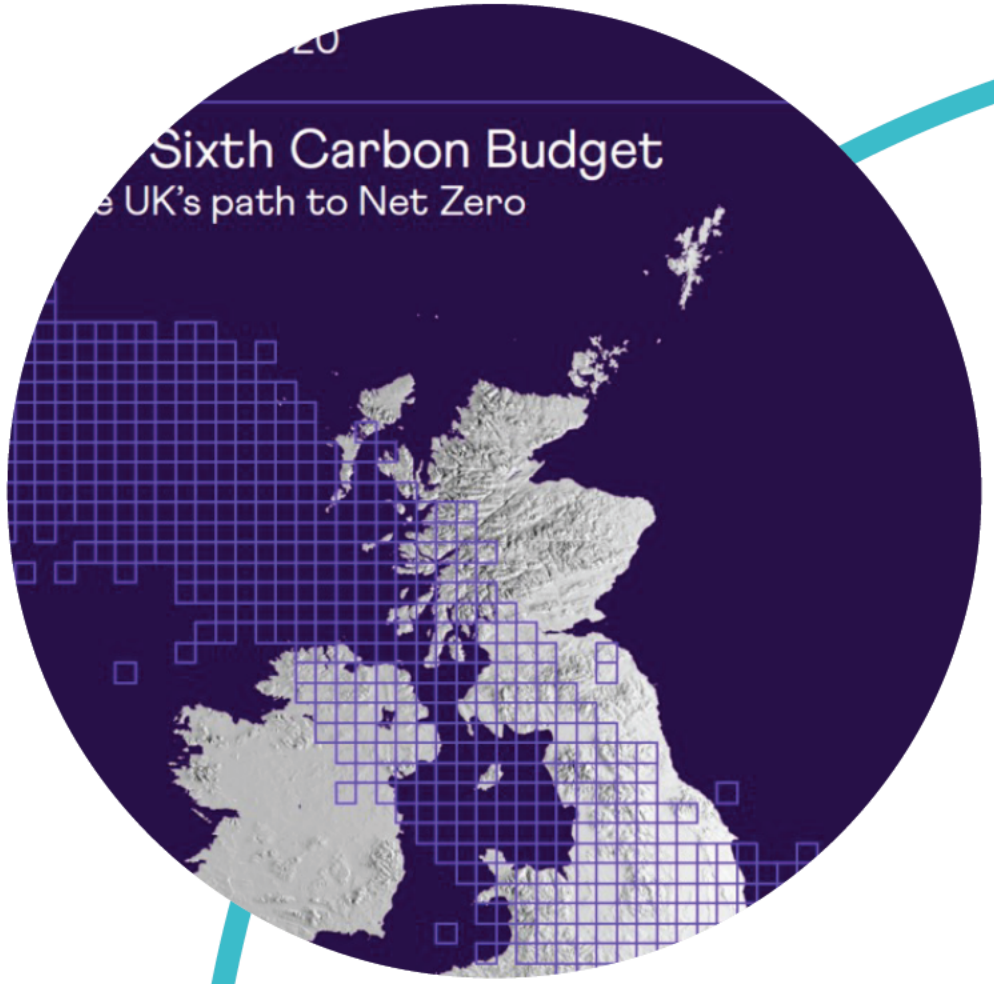


Economic Impact of Counterfactual - Tables

Total Economic of EMEC	2025	2030	2035	2040
Orkney				
GVA (£m)	£9m	£7m	£7m	£7m
Jobs	100	90	90	90
Highlands and Islands				
GVA (£m)	£12m	£10m	£9m	£9m
Jobs	130	110	110	110
Scotland				
GVA (£m)	£28m	£23m	£21m	£21m
Jobs	220	180	180	180
UK				
GVA (£m)	£42m	£34m	£32m	£31m
Jobs	300	250	240	240

Impacts by Scenario

This section describes the scenarios used in this assessment



Key Assumptions by Scenario

They key assumptions used to model the economic impact in each Scenario are outlined in the table below. These are based on the details of the Sixth Carbon Budget and discussions with the team at EMEC.

Scenario	Research Activity (as % 2020)	Berth Occupancy	Cable Extension (Y/N)	S36 Extension (Y/N)	Year Steady State Reached	Wave and Tidal UK Capacity 2050
Counterfactual	50%	20%	N	N	2030	0.0 GW
Headwinds	80%	30%	N	Y	2025	0.0 GW
Widespread Engagement	167%	50%	Y	Y	2025	1.2 GW
Tailwinds	233%	70%	Y	Y	2025	1.3 GW
Widespread Innovation	333%	100%	Y	Y	2025	1.5 GW
Balanced Pathway	200%	60%	Y	Y	2025	1.3 GW

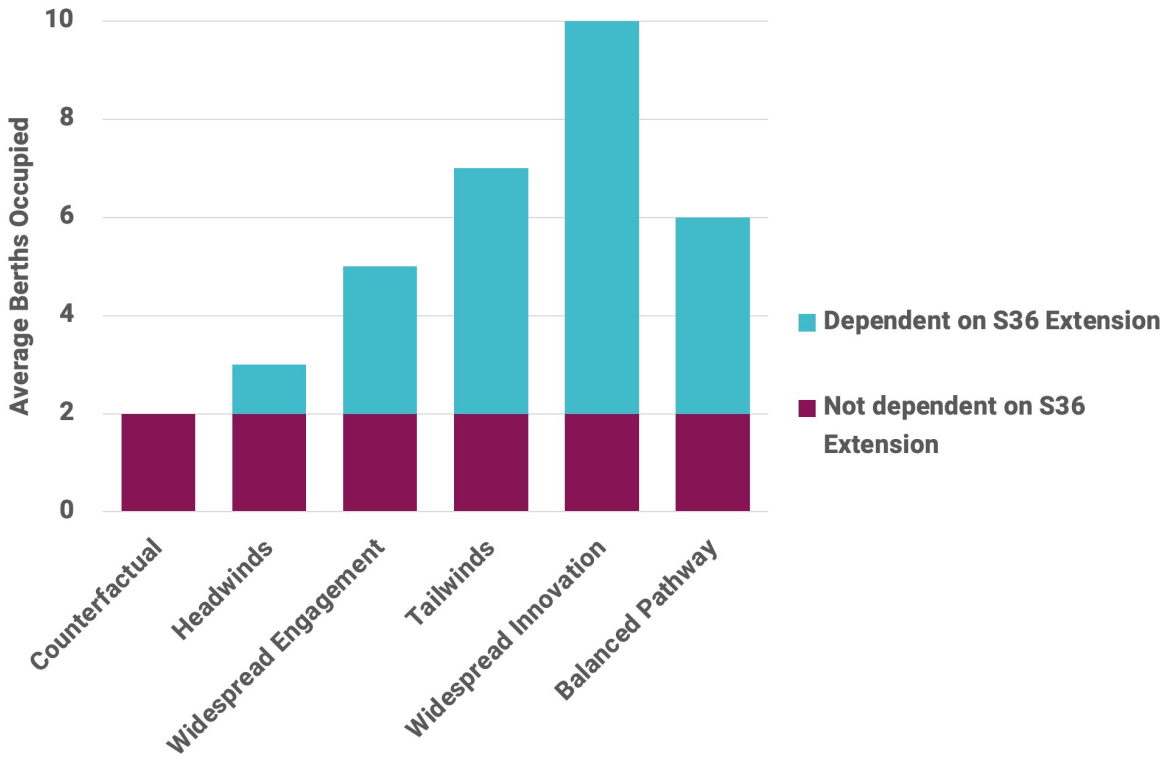
Berth Occupancy

The level of berth occupancy is they key assumption driving the differences between each scenario.

The number of berths that will be available and used by developers will be significantly constrained if the S36 Extension is not granted.

The average number of devices tested could be up to five times higher with the S36 Extension than without it.

The impacts from the testing of devices currently account for the majority of the economic impact of EMEC. Therefore, significant increases to the number of devices that are tested at EMEC will result in significant increases in the GVA and jobs generated.



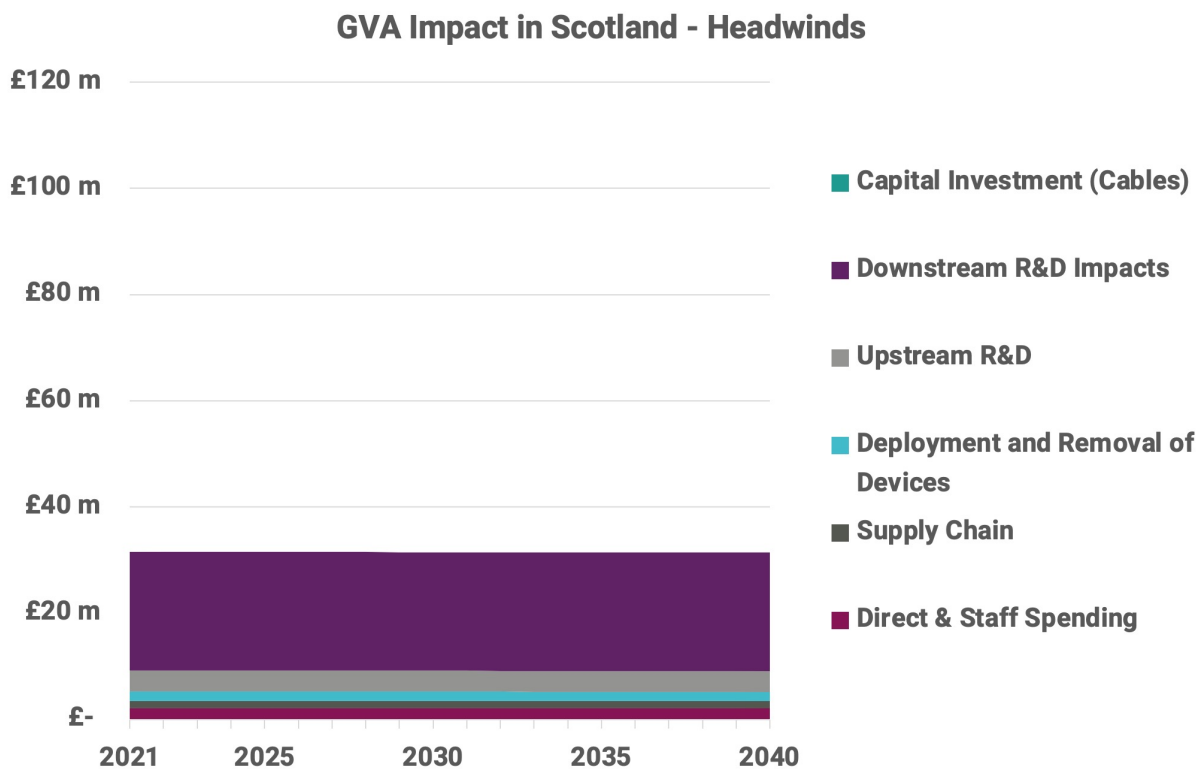
Gross Economics Impact to 2040

Headwinds

In the Headwinds scenario testing activity at EMEC continues at a similar level to recent years. The economic impact of EMEC is expected to also remain constant. By 2040 it is estimated that EMEC will support:

- £9 million GVA and 110 jobs in Orkney;
- £14 million GVA and 140 jobs across the Highlands and Islands;
- £31 million GVA and 240 jobs in Scotland; and
- £46 million GVA and 330 jobs across the UK.

The majority of the impact will occur in UK based offshore wind and hydrogen developers. The core activities at EMEC will also remain constant throughout this period.



Gross Economics Impact to 2040

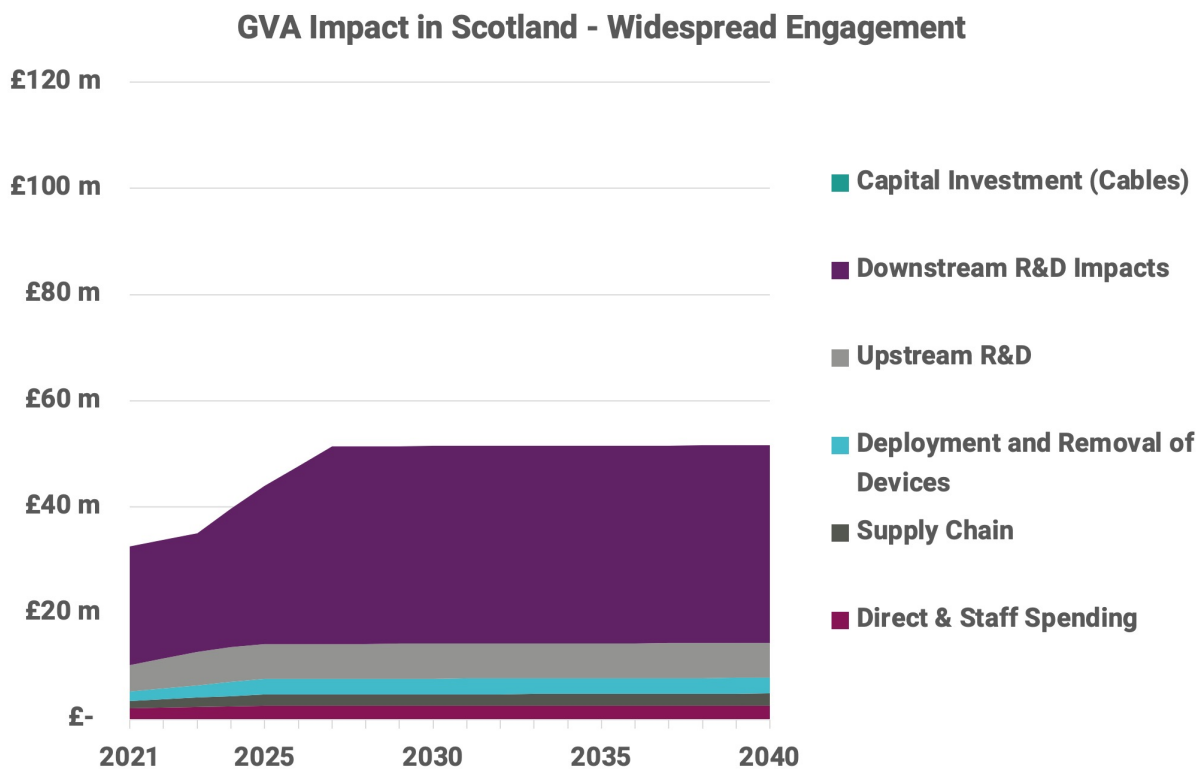
Widespread Engagement

In the Widespread Engagement scenario testing activity at EMEC grows and on average 5 berths are occupied at any one time. The economic impact of EMEC is expected to also grow. By 2040 it is estimated that EMEC will support:

- £15 million GVA and 160 jobs in Orkney;
- £22 million GVA and 210 jobs across the Highlands and Islands;
- £52 million GVA and 380 jobs in Scotland; and
- £77 million GVA and 530 jobs across the UK.

The majority of the impact will occur in UK based offshore wind and hydrogen developers.

The core activities at EMEC will also increase and by 2040, EMEC is estimated to directly employ 72 people.



Gross Economics Impact to 2040

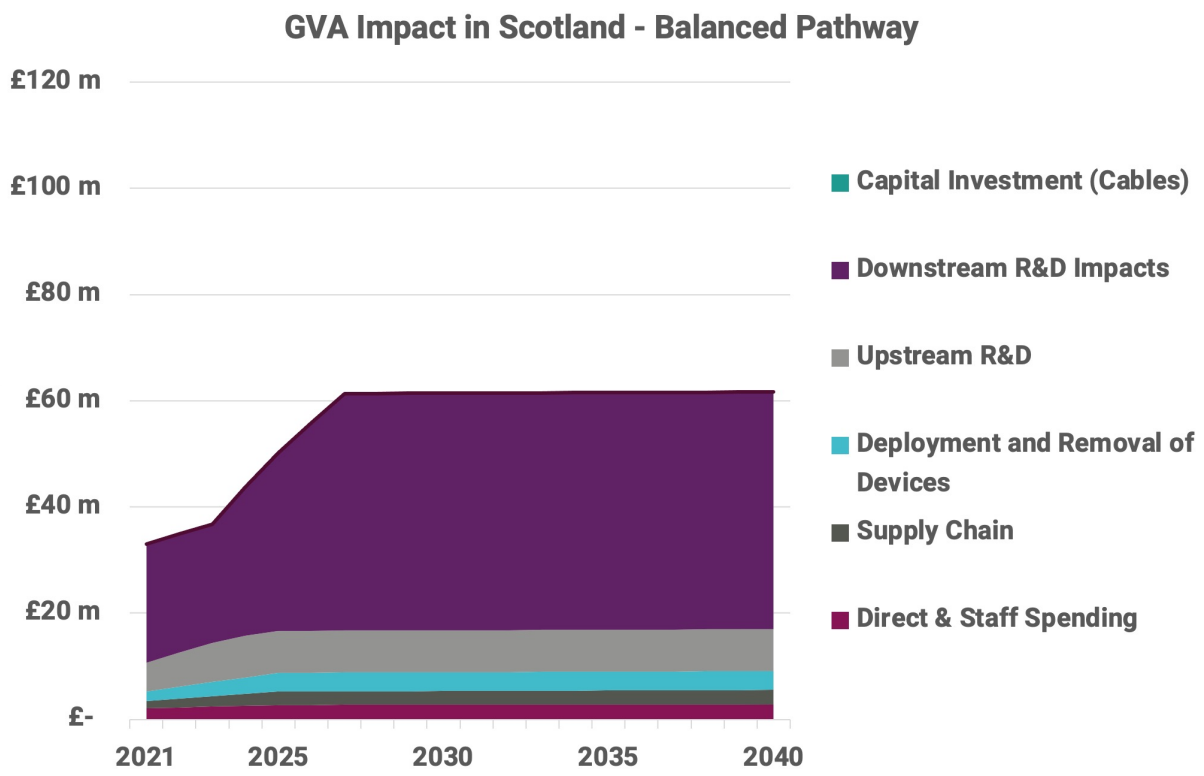
Balanced Pathway

In the Balanced Pathway scenario, the economic impact of EMEC is expected to grow. By 2040 it is estimated that EMEC will support:

- £18 million GVA and 190 jobs in Orkney;
- £26 million GVA and 250 jobs across the Highlands and Islands;
- £62 million GVA and 450 jobs in Scotland; and
- £92 million GVA and 620 jobs across the UK.

The majority of the impact will occur in UK based marine and tidal energy developers, as devices that are developed at EMEC become commercially viable by 2030.

The core activities at EMEC will also increase and by 2040, EMEC is estimated to directly employ 72 people.



Gross Economics Impact to 2040

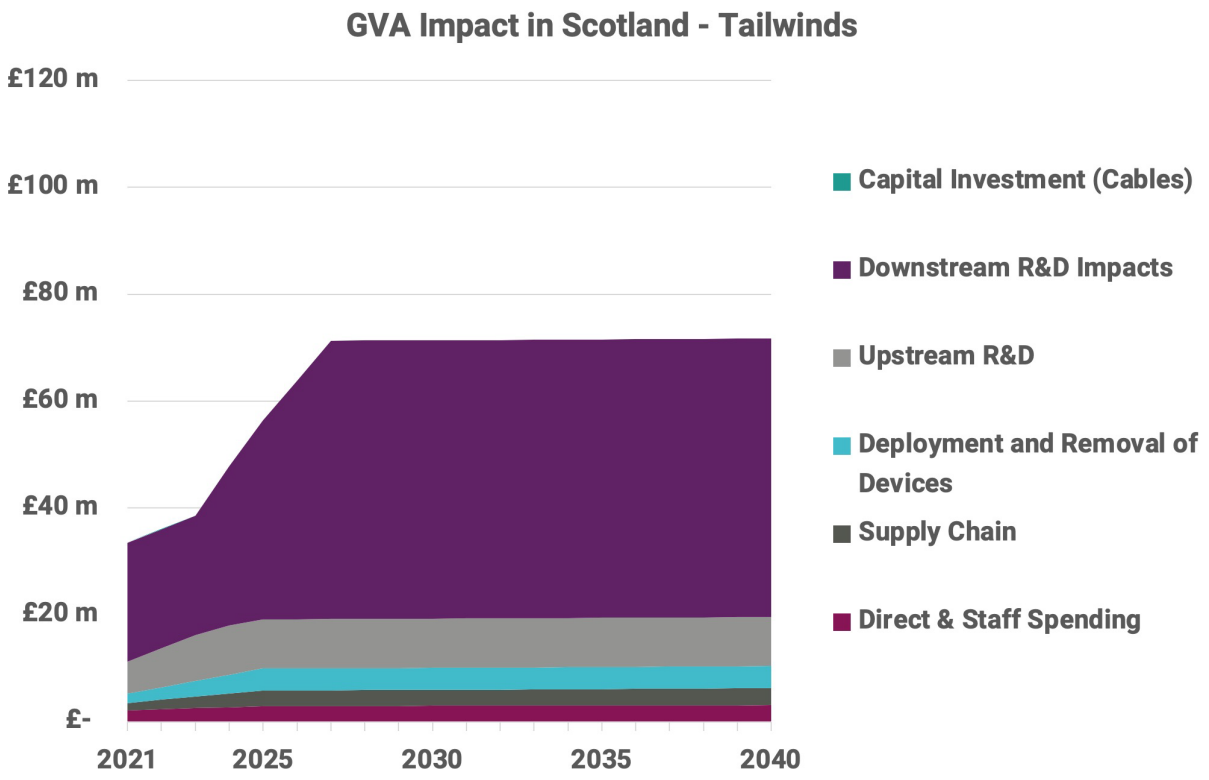
Tailwinds

In the Tailwinds scenario testing activity at EMEC grows and on average 7 berths are occupied at any one time. The economic impact of EMEC is expected to also grow. By 2040 it is estimated that EMEC will support:

- £20 million GVA and 210 jobs in Orkney;
- £30 million GVA and 280 jobs across the Highlands and Islands;
- £72 million GVA and 510 jobs in Scotland; and
- £107 million GVA and 720 jobs across the UK.

The majority of the impact will occur in UK based offshore wind and hydrogen developers.

The core activities at EMEC will also increase and by 2040, EMEC is estimated to directly employ 78 people.



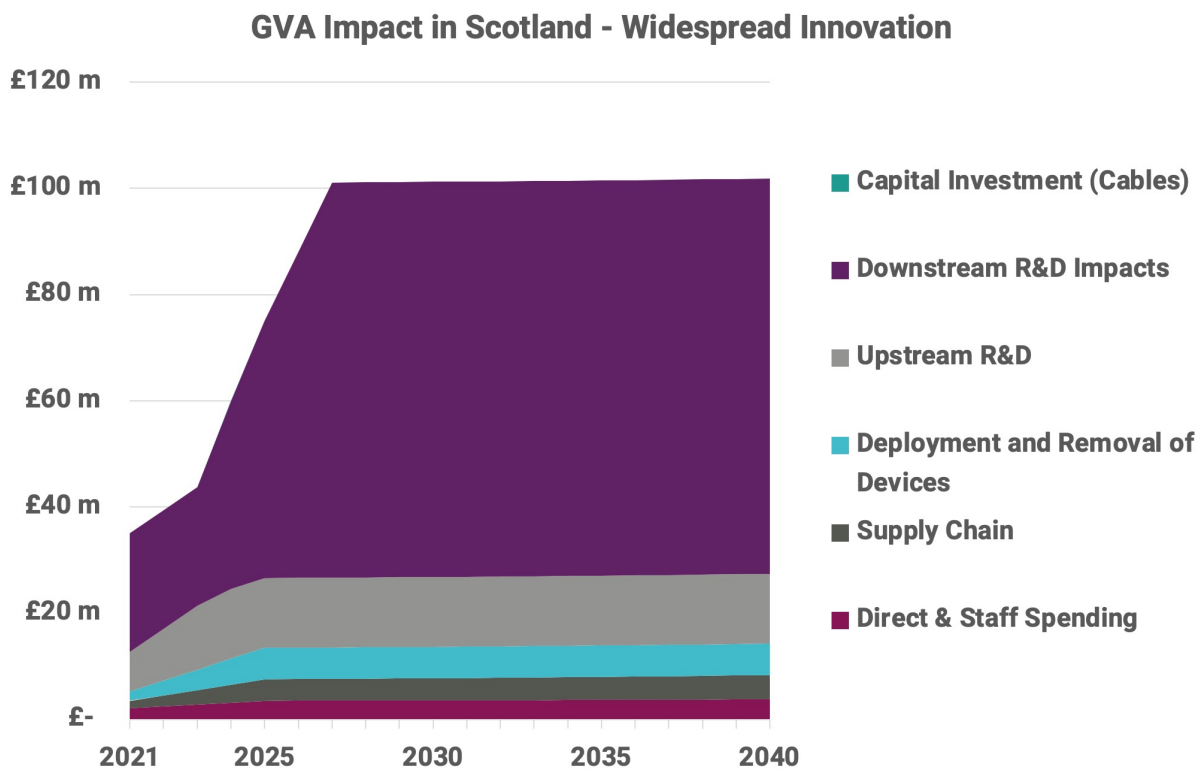
Gross Economics Impact to 2040

Widespread Innovation

In the Widespread Engagement scenario testing activity at EMEC grows and the testing berths are fully occupied from 2025. The economic impact of EMEC is expected to also grow. By 2040 it is estimated that EMEC will support:

- £28 million GVA and 280 jobs in Orkney;
- £42 million GVA and 380 jobs across the Highlands and Islands;
- £102 million GVA and 710 jobs in Scotland; and
- £152 million GVA and 1,010 jobs across the UK.

The majority of the impact will occur in UK based offshore wind and hydrogen developers which becomes a highly innovative and commercially competitive sector, with EMEC playing a crucial role in driving the sector.

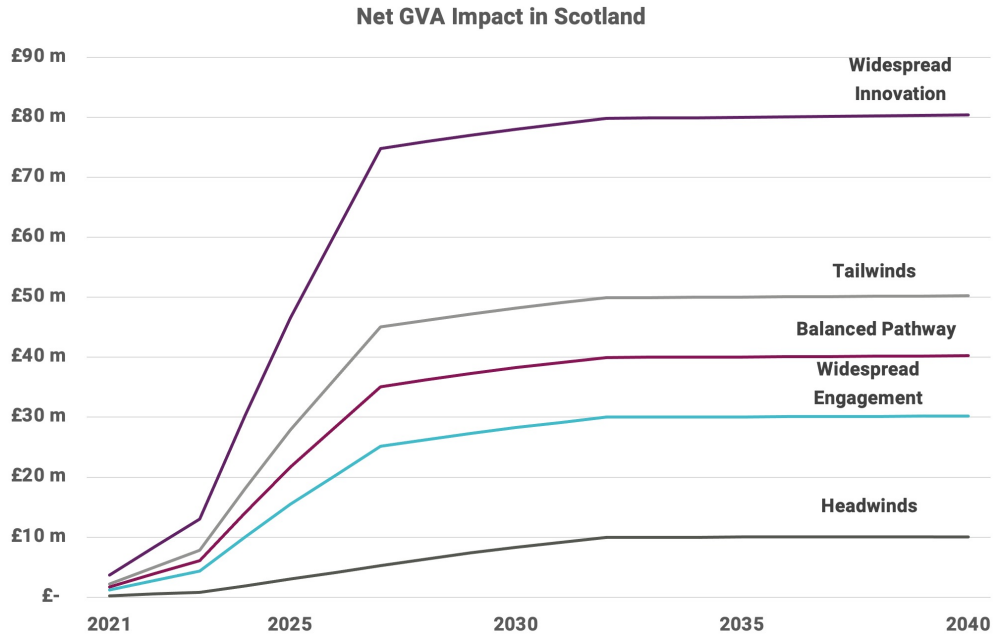


Net Economic Impact

The Net Economic Impact of each scenario is the impact that will only occur if the S36 extension is granted.

In the Counterfactual scenario, testing and research activities continue at EMEC, however at a smaller scale than recent years. To calculate the net effect of the extension being granted, the economic impact of EMEC in the Counterfactual scenario was deducted from the gross economic impact of each other scenario. This found that by 2040 the S36 extension at EMEC will annually generate:

- £80m GVA and 530 jobs in the Widespread Innovation Scenario;
- £50m GVA and 330 jobs in the Tailwinds Scenario;
- £40m GVA and 270 jobs in the Balanced Pathway Scenario;
- £30m GVA and 200 jobs in the Widespread Engagement Scenario; and
- £10m GVA and 70 jobs in the Headwinds Scenario.

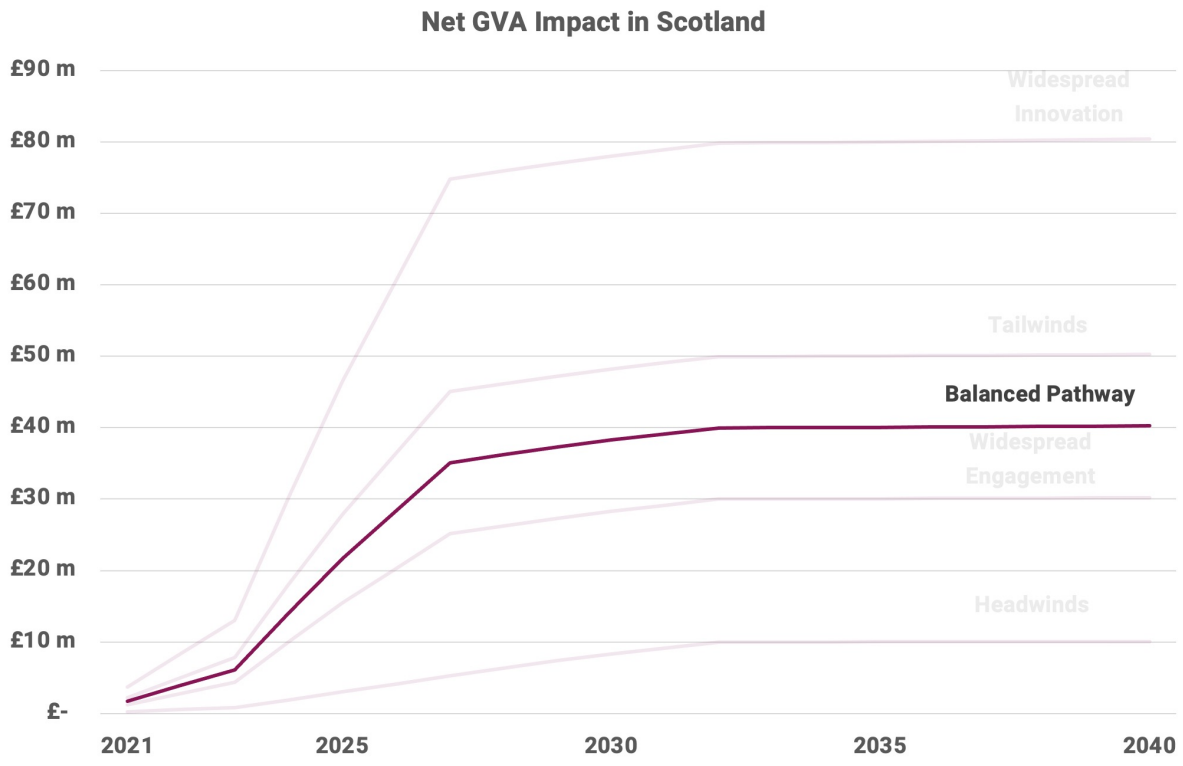


Net Economic Impact – Balanced Pathway

The Balanced Pathway scenario is the central projection and therefore the focus of the analysis.

In the Balanced Pathway, the net economic impact of EMEC by 2040 would be an additional:

- £1m GVA and 30 jobs from direct and staff spending;
- £2m GVA and 40 jobs in the supply chain to EMEC
- £2m GVA and 30 jobs from the deployment and removal of devices;
- £7m invested in upstream R&D occurring in Scotland, generating £5m GVA and supporting 80 jobs; and
- £30m GVA and 90 jobs from developers benefiting from positive outcomes from testing devices at EMEC.



Net Economic Impact by Source – Balanced Pathway

Net Economic of EMEC S36 Extension	Orkney	Highlands and Islands	Scotland	UK
GVA (£m)	*Rounded to nearest £1m, totals may not sum due to rounding*			
Direct and Staff Spending	£1m	£1m	£1m	£1m
Supply Chain	£1m	£1m	£2m	£3m
Deployment and Removal	£1m	£2m	£2m	£3m
Upstream R&D	£2m	£2m	£5m	£9m
Impacts of R&D	£7m	£11m	£30m	£44m
Total GVA	**£11m**	**£16m**	**£40m**	**£60m**
Jobs	*Rounded to nearest 10, totals may not sum due to rounding*			
Direct and Staff Spending	30	30	30	30
Supply Chain	10	20	40	60
Deployment and Removal	10	20	30	50
Upstream R&D	20	30	80	140
Impacts of R&D	20	30	90	130
Total Jobs	**100**	**140**	**270**	**380**

Summary of Impacts

The gross economic impact of each scenario is outlined in this section

Economic Impact of Headwinds - Tables

Total Economic of EMEC	2025	2030	2035	2040
Orkney				
GVA (£m)	£9m	£9m	£9m	£9m
Jobs	110	110	110	110
Highlands and Islands				
GVA (£m)	£14m	£14m	£14m	£14m
Jobs	140	140	140	140
Scotland				
GVA (£m)	£32m	£31m	£31m	£31m
Jobs	240	240	240	240
UK				
GVA (£m)	£47m	£46m	£46m	£46m
Jobs	340	340	340	330

Economic Impact of Widespread Engagement - Tables

Total Economic of EMEC	2025	2030	2035	2040
Orkney				
GVA (£m)	£13m	£15m	£15m	£15m
Jobs	150	160	160	160
Highlands and Islands				
GVA (£m)	£19m	£22m	£22m	£22m
Jobs	200	210	210	210
Scotland				
GVA (£m)	£44m	£51m	£52m	£52m
Jobs	350	380	380	380
UK				
GVA (£m)	£65m	£76m	£76m	£77m
Jobs	490	520	530	530

Economic Impact of Balanced Pathway- Tables

Total Economic of EMEC	2025	2030	2035	2040
Orkney				
GVA (£m)	£15m	£17m	£18m	£18m
Jobs	170	180	190	190
Highlands and Islands				
GVA (£m)	£22m	£26m	£26m	£26m
Jobs	230	240	240	250
Scotland				
GVA (£m)	£50m	£61m	£62m	£62m
Jobs	400	440	440	450
UK				
GVA (£m)	£75m	£91m	£91m	£92m
Jobs	560	620	620	620

Economic Impact of Tailwinds- Tables

Total Economic of EMEC	2025	2030	2035	2040
Orkney				
GVA (£m)	£17m	£20m	£20m	£20m
Jobs	190	210	210	210
Highlands and Islands				
GVA (£m)	£24m	£30m	£30m	£30m
Jobs	260	270	280	280
Scotland				
GVA (£m)	£56m	£71m	£72m	£72m
Jobs	460	500	510	510
UK				
GVA (£m)	£84m	£106m	£106m	£107m
Jobs	640	710	710	720

Economic Impact of Widespread Innovation- Tables

Total Economic of EMEC	2025	2030	2035	2040
Orkney				
GVA (£m)	£22m	£28m	£28m	£28m
Jobs	250	280	280	280
Highlands and Islands				
GVA (£m)	£32m	£42m	£42m	£42m
Jobs	340	370	380	380
Scotland				
GVA (£m)	£75m	£101m	£101m	£102m
Jobs	620	700	700	710
UK				
GVA (£m)	£112m	£151m	£151m	£152m
Jobs	860	990	1,000	1,010

References

References

- Climate Change Committee (2020) The Sixth Carbon Budget: The UK's Path to Net Zero
- Frontier Economics (2014) Rates of return to investment in science and innovation: A report prepared for the Department of Business, Innovation and Skills (BIS)
- OREC (2018) Tidal Stream and Wave Energy Cost Reduction and Industrial Benefit

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