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The Economic Impact of Scotland's Renewable Energy Sector

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Disclaimer

The analysis in this report has been conducted by the Fraser of Allander Institute (FAI) at the University of Strathclyde. The FAI is a leading academic research centre focused on the Scottish economy.

The report was commissioned by Scottish Renewables.

The analysis and writing-up of the results was undertaken independently by the FAI. The FAI is committed to informing and encouraging public debate through the provision of the highest quality analytical advice and analysis. We are therefore happy to respond to requests for factual advice and analysis. Any technical errors or omissions are those of the FAI.

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Executive Summary

- This report presents estimates of the economic impact of Scotland's renewable energy industry in 2023 and 2024.
- Using a model of the Scottish economy that describes inter-industry economic relationships, we are able to estimate how much output, gross value added (GVA) and employment renewable activities support in Scotland's economy as a whole.
- The renewables sector is not defined in National Accounts, so we have constructed the sector using data published by the Office for National Statistics (ONS). This edition draws on two years of Low Carbon and Renewable Energy Economy (LCREE) data: 2023 and 2024.
- We estimate that the renewable energy industry had a direct turnover of £8.3 billion and approximately 13,500 FTE jobs in 2023, rising to a direct turnover of £9.0 billion and approximately 16,800 FTE jobs in 2024.
- However, the economic activity supported by the renewables sector is far greater than its own turnover and employment. The sector supports activity throughout its supply chains, and this activity in turn supports wage spending across Scotland.
- Including these spill-over effects, we estimate that the renewable energy industry supported £13.8 billion of output, £4.7 billion of GVA and around 42,800 FTE jobs across the Scottish economy in 2023, and £14.9 billion of output, £5.1 billion of GVA and around 49,200 FTE jobs in 2024.
- In 2024, the technologies that individually supported the most FTE employment were offshore wind (18,800), onshore wind (17,825), hydropower (4,100) and renewable heat (3,025).
- Both years are presented here for completeness, but they are not intended to be read as a measure of year-on-year change. The LCREE estimates carry a considerable margin of error, particularly at the level of individual technologies.
- ONS has also revised its estimates for earlier years, and we have updated the model underpinning this report to the Scottish Government's latest input-output tables, covering the year 2022. Results in this report should therefore not be compared directly with those published in previous editions.

Introduction

Renewable energy is key to reaching a net-zero economy.

In Scotland, technologies like offshore and onshore wind, solar panels, heat pumps, and marine energy are already playing a key role in cutting carbon emissions and supporting future energy security.

Alongside these environmental benefits, the renewable energy sector also brings important economic advantages. It supports jobs, attracts investment, and creates positive effects across other parts of the economy. This report draws on an input-output model of the Scottish economy to estimate how much economic activity is currently supported by the renewable energy sector.

This report marks a change from our previous editions. Rather than reporting on a single year, it presents results for two years of LCREE data alongside one another (2023 and 2024).

The two years are shown for completeness rather than for comparison. The LCREE is a sample survey, and ONS advise that the uncertainty around the estimates should be taken into account when looking at changes over time. Movements over a longer period (of around five years) are a more reliable guide to the direction of travel in the sector than the difference between two consecutive years. The explainer box below sets this out in more detail.

EXPLAINER – Comparing the 2023 and 2024 results

This report presents results for both 2023 and 2024. We have included both years so that readers have the most recent picture of the sector alongside the preceding year. The two sets of results are not intended to be compared with one another as a measure of year-on-year change.

The estimates rest on the ONS LCREE survey, which collects data from a sample of businesses rather than from the whole population. ONS publish the estimates with measurable sampling uncertainty attached, and advise that this should be considered when looking at changes in the estimates over time. At the level of individual technologies, where sample sizes are smallest, the margin of error is wider still.

The estimates are also subject to revision as further survey responses are received and as methods are improved. A difference between two years can therefore reflect changes in the data as much as changes in the sector itself.

We would encourage readers to focus on the broader picture: the scale of the sector, how the activity it supports is distributed across the Scottish economy, and the direction of travel over time. Year-on-year changes, and in particular changes for individual technologies, should not be over-interpreted.

Turnover and employment of Scotland's renewable energy sector

The renewable energy sector is not currently defined in National Statistics.

We construct a hypothetical renewable energy sector. This requires identifying the renewable energy activities occurring in other industries. We do this using data from surveys collected by the Office for National Statistics. In that data, sampled firms self-report whether they are knowingly involved in the selected renewable energy activities.

For further details, see the 'Modelling Methodology' section.

We examine the economic impact related to eight renewable energy technologies:

- Offshore wind
- Onshore wind
- Solar photovoltaic
- Hydropower
- Other renewable electricity (including geothermal, wave and tidal)
- Renewable heat
- Renewable combined heat and power
- Bioenergy

Using the latest available data, we calculate that Scotland's renewable energy sector had a direct turnover of approximately £8.3 billion and 13,500 full-time equivalent (FTE) jobs in 2023, and a direct turnover of approximately £9.0 billion and 16,800 FTE jobs in 2024. This is consistent with definitions of direct renewable energy activity used within the ONS Low Carbon and Renewable Energy Economy survey. See Glossary for a definition of output, GVA and FTE.

Table 1 shows how this turnover and employment is spread across different sectors of the Scottish economy in each year. In both years the electricity and gas sector stands out, accounting for around three fifths of turnover, while construction accounts for the largest share of employment.

Table 1: Total direct turnover and FTE employment in Scotland's renewable energy sector, 2023 and 2024*

	2023		2024	
Description	**Turnover (£m)**	**FTE Employment**	**Turnover (£m)**	**FTE Employment**
Agriculture, forestry & fishing	50	-	45	-
Mining and quarrying	-	-	-	-
Manufacturing	860	3,225	945	4,275
Electricity & gas	5,125	2,200	5,480	2,650
Water supply, sewerage & waste	110	500	90	175
Construction	1,470	3,825	1,655	4,700
Wholesale & Retail	95	325	55	225
Real estate	15	-	10	-
Professional, scientific & technical	520	3,000	565	4,300
Admin & support	20	150	20	125
Other services	55	75	55	50
Total	**8,345**	**13,500**	**8,950**	**16,800**

*Rounded to the nearest £5m for turnover and 25 for FTE employment. Columns may not sum to totals due to rounding. '-' indicates under 25 for employment, and under £5m for turnover.

EXPLAINER – Comparing with our previous report

Our previous report presented results for 2022 and reported direct turnover of £10.1 billion. The direct turnover reported here is lower, but this does not mean that the sector has contracted by that amount.

ONS has since revised its LCREE estimates for earlier years. On the revised data, and applying the methodology used in this report, direct turnover in 2022 would be around £8.5 billion rather than the £10.1 billion previously published. Measured on that consistent basis, direct turnover dipped slightly in 2023, to £8.3 billion, before rising to £9.0 billion in 2024.

Revisions of this kind are a normal part of the statistical process. They occur as further survey responses are received, as methods are improved, and as estimates are brought into line with other data sources.

For readers, this means that figures published in different editions of this report are not directly comparable with one another.

As elsewhere in this report, the margins of error around these estimates are considerable, and year-on-year changes should not be over-interpreted.

Economy wide impact of Scotland's renewable energy sector

The economic contribution of Scotland’s renewable energy sector goes beyond the activity within the industry itself.

Renewables companies purchase goods and services from firms in their supply chain. In turn, these suppliers also support jobs and business activity through their own supply chains. As a result, the renewable energy sector helps to support economic activity across many areas of the wider economy via the interlinked supply chains involved in producing their output.

We modelled these links between supply chains to estimate the full economic impact of Scotland’s renewable energy sector. The economic impact can be broken down into three components:

- The direct impact: the output and employment of renewable energy companies.
- The indirect impact: the economic activity supported within the supply chains of renewable energy companies.
- The induced impact: the direct and indirect effects are associated with employment across the Scottish economy which in turn are associated with wage spending. The economic activity arising from this increased spending is the induced impact.

EXAMPLE

Economic Impact of Offshore Wind

An offshore wind farm delivers more than clean electricity – it also drives substantial economic activity.

A company that builds and operates wind farms hires engineers, technicians, and project managers. Their wages, along with spending on equipment and day-to-day operations, make up the direct economic impact.

The wind farm developer buys materials like steel for turbines components, electrical equipment, software systems from other businesses and may also contract out construction services. Those suppliers, in turn, may buy raw materials, hire additional staff or subcontract other supply chain businesses to meet demand. This ripple effect through suppliers is the indirect impact.

Finally, employees in both the renewable energy sector and its supply chains spend their wages in the broader economy for example, an engineer working on a wind farm spends their income on housing, groceries, and local services. This supports jobs and businesses in other sectors like retail, hospitality, and other services, contributing to the induced impact.

Tables 3a and 3b sets out the total output, Gross Value Added (GVA) and FTE employment supported by Scotland's renewable energy sector in 2023 and 2024, broken down by the direct, indirect and induced impact. In total, renewables supported £13.8 billion of output, £4.7 billion of GVA and around 42,800 FTE jobs across the Scottish economy in 2023, and £14.9 billion of output, £5.1 billion of GVA and around 49,200 FTE jobs in 2024.

Table 3a: Direct, indirect and induced output, GVA and FTE employment supported by Scotland's renewable energy sector, 2023*

Impact	Output (£m)	GVA (£m)	FTE Employment
Direct	8,345	2,420	13,500
Indirect	3,815	1,340	17,025
Induced	1,600	975	12,250
Total	**13,760**	**4,730**	**42,800**

*Figures rounded. Columns may not sum due to rounding.

Table 3b: Direct, indirect and induced output, GVA and FTE employment supported by Scotland's renewable energy sector, 2024*

Impact	Output (£m)	GVA (£m)	FTE Employment
Direct	8,950	2,590	16,800
Indirect	4,070	1,430	18,275
Induced	1,840	1,120	14,075
Total	**14,860**	**5,140**	**49,200**

*Figures rounded. Columns may not sum due to rounding.

Both years are presented here for completeness. As set out in the explainer boxes above, the margins of error around the survey estimates, and the revisions that ONS makes to them, mean that the difference between 2023 and 2024 should not be read as a precise measure of growth in the sector. Output and GVA are also presented in nominal terms (not adjusted for inflation and expressed in the prices of the year in question).

Tables 4and 5 provide an overview of the total output, GVA and FTE employment supported by the renewable energy sector, both directly and through its spill-over impacts, distributed across various sectors of the Scottish economy, in 2023 and 2024 respectively.

In both years, the electricity and gas sector accounts for just over half of the total output supported by Scotland's renewable energy sector. Construction and manufacturing were the next largest sectors in terms of output supported by the renewable energy sector.

In terms of employment, more than half of the jobs supported by the renewable energy sector are found across construction; professional, scientific and technical services; manufacturing; and wholesale and retail. Electricity and gas, and administrative and support services, also account for a significant share of the workforce.

Table 4: Total output, GVA and FTE Employment by sector supported by Scotland's renewable energy sector, 2023*

Industry	Output (£m)	GVA (£m)	FTE Employment
Agriculture, forestry & fishing	170	70	825
Mining and quarrying	35	15	175
Manufacturing	1,300	520	5,025
Electricity & gas	6,980	1,350	4,475
Water supply, sewerage & waste	165	75	675
Construction	2,100	830	7,925
Wholesale & Retail	490	300	4,925
Transport & storage	175	80	1,400
Accommodation & food services	110	65	2,000
Information & communications	115	70	925
Finance & insurance	320	175	1,000
Real estate	435	365	575
Professional, scientific & technical	775	445	5,325
Admin & support	205	125	3,000
Public admin & defence	55	30	325
Education	90	65	1,625
Health & social work	80	50	825
Arts, entertainment & recreation	50	25	725
Other services	120	75	1,000
Activities of households as employers	5	5	25
Total	**13,760**	**4,730**	**42,800**

*Figures rounded. Columns may not sum due to rounding.

Table 5: Total output, GVA and FTE Employment by sector supported by Scotland's renewable energy sector, 2024*

Industry	Output (£m)	GVA (£m)	FTE Employment
Agriculture, forestry & fishing	180	70	900
Mining and quarrying	35	15	200
Manufacturing	1,425	570	6,250
Electricity & gas	7,435	1,440	5,050
Water supply, sewerage & waste	155	70	375
Construction	2,345	925	9,200
Wholesale & Retail	495	305	5,375
Transport & storage	195	90	1,600
Accommodation & food services	125	75	2,275
Information & communications	125	75	1,025
Finance & insurance	355	190	1,135
Real estate	490	415	625
Professional, scientific & technical	835	485	6,825
Admin & support	225	135	3,225
Public admin & defence	60	30	350
Education	100	75	1,850
Health & social work	90	55	950
Arts, entertainment & recreation	55	30	825
Other services	125	80	1,000
Activities of households as employers	5	5	25
Total	**14,855**	**5,135**	**49,200**

*Figures rounded. Columns may not sum due to rounding.

Economy wide impact of renewable energy technologies

By examining data for each type of renewable energy technology, we are able to calculate the individual technology economic effects. Tables 6ato 8b present the estimated output, GVA and FTE employment figures for each specific renewable energy technology in 2023 and 2024.

However, it is important to interpret these figures with some caution. The estimates are based on statistics which involve relatively small sample sizes at this level of detail. As a result, there is a wider margin of uncertainty around the numbers.

These figures are therefore more useful for providing a broad picture of how different renewable technologies contribute to the economy in the year of the survey, rather than for tracking short-term changes in the sector. In both years, offshore and onshore wind account for the largest shares of the output, GVA and employment supported by the sector.

Table 6a: Output supported by renewable technologies (£ million), 2023*

Technology	Direct	Indirect	Induced	Total
Offshore wind	2,475	1,370	520	**4,360**
Onshore wind	3,620	1,920	565	**6,105**
Solar photovoltaic	185	110	75	**370**
Hydropower	855	540	140	**1,535**
Other renewable elec	100	40	35	**175**
Renewable heat	380	165	165	**710**
Renewable comb. heat & power	155	65	40	**255**
Bioenergy	575	325	175	**1,075**

*Figures rounded. Columns may not sum due to rounding. Sums may not match figures for the renewables sector as a whole due to methodological differences in comparing individual shocks with aggregate shocks.

Table 7a: GVA supported by renewable technologies (£ million), 2023*

Technology	Direct	Indirect	Induced	Total
Offshore wind	730	470	310	**1,510**
Onshore wind	1,005	625	340	**1,970**
Solar photovoltaic	55	35	45	**135**
Hydropower	195	160	85	**435**
Other renewable elec	45	20	20	**85**
Renewable heat	160	75	100	**335**
Renewable comb. heat & power	70	25	25	**120**
Bioenergy	160	105	105	**365**

*Figures rounded. Columns may not sum due to rounding. Sums may not match figures for the renewables sector as a whole due to methodological differences in comparing individual shocks with aggregate shocks.

Table 8a: FTE employment supported by renewable technologies , 2023*

Technology	Direct	Indirect	Induced	Total
Offshore wind	3,700	5,850	3,885	**13,425**
Onshore wind	3,200	7,375	4,260	**14,825**
Solar photovoltaic	1,100	440	570	**2,100**
Hydropower	800	1,690	1,050	**3,550**
Other renewable elec	400	250	275	**925**
Renewable heat	2,200	1,095	1,230	**4,525**
Renewable comb. heat & power	400	340	290	**1,025**
Bioenergy	1,585	1,125	1,305	**4,025**

*Figures rounded. Columns may not sum due to rounding. Sums may not match figures for the renewables sector as a whole due to methodological differences in comparing individual shocks with aggregate shocks.

Table 6b: Output supported by renewable technologies (£ million), 2024*

Technology	Direct	Indirect	Induced	Total
Offshore wind	3,305	1,790	725	**5,820**
Onshore wind	3,580	1,910	680	**6,175**
Solar photovoltaic	210	125	105	**435**
Hydropower	905	570	165	**1,640**
Other renewable elec	210	80	70	**360**
Renewable heat	280	120	110	**515**
Renewable comb. heat & power	65	25	30	**120**
Bioenergy	395	225	85	**705**

*Figures rounded. Columns may not sum due to rounding. Sums may not match figures for the renewables sector as a whole due to methodological differences in comparing individual shocks with aggregate shocks.

Table 7b: GVA supported by renewable technologies (£ million), 2024*

Technology	Direct	Indirect	Induced	Total
Offshore wind	975	620	435	**2,025**
Onshore wind	995	620	410	**2,025**
Solar photovoltaic	60	40	60	**165**
Hydropower	205	170	100	**470**
Other renewable elec	90	35	40	**170**
Renewable heat	120	55	65	**240**
Renewable comb. heat & power	30	10	15	**60**
Bioenergy	110	70	50	**230**

*Figures rounded. Columns may not sum due to rounding. Sums may not match figures for the renewables sector as a whole due to methodological differences in comparing individual shocks with aggregate shocks.

Table 7b: FTE employment supported by renewable technologies , 2024*

Technology	Direct	Indirect	Induced	Total
Offshore wind	5,600	7,750	5,450	**18,800**
Onshore wind	5,400	7,275	5,150	**17,825**
Solar photovoltaic	1,600	500	775	**2,875**
Hydropower	1,100	1,775	1,225	**4,100**
Other renewable elec	700	525	500	**1,725**
Renewable heat	1,400	800	825	**3,025**
Renewable comb. heat & power	400	150	225	**750**
Bioenergy	550	775	625	**1,950**

*Figures rounded. Columns may not sum due to rounding. Sums may not match figures for the renewables sector as a whole due to methodological differences in comparing individual shocks with aggregate shocks.

Next steps: Renewable Energy Microdata

In our previous report we set out plans to strengthen the data feeding into our modelling by working with microdata on renewable energy firms and, where possible, linking data on renewable energy activities to the large surveys of businesses collected by the Office for National Statistics. Delays in accessing the data meant that it was not possible to incorporate this work into the current report. We intend to do so in our next edition.

The primary dataset for this research is the ONS Low Carbon and Renewable Energy Economy (LCREE) survey. All analysis will be conducted within a secure data environment and will follow the ONS' Five Safes Framework, ensuring that data is handled in a secure and responsible way.

Examples of improvements this will support include:

- Scotland-specific industry breakdowns: replacing the UK industry proportions currently used to allocate Scottish renewable energy activity across industries, which is the most significant data limitation in our current approach.
- Granular industrial breakdowns: a more detailed understanding of which industries are involved in which renewable energy technologies, and of how these interact with different parts of the economy.
- Technology-specific time series: consistent series for individual technologies (for example wind, hydro and solar) to help address the volatility observed in individual years.

Moving forward, this work will support a more accurate and insightful view of the renewable energy industry in Scotland, helping to inform future decisions and policy development.

Modelling methodology

To estimate the economic impact of Scotland's renewable energy industry we combined data from the Low Carbon and Renewable Energy Economy (LCREE) Survey published by the ONS with a model of the Scottish economy.

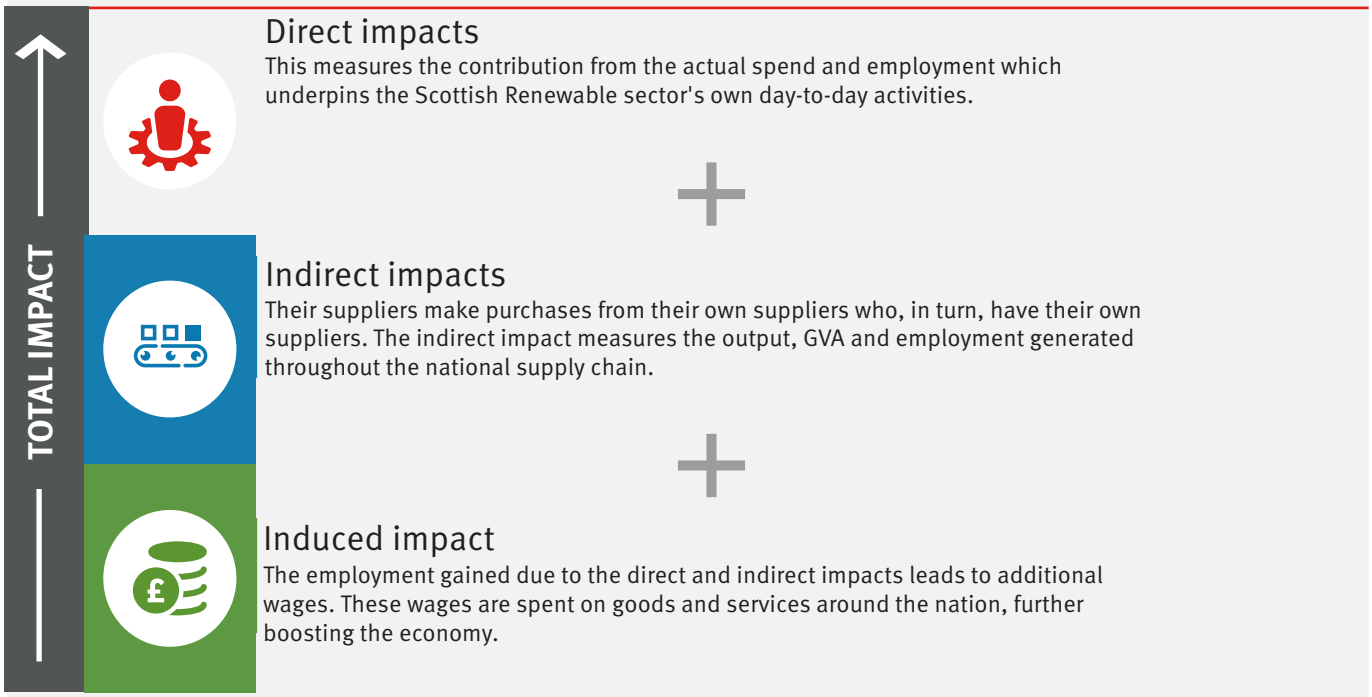
This model separates the Scottish economy into 98 sectors and describes the economic links between each sector as well as how these sectors interact with households, government and investment. The Scottish Government's input-output tables are the key dataset supporting this model. For this report we have updated the model to the 2022 tables, published in December 2025, which are the most recent available.

Input-output tables are compiled from a wide range of sources and describe the structure of the economy in a single year. The 2022 tables are the first to cover a post-pandemic year, and the Scottish Government notes that they are suitable for use as a proxy for post-pandemic modelling. They are therefore a better basis for estimating the impact of activity in 2023 and 2024 than the 2019 tables used in previous editions of this report. They will not, however, capture structural change in the Scottish economy since 2022, and this remains a source of uncertainty in our estimates.

As in our 2025 report, we took Scotland's overall renewable energy figures for each year and allocated them to industries using the UK industry breakdown for the corresponding year. In previous editions we relied on Scotland-specific industry proportions from 2017. We made this change because the 2017 Scottish figures are now considered outdated, and more recent industry detail is only available at the UK level. Where the industrial composition of renewable activity in Scotland differs from that of the UK as a whole, this will affect our estimates; addressing this is one of the main aims of the microdata work set out in the next section.

Output and GVA are presented in nominal terms, in the prices of the year in question. They are not adjusted for inflation, and the two years are not expressed on a common price basis.

Diagram 1: Direct, indirect and induced impacts



Source: *Fraser of Allander Institute*

Glossary

Full-time equivalent (FTE) employment is a simple adjustment to account for differences in hours worked between full-time and part-time employees. One FTE job equates to one full-time employee working for one year, or, alternatively, two part-time employees.

Gross value added (GVA) is the additional value of goods and services created during production and is a measure of the contribution to an economy. GVA is a preferred measure of economic contribution to output because output can overstate economic activity by including the value of goods and services purchased from other firms. For example, a firm could buy £1m of goods and sell these on for £1m – generating no additional value but recording an output of £1m. GVA can be expressed generally as the difference between revenue from sales and the cost of non-labour inputs.

Output refers to the value of goods and services produced in an economy. The majority of output relates to the turnover of firms. However, output is chosen over turnover because a large amount of activity is not undertaken by just firms (e.g. Public Sector Spending). Output is transformed into GVA by subtracting the value of goods and services used up in production, known as intermediate consumption.

Renewable Energy in this report refers to the following technologies: offshore wind, onshore wind, solar photovoltaic, hydropower, other renewable electricity (including geothermal, wave and tidal stream), renewable heat, renewable combined heat and power, and bioenergy.

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