University of Strathclyde Glasgow

Fraser of Allander Institute

The Economic Impact of Scotland's Renewable Energy Sector - 2025 Update

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The Fraser of Allander Institute

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.

Executive Summary

- This report presents estimates of the economic impact of Scotland's renewable energy industry.
- 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 the national accounts, so we have constructed the sector using available data published by the Office for National Statistics (ONS).The latest available data is for 2022.
- We estimate that the renewable energy industry had a turnover of £10 billion and approximately 10,900 FTE jobs in 2022.
- However, the economic activity supported by the renewables sector is far greater than its own turnover and employment. The renewable energy sector supports economic activity throughout its supply chains and this economic activity supports wage spending across Scotland.
- Including these spill-over effects, we estimate that the renewable energy industry supportsed £15.5 billion of output, £6.6 billion of GVA and over 47,000 FTE employment across the Scottish economy in 2022.
- The technologies that individually supported the most FTE employment are offshore wind (19,580), onshore wind (16,865), renewable heat (4,095) and hydropower (3,560).
- However, due to significant uncertainty in the underlying data and updates to the methodology, the 2022 results should be seen as a standalone snapshot rather than part of a trend. Methodological changes were made to better reflect current conditions.
- Additionally, the energy price crisis in 2022 had significant effects - boosting sector turnover but also increasing costs, which limited growth in GVA and employment. As a result, the 2022 results should be interpreted with care and not directly compared with data from previous years.

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.

Turnover and employment of Scotland's renewable energy sector

The renewable energy sector is not currently defined in national statistics. Therefore, to model the economic impact of Scotland's renewable energy industry on the Scottish economy we must construct the sector using existing data. This involves identifying and aggregating the activity in other sectors that is attributable to renewables to develop a picture of the renewables industry as a whole. For further details, see the 'Modelling Methodology' section.

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

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

Using the latest available data (2022), we calculate that Scotland's renewable energy sector had a turnover of £10 billion and approximately 10,900 FTE jobs. This is consistent with definitions of direct renewable energy activity used within the ONS Low Carbon and Renewable Energy Economy survey.

Table 1 shows how this turnover and employment is spread across different sectors of the Scottish economy. Notably, the electricity and gas sector stands out with nearly two thirds of the turnover, while most employment in the renewable industry falls under the construction sector.

Table 1: Total direct turnover and FTE employment in Scotland's renewable energy sector, 2022*

Description	Turnover (£m)	FTE Employment
Agriculture, forestry & fishing	50	-
Mining and quarrying	-	-
Manufacturing	1,025	2,650
Electricity & gas	6,175	1,775
Water supply, sewerage & waste	75	300
Construction	1,945	3,125
Wholesale & Retail	50	200
Real estate	15	-
Professional, scientific & technical	610	2,525
Admin & support	25	125
Other services	60	50
Total	**10,070**	**10,900**

*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

Direct 2022 Employment Results

Compared to our previous report, the 2022 findings show a noticeable decrease in direct employment figures.

This decline is largely due to a reduction in the ONS-reported employment numbers for Hydropower and Renewable Heat in 2022. The drop appears to reflect a return to normality following an unusually high figure reported in 2021.

However, as discussed throughout this report, there is significant uncertainty in the underlying ONS survey of renewable activities, particularly at the individual technology level.

Our results are therefore accompanied by a moderately large margin of error. Consequently, we caution against overinterpretation of individual results in this report.

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 lead to increased employment across the Scottish economy which in turn leads to increased wage spending. The economic activity arising from this increased spending is the induced impact.

Table 2 sets out the total output, GVA and FTE employment supported by Scotland's renewable energy sector broken down by the direct, indirect and induced impact. In total, renewables supported £15.5 billion of output, £6.6 billion of GVA and over 47,000 FTE jobs across the Scottish economy in 2022.

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 for turbines components, electrical equipment, and software systems from other businesses. 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.

Table 2: Direct, indirect and induced output, GVA and FTE employment supported by Scotland's renewable energy sector, 2022*

Impact	Output (£m)	GVA (£m)	FTE Employment
Direct	10,070	3,990	10,900
Indirect	3,870	1,690	22,850
Induced	1,550	950	13,460
Total	**15,490**	**6,630**	**47,210**

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

Although the figures indicate positive growth in supported output, GVA, and FTE employment, they should be interpreted with caution.

As outlined in the explainer box on the next page, survey margins of error, along with recent methodological updates and changes within the sector, mean that results should not be directly compared to previously reported results.

It is also worth noting that output and GVA are presented in nominal terms (i.e., not adjusted for inflation and expressed in 2022 prices). As a result, these figures are not suitable for direct comparison with those from previous years, as apparent increases or decreases may partly reflect changes in the general price level rather than actual changes in economic activity or sector performance.

Table 3 provides 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.

Notably, the electricity and gas sector accounts for just over half of total output and slightly less than half of total GVA supported by Scotland's renewable energy sector.

In terms of employment, more than half of the jobs supported by the renewable energy sector are found across construction, wholesale and retail, electricity and gas, and manufacturing. In addition, a significant share of the workforce is employed in professional, scientific and technical services, as well as administrative and support services.

Table 3: Total output, GVA and FTE Employment by sector supported by Scotland's renewable energy sector, 2021*

Industry	Output (£m)	GVA (£m)	FTE Employment
Agriculture, forestry & fishing	165	60	855
Mining and quarrying	35	15	220
Manufacturing	1,490	615	4,850
Electricity & gas	7,920	2,795	5,835
Water supply, sewerage & waste	145	80	505
Construction	2,605	1,120	8,760
Wholesale & Retail	485	295	5,470
Transport & storage	205	100	1,615
Accommodation & food services	120	70	2,295
Information & communications	115	75	1,150
Finance & insurance	315	150	1,055
Real estate	425	340	685
Professional, scientific & technical	810	485	4,865
Admin & support	270	155	4,080
Public admin & defence	60	35	465
Education	85	65	1,715
Health & social work	70	45	880
Arts, entertainment & recreation	50	25	845
Other services	125	90	1,025
Activities of households as employers	5	5	35
Total	**15,490**	**6,635**	**47,210**

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

EXPLAINER

Key Differences in the 2022 Report

This year's report differs from previous editions in two important ways.

Firstly, we have updated our methodology to more accurately capture the economic contribution of the renewable energy sector in 2022. These changes, outlined in the modelling methodology section, are necessary to reflect current data and industry conditions.

Due to this update, we strongly advise against making direct comparisons with previous reports. The 2022 results should be viewed as a standalone snapshot of the sector's activity, rather than part of a continuous trend.

Secondly, 2022 was an unusual and pivotal year for the renewable energy sector.

The onset of the energy price crisis - seen largely by sharp increases in wholesale energy costs - had wide-reaching effects. While the crisis accelerated interest in renewables, it also brought significant challenges. Supply chain disruptions and rising input costs made renewable energy projects more expensive to deliver.

This dynamic led to an increase in turnover and output across the sector, but the higher operational and material costs meant that the gains in gross value added (GVA) and full-time equivalent (FTE) employment were not as pronounced.

We can see this evidenced in the Scottish Annual Business Statistics 2022 for the Electricity, Gas, Steam and Air Conditioning Supply sector.

This data shows that total turnover increased by 46% in the sector in 2022. At the same time, the value of purchases of goods and services rose by 83% and total labour costs by 7%, while GVA decreased by 4% across the sector overall.

Unfortunately, the publicly available data does not allow for disaggregation to isolate electricity generation specifically. However, the figures strongly suggest that rising input costs have constrained growth in GVA and FTE employment across the sector in 2022, as reflected in our modelling results.

For these reasons, the 2022 results should be interpreted with care and not directly compared with data from previous years.

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 4, 5, and 6 present the estimated output, GVA, and FTE employment figures for each specific renewable energy technology.

However, it is important to interpret these figures with some caution. The estimates are based on ONS 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.

Table 4: Output supported by renewable technologies (£ million), 2022*

Technology	Direct	Indirect	Induced	Total
Offshore wind	4,205	2,005	655	**6,870**
Onshore wind	4,010	1,865	565	**6,440**
Solar photovoltaic	190	105	60	**355**
Hydropower	805	455	125	**1,385**
Other renewable elec	30	10	15	**55**
Renewable heat	215	100	100	**410**
Renewable comb. heat & power	45	15	15	**75**
Bioenergy	410	215	105	**730**

*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 5: GVA supported by renewable technologies (£ million), 2022*

Technology	Direct	Indirect	Induced	Total
Offshore wind	1,660	860	400	**2,925**
Onshore wind	1,590	785	345	**2,720**
Solar photovoltaic	75	45	35	**155**
Hydropower	295	180	75	**555**
Other renewable elec	15	5	10	**30**
Renewable heat	170	75	80	**330**
Renewable comb. heat & power	20	10	10	**40**
Bioenergy	160	90	60	**315**

*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 6: FTE employment supported by renewable technologies , 2022*

Technology	Direct	Indirect	Induced	Total
Offshore wind	3,100	10,880	5,600	**19,580**
Onshore wind	3,100	8,930	4,830	**16,865**
Solar photovoltaic	800	510	485	**1,795**
Hydropower	800	1,720	1,035	**3,560**
Other renewable elec	200	85	125	**410**
Renewable heat	1,700	1,250	1,145	**4,095**
Renewable comb. heat & power	200	110	125	**435**
Bioenergy	1,000	885	870	**2,690**

*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

For our next report, we are planning to enhance the data feeding into our modelling by exploring microdata of renewable energy firms and, where possible, linking data on renewable energy activities to large surveys of businesses collected by the Office for National Statistics. Analysing microdata and creating data linkages can improve the accuracy of the data, improve Scotland-specific relevancy, and provide opportunities for capturing novel interactions between renewable energy activities and the economy.

The primary dataset for this research is the ONS Low Carbon and Renewable Energy Economy (LCREE) survey. We will explore linking this to other datasets such as the ONS Annual Business Survey (ABS), the ONS' largest survey of business indicators, and the ONS Annual Purchases Survey, a detailed survey of the types of goods and services that businesses buy.

All analysis will be conducted within a secure data environment and will follow the ONS' Five Safes Framework, ensuing data is handled in a secure and responsible way.

Examples of improvements this will support include:

- Granular industrial breakdowns: By using the microdata, we will gain a more detailed understanding of which industries are involved in different renewable energy technologies. This can allow us to more robustly identify renewable energy activities and how these interact with different parts of the economy.
- Technology-Specific Time Series: We also intend to construct consistent time series for individual technologies (e.g., wind, hydro, solar) to help address volatility observed in specific years, such as the fluctuations seen in for Hydropower and Renewable Heat data in 2021.
- Further business indicators: We will explore linking the LCREE microdata to the Annual Business Survey (ABS). This can support new indicators for firms involved in renewables, such as taxes paid, investment, firm productivity, employee costs etc, and improve our existing estimates of GVA and spillover impacts.
- More information on the location of spending: Linking the LCREE microdata to the Annual Purchases Survey can support a better understanding of renewable firms' propensity to import goods and services relative to buying from within the UK. Improving this data will support more accurate estimates of the spillover impacts of renewable activities on their supply chains.

Moving forward, this work will support a more accurate and insightful view of the renewable energy industry in Scotland, helping 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 (2019) input-output tables were the key dataset supporting this model.

It is important to note that these input-output tables are based on data from many sources and therefore do not include the most recent structural changes. Our model is based on data from 2019, and it might not capture the big changes that happened in 2020 onwards until the Scottish Government releases the new reliable data. This means that our estimates for 2022 have considerable uncertainty attached to them.

This year, we have also updated our methodology to reflect more current and accurate data.

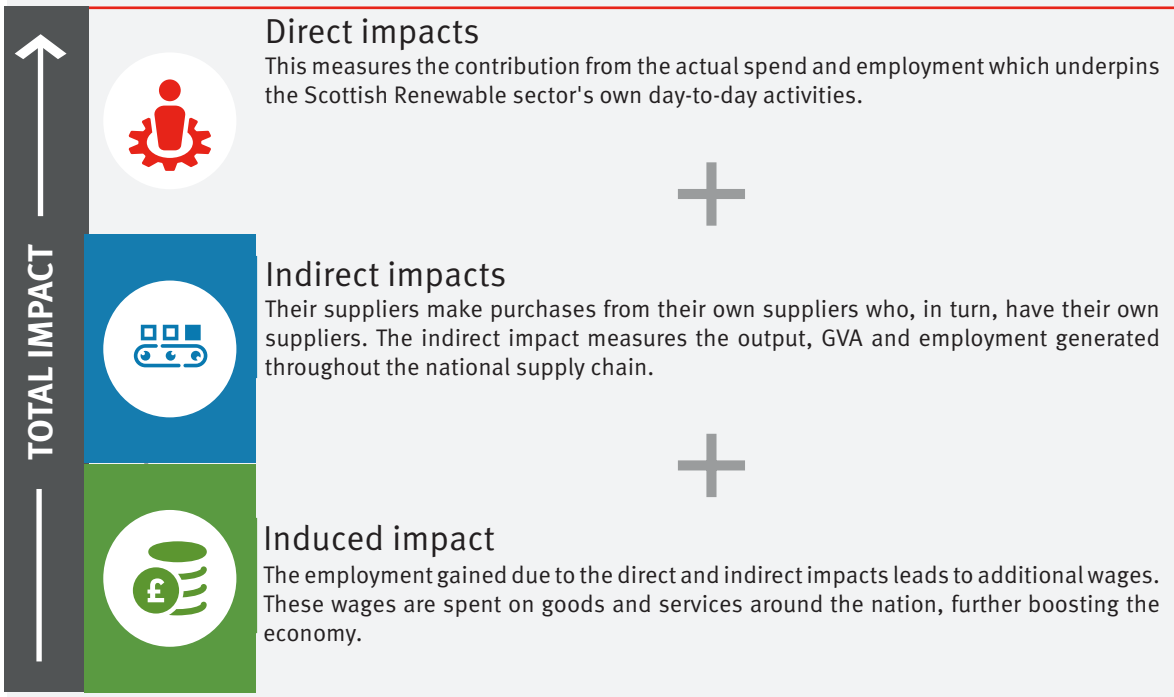
To produce these estimates, we used Scotland's overall renewable energy figures for 2022 and allocated them to UK industries based on the 2022 industry breakdown. In previous years, we relied on Scotland-specific industry proportions from 2017. We made this change because the Scottish 2017 figures are now considered outdated, and 2022 data is only available at the UK level. This represents a significant shift in our approach, meaning the 2022 results are not directly comparable to those from earlier reports.

In addition, we applied a bespoke deflator for Section D (Electricity, gas, steam and air-conditioning supply), using publicly available data from the Scottish Quarterly National Accounts (QNA). This adjustment was made to better reflect the particularly high inflationary pressures experienced by this sector of the economy in 2022. This enhancement means that our mode more accurately accounts for varying inflationary impacts across different parts of the renewable energy supply chain. As a result, our estimates are more conservative than they would otherwise be.

We also refined our method for capturing the role of exports, imports, and Gross Fixed Capital Formation (GFCF) related to renewable energy activity. Minor adjustments were made to correct a previously identified error. As a result, this is another reason why figures in this report should not be directly compared with those published in previous editions.

Combined with the existing uncertainty around the ONS estimates for Scotland, these changes highlight the need for caution when interpreting the results - especially for individual renewable technologies.

Diagram 1: Direct, indirect and induced impacts



Source: *Fraser of Allander Institute*

Glossary

Full-time equivalent (FTE) employment considers the importance of 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 value of all final goods and services produced and is a measure of the contribution to an economy. GVA is a preferred measure to output as a firm could buy £1m of goods and sell these on for a further £1m – clearly, no additional value has been created. GVA can be expressed generally as the difference between revenue from sales and the cost of inputs.

Output refers to the value of sales of all goods and services produced in an economy. This is most easily thought of as similar 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). The key difference between output and GVA is that the value of intermediate goods is included in the calculation of output whereas they are not included in the calculation of GVA.

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.

Fraser of Allander Institute
University of Strathclyde
199 Cathedral Street
Glasgow G4 0QU
Scotland, UK

Telephone: 0141 548 3958
Email: fraser@strath.ac.uk
Website: fraserofallander.org
Follow us on Twitter via @Strath_FAI
Follow us on LinkedIn: FAI LinkedIn
