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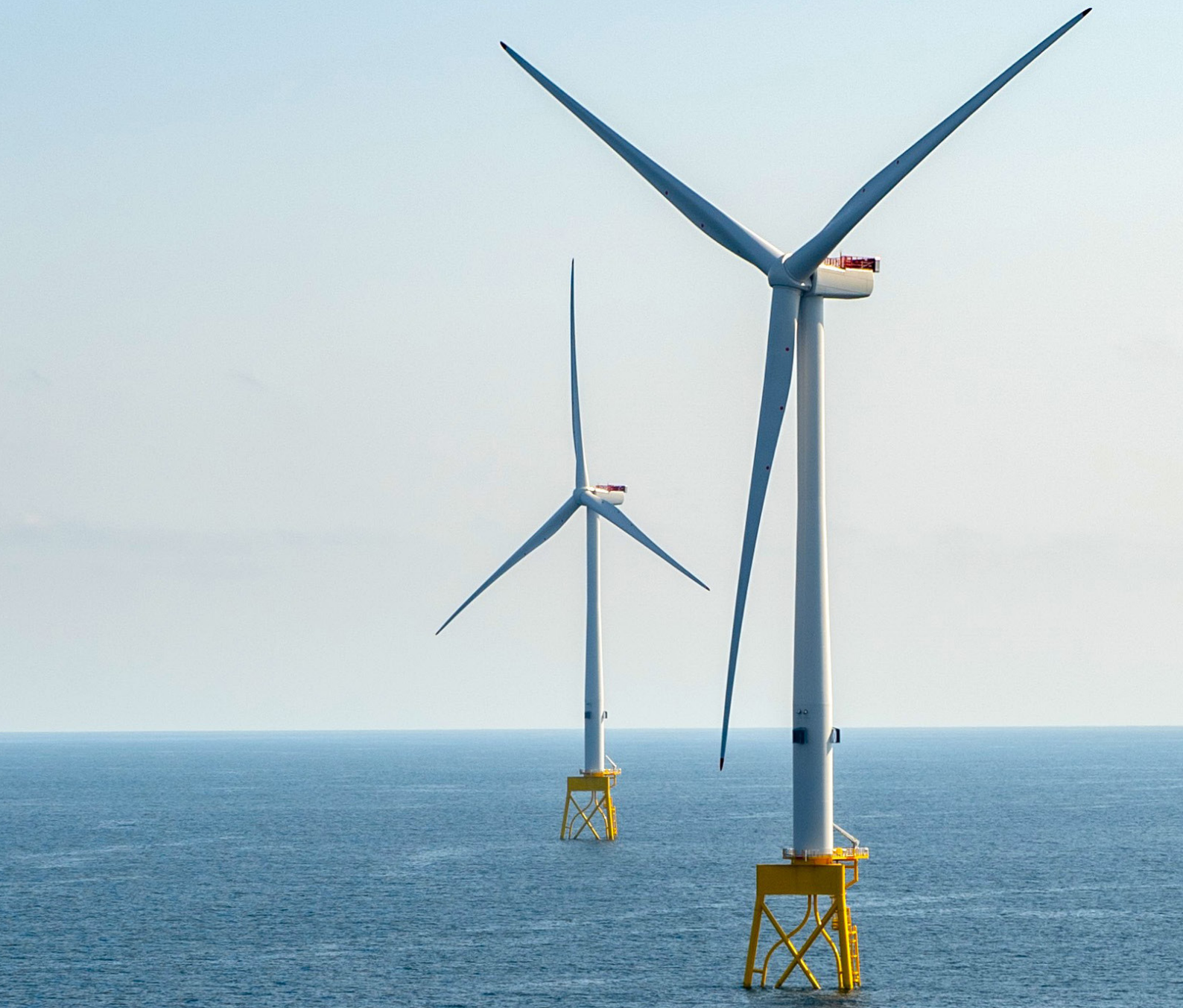

Fraser of Allander Institute

The Economic Impact of Scotland's Renewable Energy Sector - 2023 Update

December 2023

UNIVERSITY of STRATHCLYDE
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The Fraser of Allander Institute

Disclaimer

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The report was commissioned by Scottish Renewables.

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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 were able to estimate how much output, gross value added (GVA) and employment renewable activities support in Scotland's economy as a whole.
- There is no renewables sector defined in the national accounts, so we constructed the sector using data published by the Office for National Statistics (ONS).
- We estimate that the renewable energy industry had a turnover of £6.1 billion and 13,600 full-time equivalent (FTE) employment in 2021.
- However, the economic activity supported by 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 supports over £10.1 billion of output, over £4.7 billion of GVA and over 42,000 FTE employment across the Scottish economy.
- The technologies that individually support the most FTE employment are offshore wind (10,120), onshore wind (12,030), renewable heat (7,220) and hydropower (5,605).
- However, 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. More robust and timely production of renewables data by the UK and/or Scottish Government would allow for more meaningful between-year and between-technology comparisons of these estimates.

Introduction

Renewable energy generation will be the foundation of any net-zero economy. Accordingly, the use of renewable energy technologies - including onshore and offshore wind, solar photovoltaics, heat pumps, and marine renewables - play a vital role in reducing Scotland's carbon footprint as well as aiding future energy security.

In addition to the environmental benefits, renewable energy also boosts the Scottish economy. This comes from both the renewable energy sector's activities and job creation, as well as the wider spill-over impacts spreading throughout Scotland. Using a model of the Scottish economy, this report estimates the amount of economic activity that renewables currently support in Scotland.

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 is done by extracting and aggregating the activity in other sectors that is attributable to renewables to develop a picture of the renewables industry as a whole.

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 (2020), we calculate that Scotland's renewable energy sector had a turnover of £3.06 billion and approximately 8,450 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. The electricity and gas sector accounts for almost half of turnover. By a significant margin, most employment in renewables is classified as within the construction sector.

Table 1: Total direct turnover and FTE employment in Scotland's renewable energy sector, 2020*

Description	Turnover (£m)	FTE Employment
Agriculture, forestry & fishing	65	200
Mining and quarrying	55	125
Manufacturing	465	1,575
Electricity & gas	1,410	1,700
Water supply, sewerage & waste	25	150
Construction	580	2,450
Wholesale & Retail	105	300
Real estate	15	0
Professional, scientific & technical	265	1,550
Admin & support	65	350
Other services	10	125
Total	**3,060**	**8,450**

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

Economy wide impact of Scotland's renewable energy sector

The economic impact of Scotland's renewable energy industry is not limited to the economic activity of the sector itself.

Renewables companies purchase goods and services from firms in their supply chain. These suppliers, in turn, have their own supply chains and employment. Renewables companies thus support economic activity across the 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 supported by Scotland's renewable energy sector broken down by the direct, indirect and induced impact. In total, renewables supported over £10.1 billion of output, over £4.7 billion of GVA and over 42,000 FTE employment across the Scottish economy.

EXAMPLE

Economic Impact of Onshore Wind

An onshore wind farm does not just make electricity. It also directly boosts the local economy by providing employment to engineers responsible for wind turbine maintenance and operation.

Indirectly, it stimulates economic activity in manufacturing and transportation sectors that make and transport the turbine parts.

Moreover, it induces people working at the wind farm to spend money in the area, which helps local businesses and can lead to more job openings in the community.

Table 2: Direct, indirect and induced output, GVA and FTE employment supported by Scotland's renewable energy sector, 2021*

Impact	Output (£m)	GVA (£m)	FTE Employment
Direct	6,110	2,640	13,600
Indirect	2,590	1,190	16,790
Induced	1,450	890	12,540
Total	**10,140**	**4,710**	**42,920**

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

While this indicates an encouraging growth in supported output, GVA, and FTE employment since 2020, we would advise against overinterpreting these figures. The surveying margin of error, as well the continued challenges of economic measurement in 2021, will contribute to uncertainty in the data.

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.

Significantly, more than a third of the total output and over a quarter of GVA can be attributed to the electricity and gas sector.

For employment, the combined contributions of the construction, wholesale and retail, electricity and gas, and manufacturing sectors make up more than half of the workforce supported by renewables.

EXPLAINER

2022 Report Comparison

In comparison to our previous report, the findings indicate a notable year-on-year increase in the results. This upswing is primarily attributed to a substantial surge in the ONS figures for Offshore wind turnover in the year 2021.

The most prominent impact of this higher figure is seen in the construction sector.

This surge may be attributed to the industry's recovery from the downturn experienced in 2020 amid the global COVID-19 pandemic. The observed increase appears to signify a return to normalcy, with various projects gaining momentum once again.

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 the results in this report.

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	215	80	1,155
Mining and quarrying	110	45	335
Manufacturing	20,50	850	4,795
Electricity & gas	2,925	1,035	4,115
Water supply, sewerage & waste	100	50	400
Construction	1,480	635	7,775
Wholesale & Retail	585	355	5,470
Transport & storage	170	80	1,485
Accommodation & food services	110	70	2,175
Information & communications	90	60	910
Finance & insurance	265	130	895
Real estate	395	320	630
Professional, scientific & technical	905	540	4,145
Admin & support	415	235	3,910
Public admin & defence	55	35	435
Education	80	65	1,645
Health & social work	65	40	820
Arts, entertainment & recreation	45	25	785
Other services	75	55	1,020
Activities of households as employers	5	5	30
Total	**10,140**	**4,710**	**42,925**

*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 were able to calculate their individual economic effects. Tables 4, 5, and 6 present the estimated output, GVA, and FTE employment figures for each specific renewable energy technology.

However, we need to be careful when using these numbers. The point estimates from the ONS statistics that were used in this modelling come with wide confidence intervals due to the relatively limited sample sizes in this more detailed data.

So, these estimates are best used to get a general idea of how renewable energy impacts the economy in the survey year, rather than to make conclusions about how the industry is changing in the short term.

Table 4: Output supported by renewable technologies (£ million), 2021*

Technology	Direct	Indirect	Induced	Total
Offshore wind	2,595	965	495	**4,050**
Onshore wind	1,985	1,035	420	**3,440**
Solar photovoltaic	65	30	45	**135**
Hydropower	675	385	210	**1,265**
Other renewable elec	10	0	0	**10**
Renewable heat	215	100	100	**410**
Renewable comb. heat & power	50	25	10	**85**
Bioenergy	270	130	80	**480**

*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), 2021*

Technology	Direct	Indirect	Induced	Total
Offshore wind	1,205	475	300	**1,980**
Onshore wind	785	440	255	**1,485**
Solar photovoltaic	30	15	25	**70**
Hydropower	265	160	130	**555**
Other renewable elec	5	0	0	**5**
Renewable heat	200	100	150	**450**
Renewable comb. heat & power	20	10	5	**40**
Bioenergy	120	60	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 6: FTE employment supported by renewable technologies , 2021*

Technology	Direct	Indirect	Induced	Total
Offshore wind	3,100	7,675	4,235	**15,005**
Onshore wind	3,300	5,110	3,620	**12,030**
Solar photovoltaic	750	215	380	**1,350**
Hydropower	2,000	1,810	1,795	**5,605**
Other renewable elec	0	20	10	**30**
Renewable heat	3,500	1,625	2,095	**7,220**
Renewable comb. heat & power	95	150	95	**340**
Bioenergy	800	720	675	**2,200**

*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.

Renewable energy data - next steps

As we look ahead, it becomes evident that there are essential steps we need to take in order to enhance our understanding of renewable energy's impact. These measures are important to support informed decision-making and policy development.

- Reducing Margin of Error: One aspect that requires immediate attention is the reduction of the average margin of error in the Low Carbon Renewable Energy (LCREE) data for Scotland. Inaccuracies in these figures can lead to suboptimal decision-making and hinder effective resource allocation, making it essential to improve the precision and reliability of the data.
- Incorporating Net Zero Technologies: The LCREE currently does not include all of the technologies related to the net-zero goals outlined in government strategies. It is crucial to identify and integrate these missing technologies into our data collection efforts to ensure a comprehensive overview of the renewable energy landscape. This is vital for aligning our efforts with national sustainability objectives.
- Addressing Unanswered Questions: While LCREE provides valuable insights, it falls short in addressing certain essential questions. For instance, it may not sufficiently cover topics like local content, which is crucial in understanding the community-level impact of renewable energy projects. We need to develop data frameworks that address these gaps in our knowledge.

By taking action in these areas, we can refine our understanding of renewable energy's role in Scotland and foster more informed, effective, and sustainable decision-making processes. This, in turn, will contribute to our broader goals of achieving a low-carbon, sustainable future.

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.

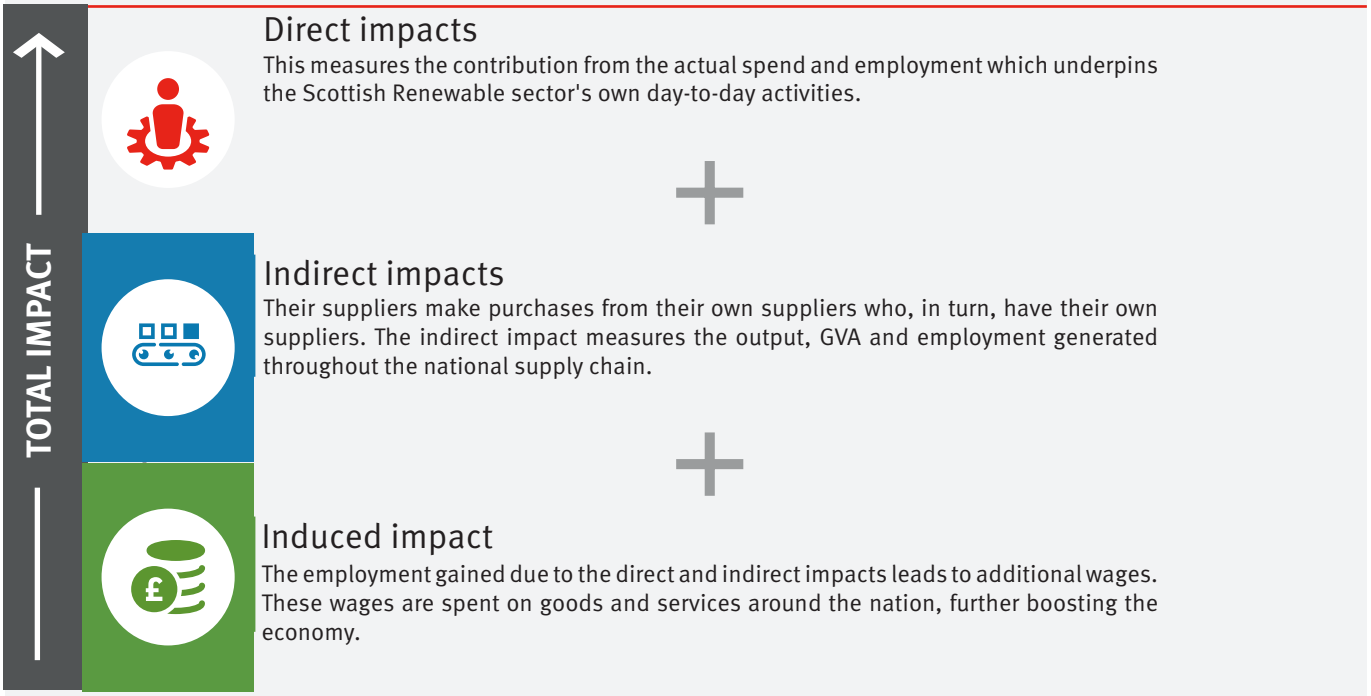
This model separates the Scottish economy into 98 sectors and describes the economic links between each sector as well as how these sectors interact with households, government and investment. The Scottish Government's 2019 input-output tables were the key dataset supporting this model.

It's 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 until the Scottish Government releases the new data. This means that our estimates for 2021 have a lot of uncertainty attached to them.

To produce these estimates, we have used the aggregate results for each technology in Scotland in 2020 and apportioned these to Scottish industries using the prior 2017 industry proportions. The exception to this was for 'Other renewable electricity' where the UK-wide employment proportions were used. This was necessary because disclosure issues meant that the Scottish industry proportions were not available. In addition to the uncertainty of the ONS' Scotland-wide estimates, this is another reason why the results of the modelling of individual technologies in this report should be treated with caution.

Lastly, because we made changes to our method to better account for the jobs, exports, imports and Gross Fixed Capital Formation (GFCF) linked to renewable activities, the numbers we came up with in this report can't be directly compared to the ones in the previous version.

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.

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