



Economic Value of Clean Heat in Scotland

Final Report
Scottish Enterprise
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Executive Summary

The [Heat in Buildings Strategy](#), published in October 2021, sets out the Scottish Government’s vision to decarbonise Scotland’s buildings and estimates that, to do so, would cost in the region of £33bn. The [Heat in Buildings Supply Chain Delivery Plan](#), published in November 2022, details the importance of maximising the proportion of this value that is retained in the Scottish economy through growth in the Clean Heat supply chain.

This study, commissioned by Scottish Enterprise, quantifies the economic value of the Clean Heat sector in Scotland. The sector is composed of a range of Clean Heat sub-sectors (heat pumps, building energy efficiency, biomass/biogas/anaerobic digestion, district and heat networks, thermal storage, direct electric heat, solar thermal, digital/smart technology and geothermal) and includes activities across the supply chain (manufacturing, sales/distribution, consultants, contractors and installers).

Key findings on the economic contribution of the Clean Heat sector to the Scottish economy are summarised in Figure 1, below.

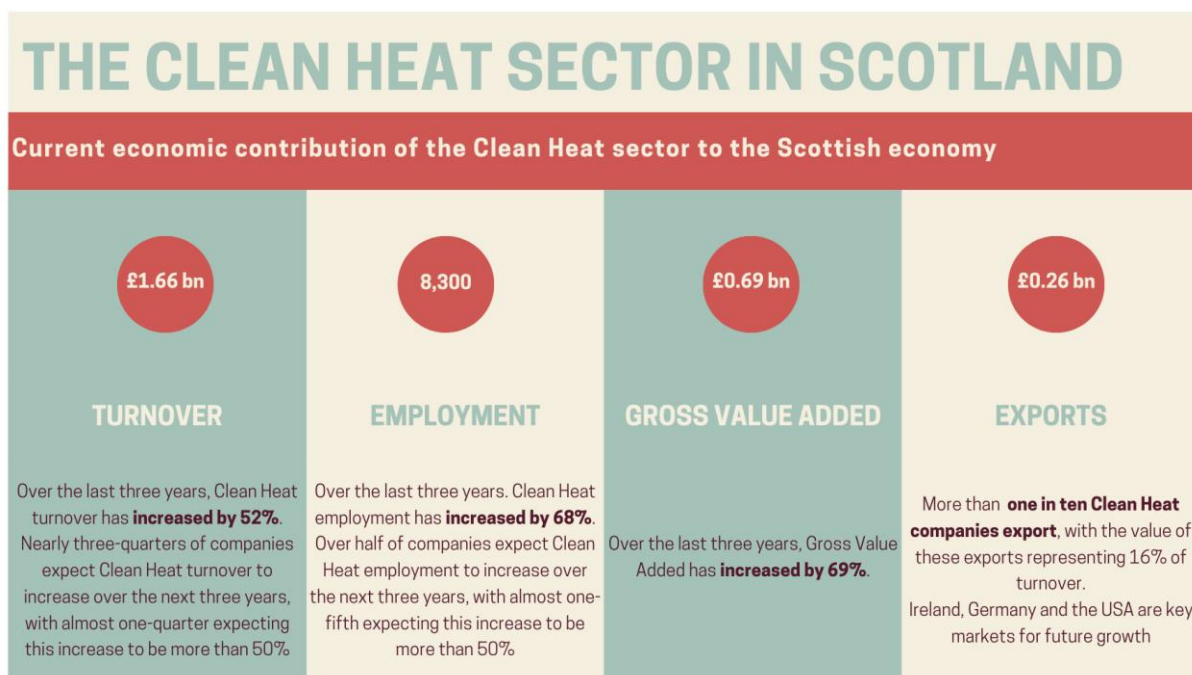


Figure 1: The economic contribution of Clean Heat to the Scottish economy

(note that data on increases in turnover, employment and GVA is based on a limited number of responses)

The Scottish Clean Heat sector consists of over 470 companies, with 8,300 direct employees and generated £1.66bn of turnover, annually, in the last financial year. This contributes £0.69bn of gross value added (GVA) per annum, to the Scottish economy. In addition to these direct economic impacts there will also be significant indirect impacts, arising from the use of Scottish based suppliers and induced impacts, arising from employees spending wages in the local economy.

The sector has experienced significant growth over the past three years, with employment increasing by 68%, turnover by 52% and GVA by 69%¹. Expectations for future growth are also very positive amongst the companies interviewed, with nearly three quarters expecting turnover to grow over the next three years and one quarter expecting this growth to increase company size by more than 50% compared to current levels. Significant continued growth in employment is also anticipated, with over half of companies expecting the number of jobs to increase over the next three years and one fifth expecting this growth to increase company size by more than 50% compared to current levels.

Just over one in ten companies export their Clean Heat products and services, compared with an estimated 3% of overall businesses in Scotland that export, according to the Scottish Government publication, [‘A Trading Nation – a plan for growing Scotland’s exports’ \(2019\)](#). An estimated £0.26bn is generated from sales of Clean Heat products and services from Scotland to export markets outside of the UK, in the most recent financial year. Three quarters of current exporters expect export sales to increase over the next three years, with one third expecting this increase to be more than 50% of current levels. Around 5% of companies expect to begin exporting Clean Heat products and services over the next three years, with Ireland, Germany and the USA being key markets identified. Sales of Clean Heat products and services from Scotland to the rest of the UK are estimated to be £0.29bn, slightly higher than exports to the rest of the world.

The Clean Heat sector is very active in innovation, with one third of companies stating that they are currently developing/planning a new Clean Heat product or service. The [UK Innovation Survey 2023](#) identifies that 16.4% of all Scottish businesses state that they were active in product innovation between 2020 and 2022.

Whilst the Clean Heat sector consists of a number of sub-sectors, heat pumps, building energy efficiency and biomass/biogas/anaerobic digestion account for more than 80% of employment in the sector. Nearly half of employment is in manufacturing and over 20% in installation.

District and heat networks was highlighted by respondents as the sub-sector with most future interest in becoming active, with one quarter indicating an interest in entering this Clean Heat sub-sector in future.

The sector faces a number of barriers to growth. The most significant of these relate to lack of market demand caused mainly by the cost of electricity compared to natural gas and the lack of capital and revenue/tariff support for customers considering Clean Heat solutions. The opportunities to grow the sector, identified by the companies, mainly relate to overcoming these barriers.

¹ Note that the reason employment increased by 68% and GVA by 69% is due to different companies having different GVA per head values



Table of Contents

1	Introduction	1
1.1	Study objectives	1
1.2	Research methodology	2
2	Results	3
2.1	Clean heat turnover, employment, GVA and exports	3
2.2	Segmentation of Clean Heat companies	4
2.3	Customers and markets	11
2.4	Innovation	15
2.5	Scottish supply chain	16
2.6	Barriers and opportunities to growth	17
3	Conclusions	20

Appendices:

Appendix A: Economic assessment methodology

Appendix B: Company survey questionnaire

Appendix C: List of study contributors

Appendix D: Economic analysis results

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1 Introduction

This report, prepared by Optimat and CJM Research for Scottish Enterprise, details a comprehensive assessment of Clean Heat activity in Scotland, analysed by sub-sector and supply chain position. It shows the scale, nature and growth trends of the sector and quantifies total turnover, employment, gross value added and exports.

For the purposes of this study, the Clean Heat sector is defined as companies with operational locations in Scotland that support the Scottish Government’s Heat in Buildings Strategy. This includes companies generating revenue from activities involving heat pumps, heat networks, building energy efficiency, geothermal, biomass/biogas, direct electric heat, solar thermal, thermal storage and digital technology/ smart systems. Activities across the full supply chain are in scope, including manufacturing, sales/distribution, contracting, installation and consulting.

The findings are based on research carried out between January and April 2024, including desk research and a detailed company survey. Data was obtained for 147 companies in the Clean Heat sector (117 from the company survey and 30 from desk research) representing 31% of the estimated total population of 472 Clean Heat companies with operational locations in Scotland.

1.1 Study objectives

The overall aim of the study was to establish a baseline to enable future monitoring of growth in the Clean Heat sector and to better understand the companies active in the sector. This is fundamental to ensuring that the delivery of the Heat in Buildings Strategy benefits the Scottish economy and provides useful insights in the context of the Heat in Buildings Supply Chain Delivery Plan.

Specific research objectives were:

- Estimate the size and growth of the sector, and sub-sectors, including:
 - Define current and historic turnover, jobs and economic impact
 - Identify projected trends in turnover and jobs to assess growth prospects
 - Quantify current exports (value and geography) and export intentions
 - Identify innovation projects/ new products
 - Identify barriers and opportunities to growth
- Identify the existing companies in the sector and understand how the sector operates, i.e.:
 - Identify companies (primarily from existing databases)
 - Analyse companies by size, geography, role in the supply chain and sub-sector
 - Understand their upstream supply chain
 - Understand their downstream supply chain
 - Identify their opportunities and aspirations for the Clean Heat sector

The economic assessment methodology used in this study has been developed in such a way that it is suitable for use by other Scottish Enterprise Energy Transition teams, specifically for Offshore Wind and Hydrogen.

1.2 Research methodology

The research methodology used in this study consisted of the following key stages:

- Building a list of companies that represent the total Clean Heat sector in Scotland
- Gathering published information on these companies, including a breakdown of activity by Clean Heat sub-sector and position in the supply chain
- Conducting a telephone survey to gather primary information directly from a sample of companies to address all the specific research objectives
- Analysing the resulting data to estimate total turnover, employment, GVA and exports and a breakdown by Clean Heat sub-sector and position in the supply chain
- Grossing up this sample data to a population level

A brief description of these stages is provided below, with a detailed explanation of the economic assessment methodology provided in Appendix A.

Firstly a long list of 570 potential Clean Heat companies was collated using data from a number of sources including Scottish Enterprise internal records, the [Scottish Industry Directories Green Heat database](#) and [The Data City](#)². This list was then reviewed to confirm the company had some activity in the Clean Heat sector and had some jobs located in Scotland. This review resulted in the database being reduced to 472 companies and this is estimated to be the total population of Clean Heat companies operating from locations in Scotland.

Desk research was then carried out, with companies assessed as to whether 100% of their activity could be classed as Clean Heat and whether their operations were 100% located in Scotland. The reason for this assessment was that whilst turnover and employment data could be identified from sources, such as the [FAME database](#), it could only be used if it was fully attributable to the Clean Heat sector and all jobs were based in Scotland. A total of 47 companies were assessed as being 100% Clean Heat and 100% based in Scotland. For these companies, an estimate was made to apportion turnover and employment across different Clean Heat sub-sectors and across different supply chain positions based on a review of each company's website.

A company survey was developed to address all the study objectives listed in section 1.1. A copy of this survey is included in Appendix B. All 472 companies were approached to participate in the survey and 117 responses were obtained (92 via telephone or MS Teams interview and 25 via a self-completed online questionnaire) representing a 25% response rate. The data gathered from this survey was supplemented by the desk research data collated earlier in the study. After accounting for 17 duplicate companies between the desk research and company survey, data from a total of 147 companies was obtained (31% of the total population of 472 companies). Appendix C contains a list of the study contributors that elected to be named in the report.

² The Data City is a provider of economic data and analysis for new and emerging sectors to address the lack of alignment of these sectors with traditional statistical data, such as Standard Industrial Classification Codes

The data was analysed to identify total Clean Heat turnover, employment, GVA and exports and apportion this to the different Clean Heat sub-sectors and positions in the Clean Heat supply chain. Other data and opinions gathered via the company survey were also analysed to respond to each of the study objectives. The results are discussed in section 2 of this report.

2 Results

This section provides the results of the study. This includes the quantitative economic performance data for the Clean Heat sector in Scotland and other qualitative insights that address the study objectives. A detailed description of how the results were derived is included in Appendix D.

2.1 Clean heat turnover, employment, GVA and exports

The economic value of the Clean Heat sector in Scotland can be assessed across several measures including, turnover, employment, GVA and exports. This section considers both current performance, historic growth trends and future expectations.

2.1.1 Current performance

The current performance of the Clean Heat sector in Scotland is:

- Turnover - £1.66bn
- Employment – 8,300
- Gross Value Added - £0.69bn
- Exports to rest of the world - £0.26bn
- Sales to rest of UK - £0.29bn

2.1.2 Recent growth

Over the last three years, the Clean Heat sector in Scotland has grown:

- Turnover by 52%
- Employment by 68%
- GVA by 69%

As noted earlier, the above trend information was calculated using low numbers of responses about historic performance.

2.1.3 Expectations for future performance

Respondents' expectations for Clean Heat turnover in the next three years are as follows:

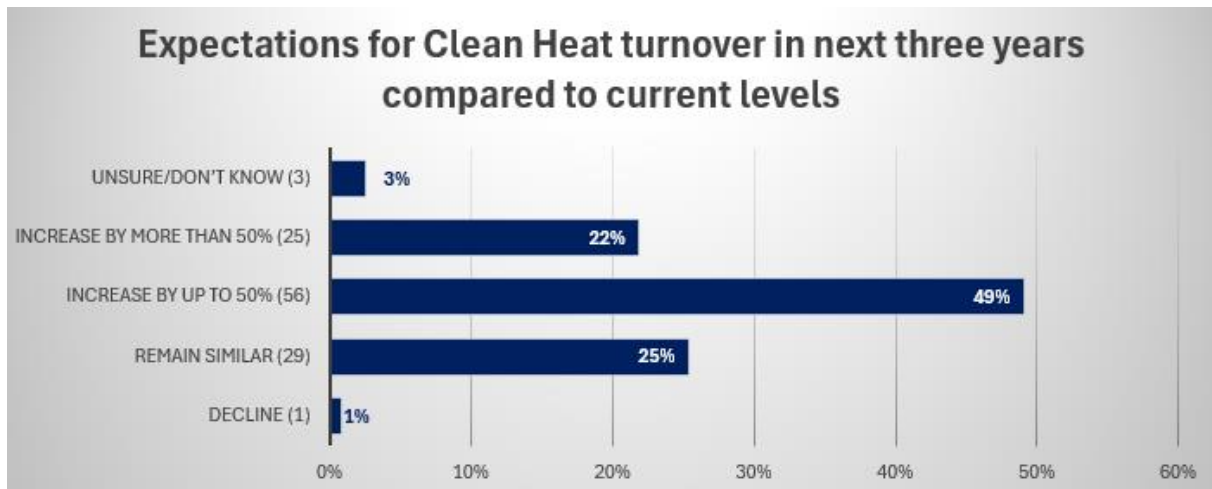


Figure 2: Expectations for Clean Heat turnover in the next three years

Nearly three quarters of companies expect their Clean Heat turnover to increase in the next three years, with almost one quarter expecting the increase to be more than 50% compared to current levels. One quarter expect their Clean Heat turnover to remain static. Combined with the earlier finding, that Scottish Clean Heat turnover has grown by over 50% in the previous three years, this presents a very positive picture of ongoing turnover growth for the majority of companies in the Clean Heat sector.

Respondents' expectations for Clean Heat employment in the next three years are shown below.

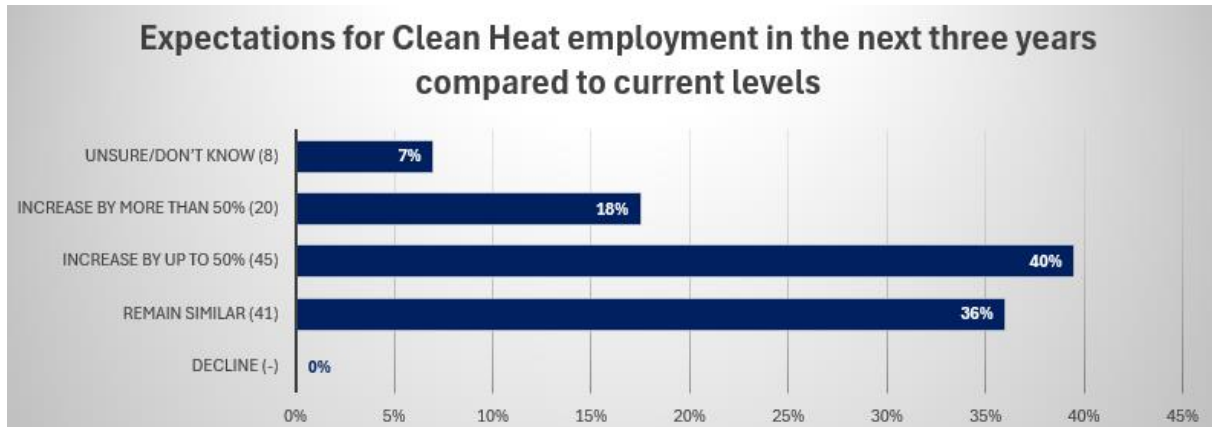


Figure 3: Expectations for Clean Heat employment in the next three years

Over half of respondents expect their Clean Heat employment to increase in the next three years, with nearly one-fifth of respondents expecting more than a 50% increase. Combined with the previous finding, that Clean Heat employment grew by 68% over the last three years, this presents a very favourable view of historic and future job growth in the sector.

2.2 Segmentation of Clean Heat companies

This section presents an overview of key characteristics of the Clean Heat sector in Scotland.

2.2.1 Company size

The size of companies active in the Clean Heat sector in Scotland is summarised in Figure 4, below.

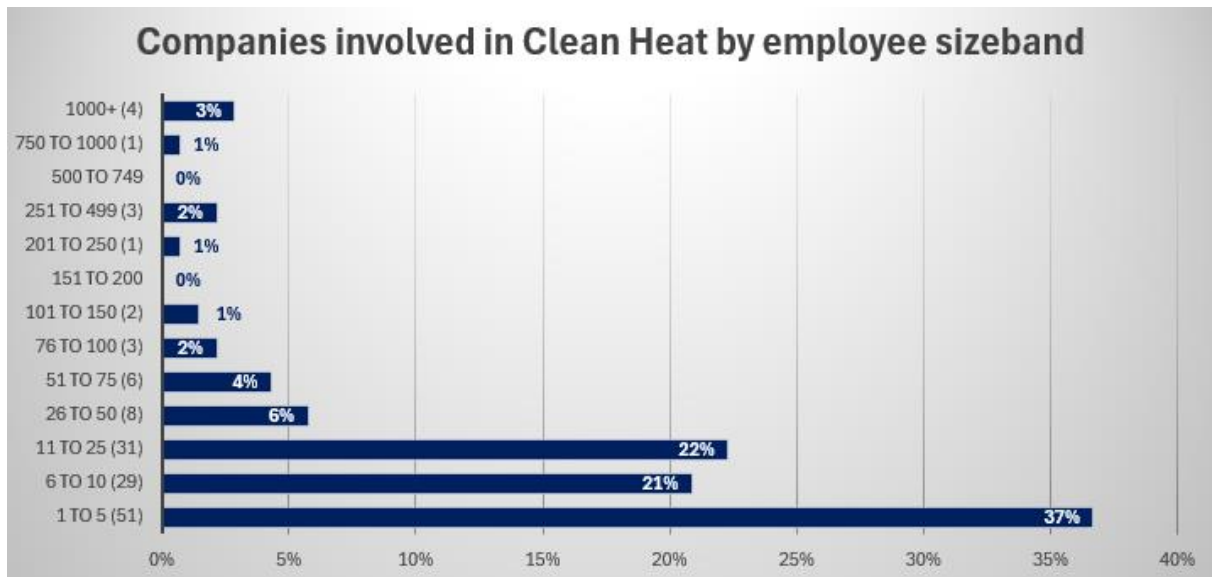


Figure 4: Companies active in Clean Heat in Scotland, based on survey sample

Almost 80% of companies active in Clean Heat have 25 or fewer employees. This is total employment within the sample of companies and not only those involved in Clean Heat. The average number of employees per company, active in Clean Heat, is 14.5 (excluding outlier data). It is likely that there is a bias in the population database towards larger companies as businesses with no contact information were not included (i.e. where the director may also be the sole employee and not have any significant online presence).

2.2.2 Geographical location

The geographical location of Clean Heat companies is shown in the map in below.

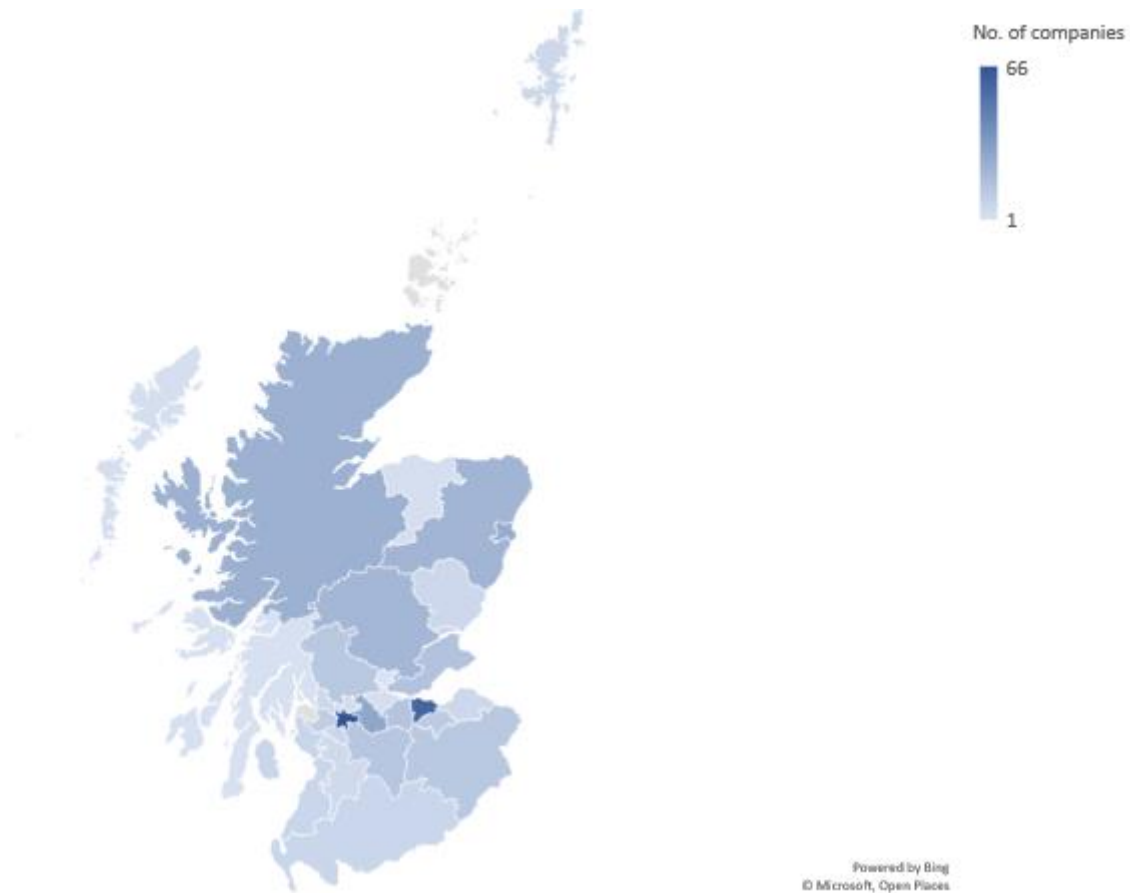


Figure 5: Concentration of Clean Heat companies (by number of companies) across Scottish Local authority areas

This is based on the location of the total population of Clean Heat companies and shows a geographical spread with concentrations of activity in Glasgow and Edinburgh. This is broadly consistent with population density, although other factors are likely to have an impact, such as the significant number of companies located in the Highlands where decarbonised heat solutions are less likely to face competition from customers on the natural gas grid.

2.2.3 Sub-sectors

Respondents to the survey were asked to identify which Clean Heat sub-sectors they are currently involved in and whether, or not, they may be interested in becoming active in each sub-sector in the future. The responses are summarised in Figure 6, below.

Current Clean Heat sub-sector activity and future intentions

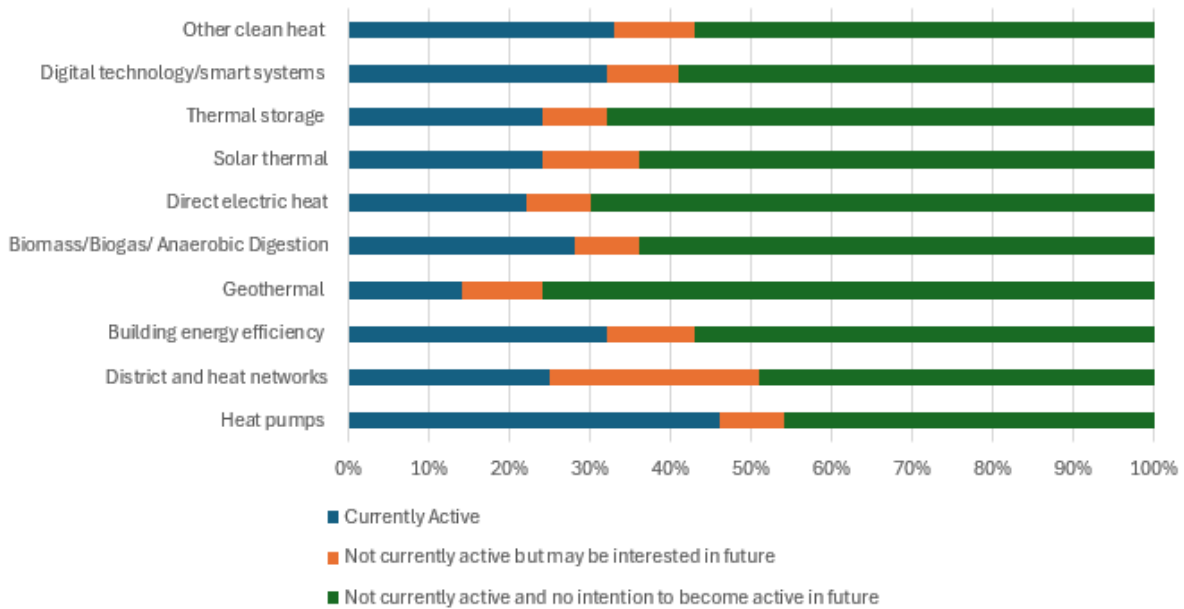


Figure 6: Current Clean Heat sub-sector activity and potential interest in future (117 responses)

Heat pumps is the most frequently selected sub-sector for currently activity, with almost half of respondents indicating they are already generating revenue in this sub-sector. Building energy efficiency and digital technology/smart systems are also significant sub-sectors, with around one third of companies currently active in these areas. One-third of respondents also indicated they were currently active in ‘Other Clean Heat’. These respondents were then asked to briefly describe the ‘Other’ areas. The most frequently described ‘Other’ sub-sector was consultancy, which is part of the supply chain position analysis addressed later in the survey questionnaire. Other respondents mentioned specific activities including solar PV and battery storage as part of an overall heat decarbonisation system, hydrogen production, etc.

District and heat networks was the sub-sector with most future interest, with one quarter of respondents indicating an interest in entering this sub-sector in future.

The respondents who indicated that they were not currently active in a sub-sector, but may be interested in future, were then asked to indicate the potential timescale for this future involvement. Figure 7, below, summarises the response to this question.

Timescale of potential future involvement in Clean Heat sub-sectors

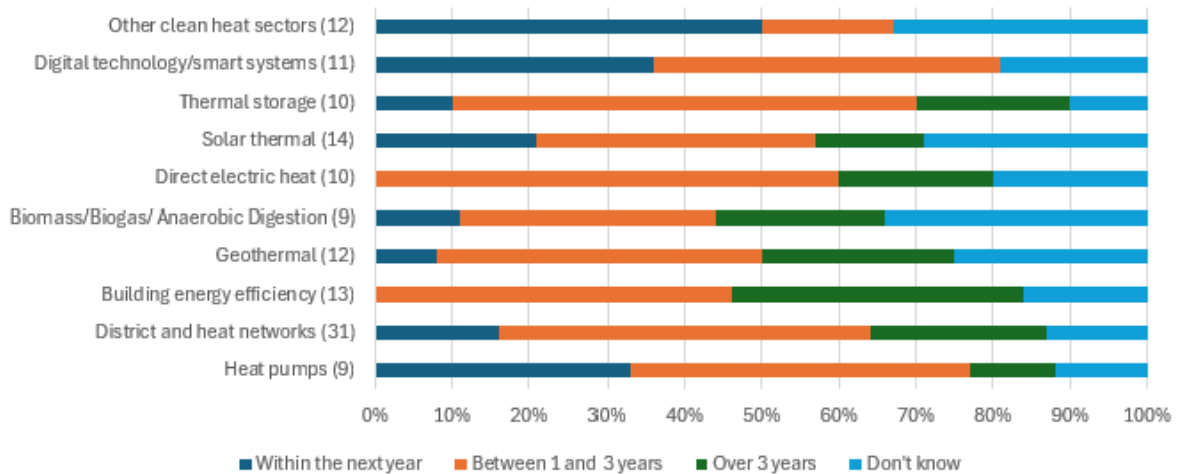


Figure 7: Likely timescale of future involvement in Clean Heat sub-sectors (number of responses indicated next to each subsector)

One third of those indicating an interest in entering the heat pump and digital technology/smart systems sub-sectors indicated that they would likely do so within the next year. Half of those stating they were interested in entering an ‘Other Clean Heat’ sub-sector also stated they would be likely to do so within the next year. Respondents selecting a potential future interest in ‘Other’ sub-sectors described areas of interest such as liquid cooling, solar PV to heat, liquid fuels, etc.

Those respondents indicating a potential future interest in building energy efficiency and direct electric heat were more likely to do so in more than 1 year.

Respondents indicating a potential future interest in entering new sub-sectors were asked to indicate where they would likely make sales. Figure 8, below, summarises the response to this question.

Intended location of likely sales made for sub-sectors of future interest

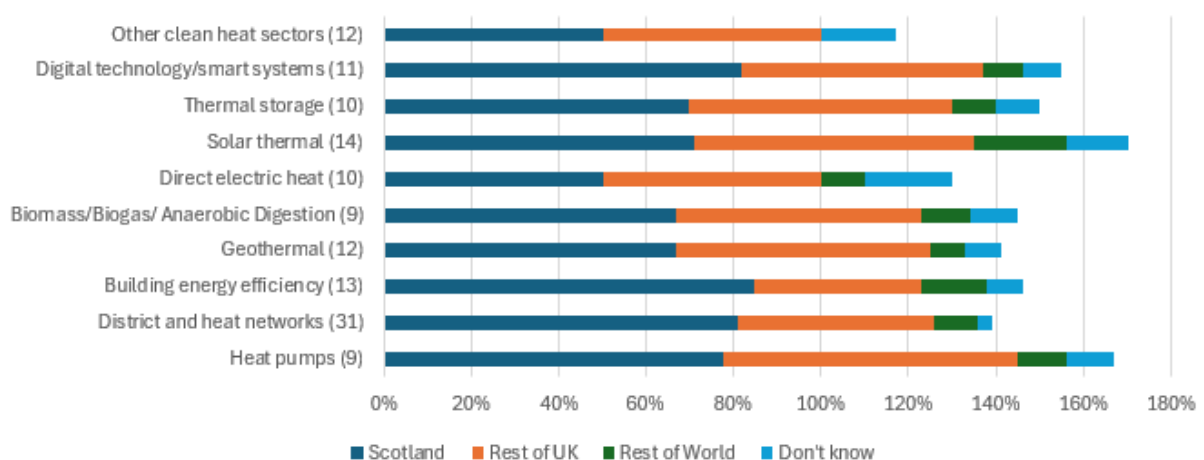


Figure 8: Likely location of sales arising from future involvement in Clean Heat sub-sectors (number of responses indicated next to each subsector)

Respondents indicated that all sub-sectors (except ‘Other Clean Heat’) offered the opportunity for future export sales, with solar thermal identified as offering the highest relative potential. Note that the totals are greater than 100% as respondents could select multiple geographical markets.

Respondents provided data to enable an estimate of the relative size of Clean Heat sub-sectors in Scotland. Data relating to employment estimates was assessed as more robust than turnover estimates as the response rate to employment questions was higher than for turnover questions. The relative size of the Scottish Clean Heat sub-sectors is shown in Figure 9, below.

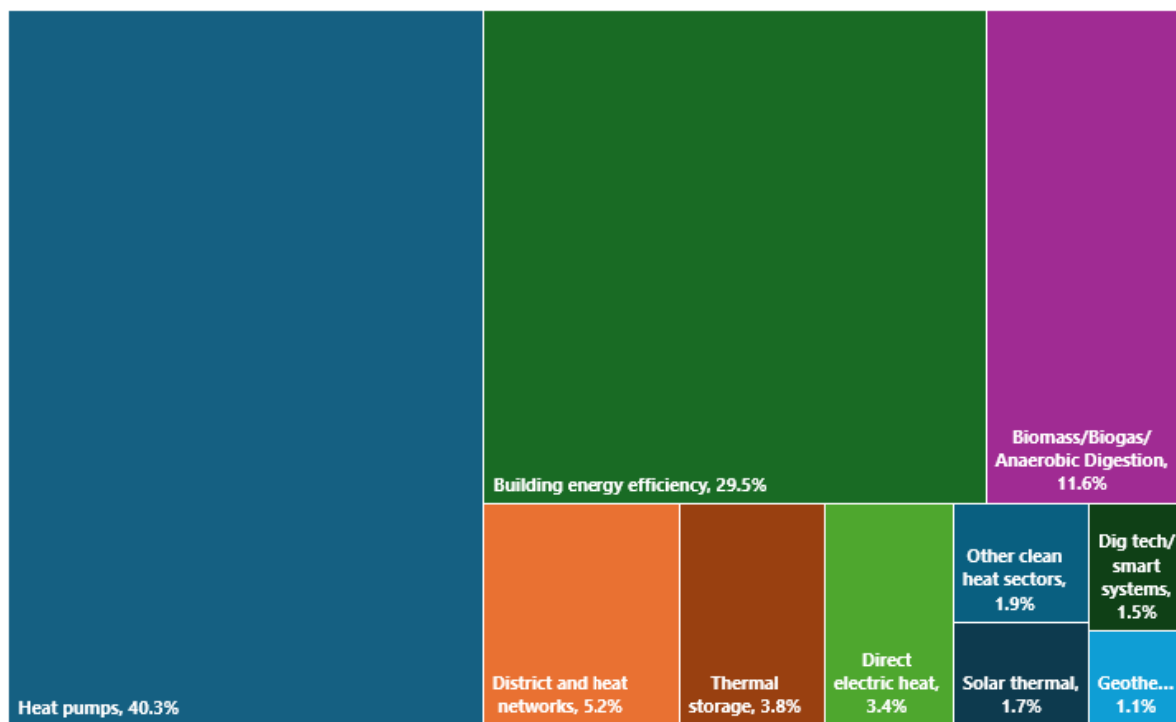


Figure 9: Relative size of Clean Heat sub-sectors in Scotland (based on percentage of total Clean Heat employment estimate – calculated using data from 86 companies)

The heat pumps, building energy efficiency and biomass/biogas/anaerobic digestion sub-sectors represent over 80% of the Scottish Clean Heat sector. Applying the data in Figure 9 to the overall employment estimate for the Clean Heat sector of 8,300, highlights that employment in the top three Clean Heat sub-sectors are:

- Heat pumps – 3,345
- Building energy efficiency – 2,448
- Biomass/biogas/anaerobic digestion - 963

2.2.4 Supply chain position

Respondents were asked to identify the positions in the Clean Heat supply chain their company were active in, selected from the following options:

- Consultant (including feasibility/design engineering, surveys, site testing, planning and EIA, legal and financial, etc.)

- Installer (including mechanical and electrical, clean heat systems installation/commissioning, etc.)
- Sales/distribution of parts, components, systems or end products used in Clean Heat
- Manufacturer of parts, components, systems or end products used in Clean Heat
- Contractor (including groundworks, building construction/adaptation, etc.)
- Any other position in the Clean Heat supply chain

Respondents could select more than one supply chain position and the answers to this question are summarised in Figure 10, below.

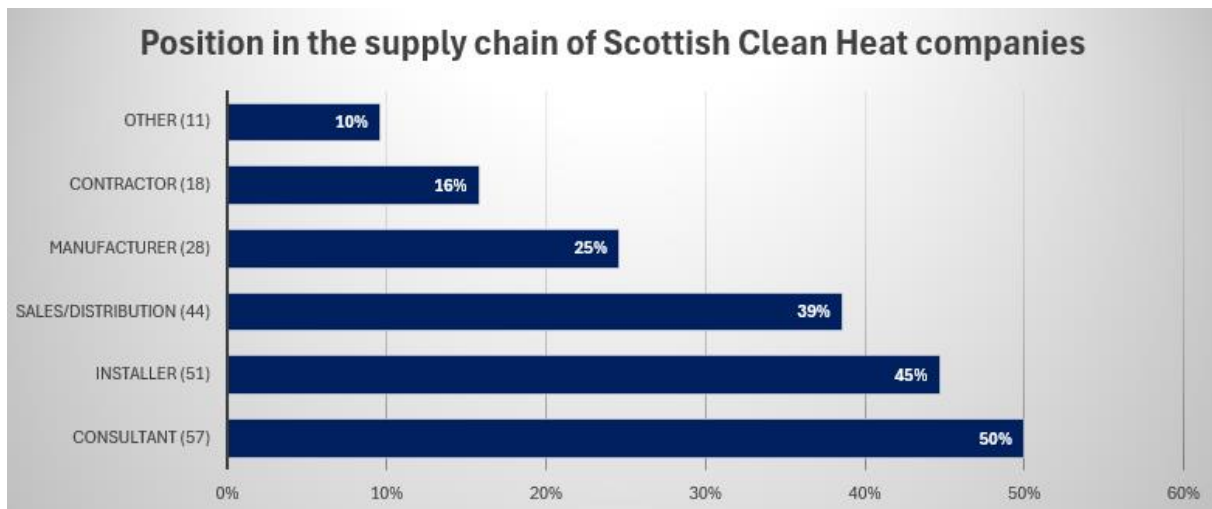


Figure 10: Position in the supply chain of Scottish Clean Heat companies – note that companies could select more than one option

Respondents were then asked a series of questions that enabled the calculation of the relative size of the Clean Heat sector by supply chain position. This uses the employment estimates for each part of the Clean Heat supply chain and is summarised in Figure 11, below.

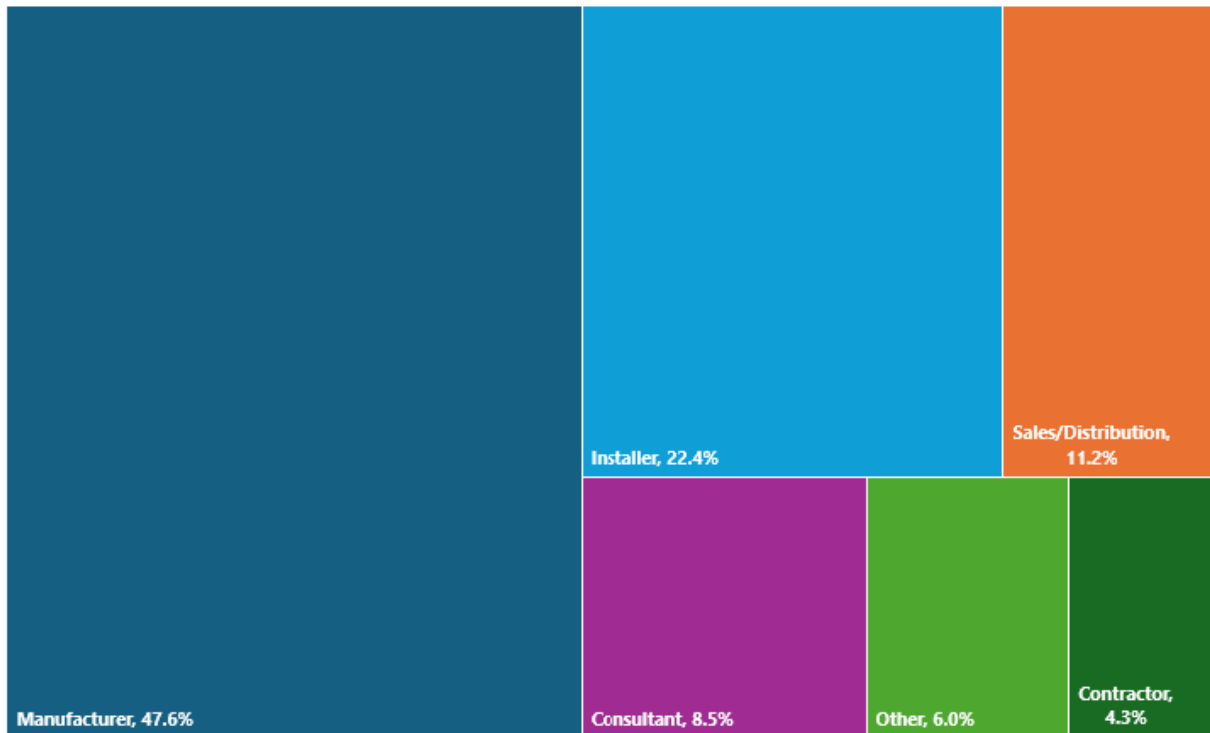


Figure 11: Relative size of Clean Heat supply chain positions in Scotland (based on percentage of total Clean Heat employment estimate – calculated using data from 92 companies)

Manufacturing represents just under half of the total Clean Heat supply chain employment in Scotland. Applying the data in Figure 11 to the overall employment estimate for the Clean Heat sector of 8,300, highlights that employment in the top three Clean Heat supply chain positions are:

- Manufacturing – 3,951
- Installers – 1,859
- Sales/Distribution - 930

2.3 Customers and markets

Companies active in the Clean Heat sector sell products and services to a variety of customer types across different geographical locations. An analysis of these customer types and market locations is provided in this section.

2.3.1 Customer types

Respondents were asked to identify the types of customers they sold Clean Heat products and services to.

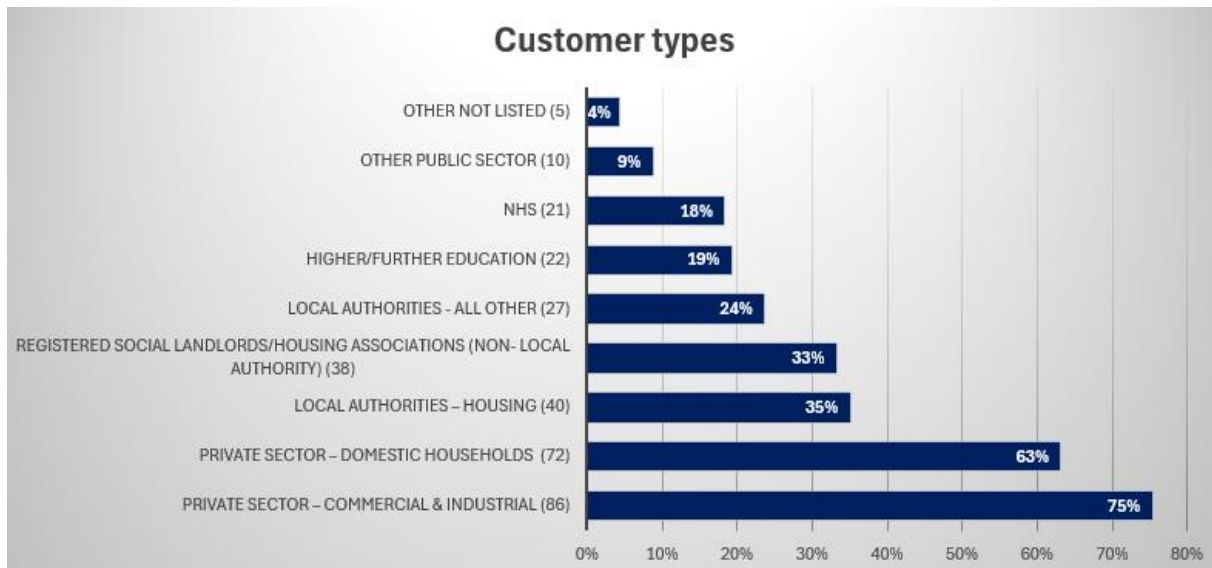


Figure 12: Number of companies indicating they sold to a specific type of customer (based on responses from 114 companies – note that companies could select more than one option)

The private sector is a much more commonly cited customer type than the public sector with a significant proportion of Clean Heat companies carrying out work across commercial and domestic markets. However, it should be noted that this does not take into account the value of the sales to the respective customer types. For example, a contract with a local authority could be significantly larger than an individual sale to a household or business.

2.3.2 Market locations

Respondents were asked to indicate where they made sales of Clean Heat products and services to, from their Scottish operations.

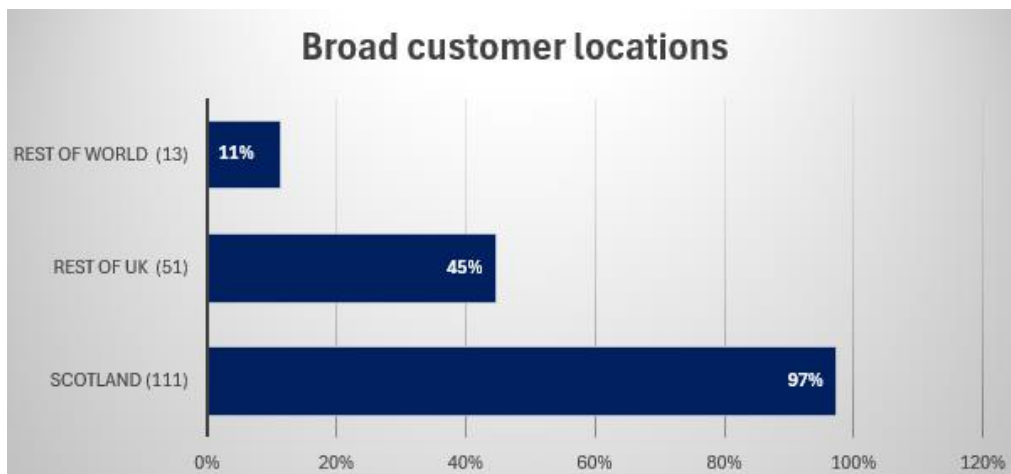


Figure 13: Broad location of overall Clean Heat sales from Scottish operations (based on responses from 114 companies – note that companies could select more than one option)

Just over one in ten Clean Heat companies export to customers outside of the UK. Using information already identified in section 2.1.1, we can compare the total sector turnover for the last financial year (£1.66bn) with total sector exports for the last financial year (£0.26bn), indicating that Clean Heat

exports represent 16% of total Clean Heat turnover. Although 45% of those responding stated they sold to customers in the rest of the UK (outside Scotland), it is estimated that the total value of sales to this group is £0.29bn, 17% of total Clean Heat turnover. This means that the value of Clean Heat sales to the rest of the UK is slightly higher than the value of exports to customers outside of the UK.

Those respondents who stated they exported to the rest of the world were then asked to identify the overseas markets they served. It is noted that the absolute number of company responses is low for the export related questions, so the results should be treated with caution. Figure 14, below, summarises the export markets served.



Figure 14: Export markets served by Clean Heat companies (based on responses from 12 companies)

Countries in the EU are the most common export markets, with Germany being the most frequently mentioned country (4 respondents). France and Poland were also identified as EU markets (each by 3 respondents).

Eight of the thirteen companies currently exporting had been doing so for three or more years, so were able to provide some indication of their recent export trends.

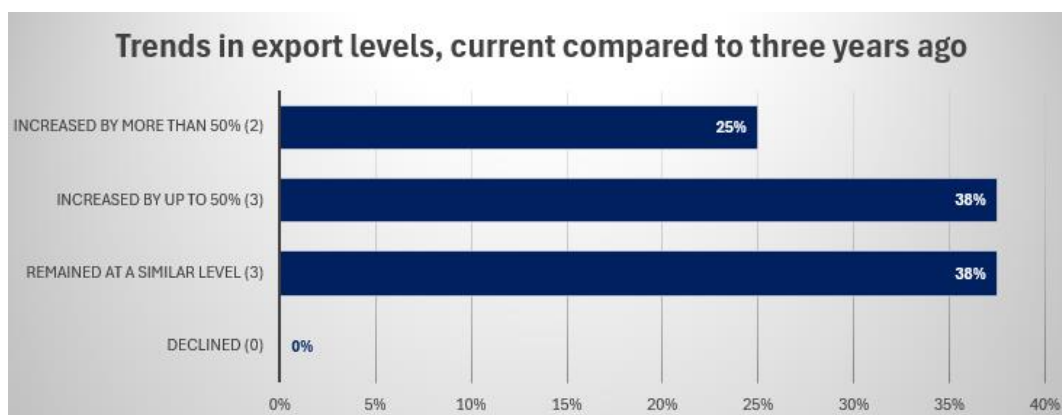


Figure 15: Recent Clean Heat exporting trends – comparison of current exports to the value three years ago (based on responses from 8 companies)

The exporting activity of all Clean Heat companies had either remained static or increased in the last three years, with two of the eight respondents stating that the value of their exports had increased by more than 50% compared to current levels.

All companies were asked about whether they plan to begin or increase exports in the next three years. This included those currently exporting and those not currently exporting. A summary of the responses to this question is shown in Figure 16, below.

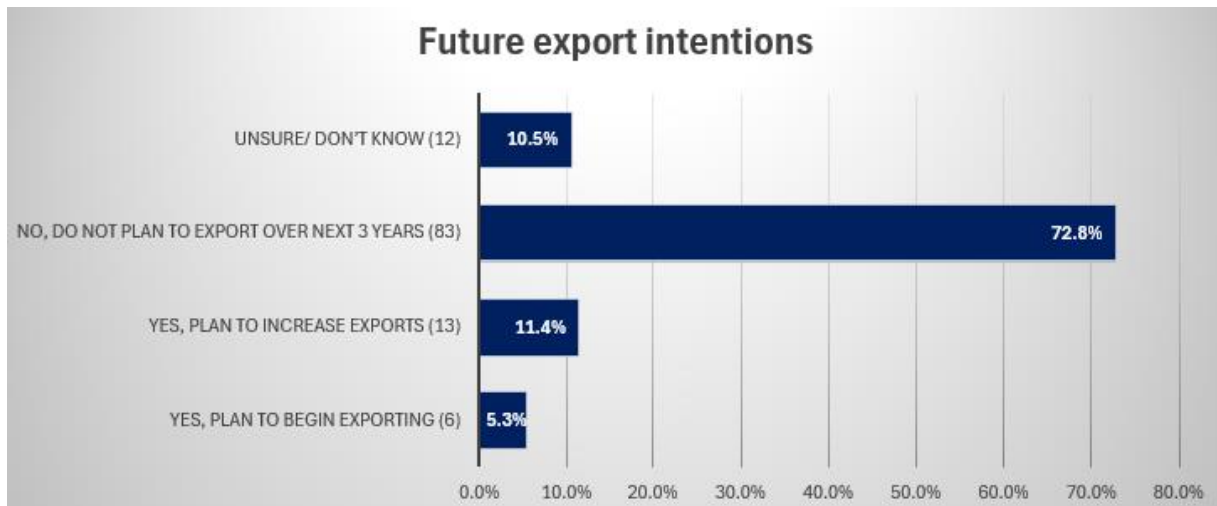


Figure 16: Plans to begin or increase exports over the next three years (based on responses from 114 companies)

All 13 companies, which previously indicated they currently export, expect to increase these exports over the next three years. Almost three quarters of respondents indicated they had no plans to begin exporting over this time period. Just over 5% of Clean Heat companies (6 respondents) indicated an intention to begin exporting in the next three years.

The 13 current exporters were asked, in more detail, about their expectations for future export performance in three years time, compared with current performance.

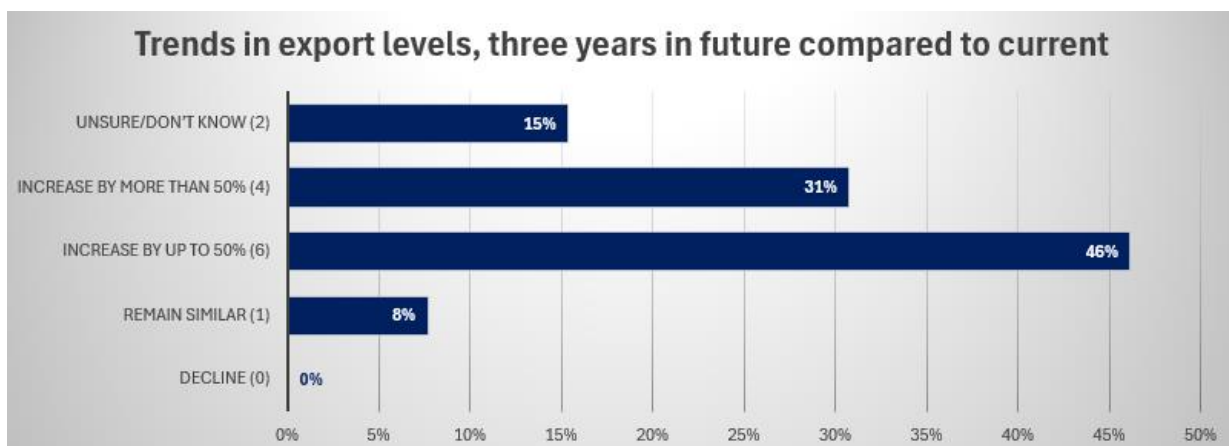


Figure 17: Expectations about future export performance in three years compared to current export performance (based on responses from 13 companies)

Ten of the 13 current exporters expect Clean Heat exports to increase over the next three years, with four of these predicting the scale of this increase will be greater than 50%.

The companies either currently exporting or intending to start exporting in the next three years were asked to identify the top three target countries for beginning or increasing Clean Heat exports. Figure 18, below, summarises the responses to this question.



Figure 18: Target countries for Clean Heat export growth (based on relatively low response - 15 companies naming 30 countries)

Ireland, Germany and the USA are the top three countries to be targeted to begin or increase exports of Clean Heat products and services.

2.4 Innovation

Companies were asked about their current innovation and new product/service introduction, based on selecting from a number of statements provided.

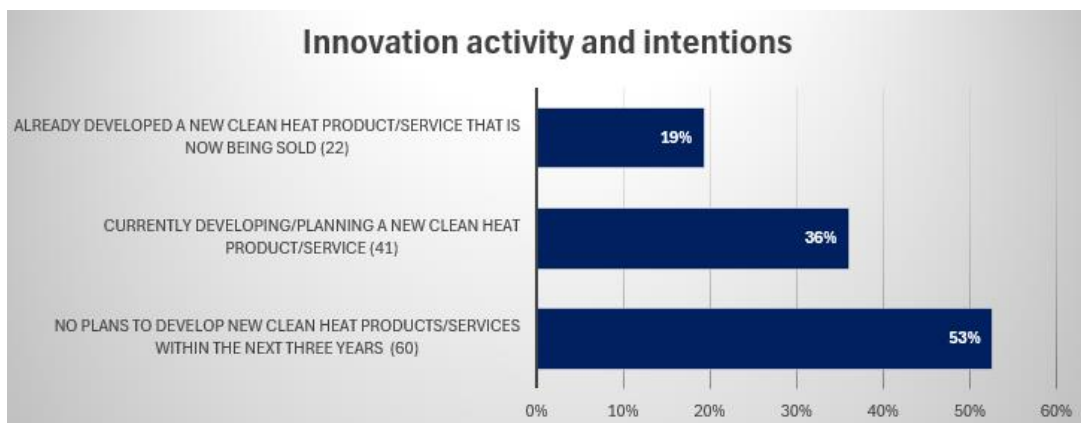


Figure 19: Current and future intentions relating to Clean Heat product and service innovation (based on responses from 114 companies – note that companies could select more than one option)

Over one third of respondents indicated that they are currently developing/planning a new clean heat product/service. One fifth of respondents stated that they had already done so and that the resulting Clean Heat product/service is being sold.

2.5 Scottish supply chain

Respondents were asked about the companies in their supply chains to identify the extent of use of Clean Heat suppliers. This was defined as products/services, excluding general office, accounting and facilities management suppliers, that were used as an input to their own Clean Heat products and services.

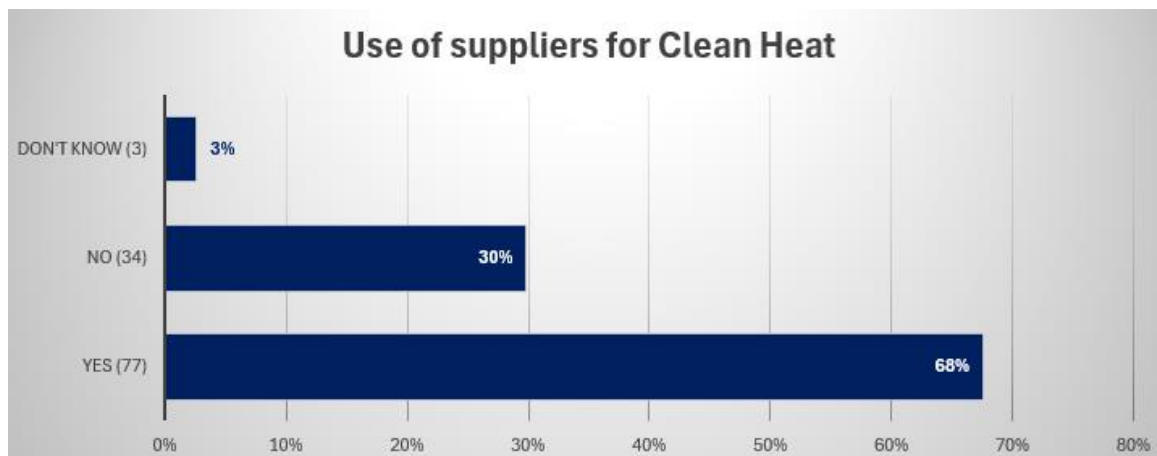


Figure 20: Company confirmation about whether they use suppliers of goods and services in Clean Heat operations (excluding general office, accounting and facilities management suppliers) (based on responses from 114 companies)

Over two thirds of respondents said they did buy in non-office related goods and services for their Clean Heat operations. These respondents were then asked to identify where their main suppliers were located. Figure 21, below, summarises the responses to this question.



Figure 21: Location of main suppliers of goods and services for use by Scottish Clean Heat companies (based on responses from 77 companies – note that companies could select more than one option)

Some respondents then provided the names of up to three of their main Scottish based suppliers. This list was cross-checked against the Clean Heat company database established earlier in the study. This

was helpful in checking whether the total estimated population of 472 companies needed to be revised. The supplier companies identified by the respondents were already included in the company population database which provides some assurance that this database is reasonably comprehensive.

2.6 Barriers and opportunities to growth

During the company survey, respondents were asked to highlight the main barriers and opportunities they faced in growing their Clean Heat business.

2.6.1 Barriers to growing sales of Clean Heat products and services

A total of 91 companies provided responses to the question about barriers to Clean Heat growth. The barriers identified can be aggregated into a number of themes:

- Market conditions
- Funding and finance
- Skills supply and availability of staff
- Regulation
- Policy
- Technical

Each of these is discussed below.

Market conditions

One of the most frequently highlighted barriers is the difference in cost between electricity and gas, meaning there is often a lack of economic incentive for the market to switch from natural gas fuelled heating systems to electrified heating systems. This impacts significantly on demand for Clean Heat products and services.

Although the shift from natural gas to electricity will result in reductions in carbon emissions only a small proportion of customers will decide to make the change based on environmental factors. Energy costs are the most important influencing factor. This is important in both domestic and non-domestic markets and is a fundamental barrier to growth.

Although there are examples of projects where Clean Heat solutions have been implemented at higher cost than natural gas alternatives, this is typically in circumstances where capital grant funding has supported the project and/or a public sector customer has been driven, in part, by carbon reduction objectives.

Some respondents highlighted negative consumer perceptions in the market related to heat pumps. This has been influenced by negative press coverage and issues where residents have not been properly briefed on system operation post-installation, resulting in dissatisfaction with some Clean Heat systems.

Funding and finance

Several respondents highlighted barriers related to finance and funding. This ranged from a perceived lack of public sector funding to help establish specialist supply chains (such as heat exchanger manufacture and medium scale heat pump manufacture) to individual company innovation grant support.

Others mentioned the significant impact on market demand arising from the cessation of market revenue support schemes such as the Renewable Heat Incentive.

Whilst it was acknowledged that there were some financial support schemes in place to support the uptake of energy efficiency and renewable/clean heat generation, these were viewed, by some as being administratively challenging for customers. Some highlighted a lack of awareness of the available financial incentives as being a barrier.

Recent increases in interest rates has been highlighted as being part of the cause for delays in decision making by clients, with public sector projects being particularly affected.

Skills supply and availability of staff

Many respondents mentioned a lack of suitably skilled staff as being a barrier to growth. This included staff within their own organisations, from heating engineers to senior project engineers, and staff within client organisations. An issue was highlighted where client staff, particularly in public sector organisations, had gained valuable experience of Clean Heat project delivery and were then attracted to private sector engineering consultancies. The loss of these skills in the client organisation then makes it more difficult to develop early-stage business cases internally for new Clean Heat projects.

The difficulty of growing a team to meet expected market demand in circumstances where the market is delaying investment decisions was highlighted as a barrier.

A lack of training facilities available to all geographical areas of Scotland was highlighted as a barrier to skills development, where significant travel was required to upskill staff.

The availability of skilled staff is impacted by more competitive salaries available in other sectors of the economy, such as oil and gas.

The lack of availability of financial support for skills development at degree level was also highlighted as a barrier. The situation in Scotland was compared to that in England where one stakeholder highlighted that funding from the Apprenticeship Levy could be used for this purpose in England but not in Scotland.

A general lack of funding for renewable apprenticeships, such as heating engineers, was identified as a barrier to growing heat pump installations.

Regulation

The cost of gas compared to electricity has already been identified as a significant market barrier. Regulatory change to enable lower cost tariffs, linked to lower carbon intensity of the electricity generation would go some way to address this barrier.

Company feedback included a concern about the lobbying power of large incumbents in the energy market and the extent to which this impacts on innovation in the sector. Smaller companies in the sector seeking regulatory change to enable innovation face significant barriers in the time required to participate in regulatory decision making.

The lack of market drivers to scale up the adoption of low embodied carbon products was highlighted as a barrier to growth. Company feedback stated that there is a lack of alignment between regulation

and policy, specifically the lack of regulatory drivers to require serious consideration by customers about embodied carbon emissions when procuring energy efficiency solutions.

Policy

Changes in net zero policies were identified as a barrier by companies as it introduces uncertainty about the commitment and stability of future net zero policies, impacting on investment risk. Several companies highlighted the lack of replacements for feed-in-tariff and renewable heat incentive support as examples of this.

Some companies expressed a view that Government policy focused too much on the use of heat pumps as a solution and did not sufficiently consider alternative technologies, such as direct electric heat.

Technical

Several companies identified electricity grid constraints and DNO grid approval timescales as barriers to growth.

One company identified that the number of different commercial structures for heat networks is confusing the market and increasing transaction costs, therefore acting as a barrier to growth in this sub-sector.

2.6.2 Opportunities to grow Clean Heat products and services

A total of 97 companies provided responses to the question about opportunities for Clean Heat sector growth. Many of the companies described specific product/market opportunities and these are not repeated here for commercial confidentiality reasons. The wider sector-level opportunities can be grouped into a number of themes, including:

- Investment/finance
- Regulations
- Consumer awareness

Each of these is discussed below.

Investment/finance

The most often cited opportunity to grow the Clean Heat sector related to the availability of capital investment and revenue funding to support market uptake. This is necessary, in many cases, due to the differential in price of electricity versus gas and the impact this has on return on investment and payback calculations carried out by domestic and non-domestic customers considering clean heat solutions.

Regulations

Two areas of regulatory change were highlighted as opportunities for growth. Both relate to addressing barriers described in the previous section. Firstly, the opportunity to make changes to the electricity tariff setting regulations to enable relatively lower cost tariffs to be established, reflecting lower carbon intensity of generation in different geographical areas of the grid network. This would go some way to addressing the differential in price between gas and electricity.

Secondly, there is an opportunity to properly incentivise the procurement of low embodied carbon products related to energy efficiency through the [Scottish Government building standard regulations technical handbooks](#).

Consumer awareness

There is an opportunity to provide physical demonstration spaces for different Clean Heat vendors' products to allow consumers to view and obtain advice from independent advisors.

3 Conclusions

In conclusion, the key findings of this study are:

- There are an estimated 472 companies active in the Scottish Clean Heat supply chain with some solely offering Clean Heat products and services, whilst for others it is only part of their business
- As a sector, these companies generate £1.66bn in turnover per annum and employ 8,300 people related to their Clean Heat products and services. This contributes £0.69bn per annum in Gross Value Added to the Scottish economy
- Nearly three quarters of companies expect their Clean Heat turnover to increase over the next three years, with one quarter expecting this increase to be more than 50% of current turnover
- Over half of companies expect their Clean Heat employment to increase over the next three years, with almost one fifth expecting this increase to be more than 50% of current employment
- Just over one in ten companies in the sector export Clean Heat products and services, with a total annual value of £0.26bn. This compares to the value of sales to the rest of the UK of £0.29bn
- Three quarters of current exporters expect the value of Clean Heat exports to increase over the next three years, with one third expecting this increase to be more than 50%
- Just over 5% of companies plan to begin exporting Clean Heat products and services over the next three years
- The top three target countries for companies seeking to begin or grow Clean Heat exports are Ireland, Germany and the USA
- The Clean Heat sector is active in innovation, with one third of companies stating that they are currently developing/planning a new Clean Heat product or service
- Employment in the Clean Heat sector is spread across a range of sub-sectors. Heat pumps (40.7%), building energy efficiency (29.5%) and biomass/biogas/anaerobic digestion (11.6%) account for more than 80% of Clean Heat employment, combined. The remaining jobs are present in district and heat networks (5.2%), thermal storage (3.8%), direct electric heat (3.4%), other Clean Heat (1.9%), solar thermal (1.7%), digital and smart technology (1.5%) and geothermal (1.1%)
- The Clean Heat sector can also be segmented by position in the supply chain with manufacturing representing the largest segment, based on employment (47.6%), followed by installers (22.4%), sales/distribution (11.2%), consultants (8.5%), other (6.0%) and contractors (4.3%)

- A wide range of barriers to growth of the Clean Heat sector were identified including market conditions, funding and finance, skills supply and availability of staff, regulations, policy and technical barriers
- Most of the opportunities identified were company specific. From a sector perspective, opportunities were identified to increase capital investment and revenue support incentives for Clean Heat products and services; improving regulation relating to functioning of electricity markets and building standards and; improve consumer awareness of a broad range of Clean Heat solutions with independent advice

Appendices

Appendix A – Economic assessment methodology

Introduction

This appendix details and discusses our approach to estimate the economic impact of the Scottish Clean Heat Sector. It details our approach, methodology, data limitations and ways to address these limitations. It has been prepared to define our methodology and offer a basis for an assessment of its suitability to assess the economic impact of other sectors (e.g. hydrogen and offshore wind).

Approach

Our approach can be summarised, at a high level as including:

- Building a list of companies that represent the total Clean Heat sector in Scotland
- Gather available information on these companies via desk-based research, including a breakdown of activity by Clean Heat sub-sector and position in the supply chain
- Conduct a telephone survey to gather primary information directly from a sample of companies
- Analysing the resulting data to estimate total GVA, turnover, exports and jobs and a breakdown by Clean Heat sub-sector and position in the supply chain

In more detail, it has nine steps:

1. Identifying the companies active in the Clean Heat sector in Scotland using available databases (e.g. the [Scottish Industry Directories Green Heat database](#) and Scottish Enterprise internal data) and a novel artificial intelligence driven industry analysis tool developed by [The Data City](#), which includes over 5 million businesses and 350 emerging sector classifications (including '[Net Zero Heating](#)'). This provided us with an initial database of the total population of companies active in Clean Heat, with an operational presence in Scotland
2. Downloading data, where available, for each listed company from the FAME company information database (supplemented by data from Companies House) to include the latest available and historic turnover, overseas sales (exports) and job numbers. Estimated data is provided by FAME for some fields where no actual data is available. For example, small companies can submit restricted accounts to Companies House which do not declare turnover. FAME has developed proprietary methods of estimating turnover (and other data points) from the data that is available but do not provide detail on how these estimates are available, due to them being a source of competitive advantage. Both actual and estimated data on turnover and employment from FAME has been used in the desk-based analysis
3. Reviewing each company in the total population (predominately using each company's website) to confirm that the company meets the criteria of being active in one or more Clean Heat sub-sectors and has an operational location in Scotland. For companies confirmed as being in the Clean Heat sector in Scotland, identify whether the company can reasonably be classed as generating all turnover from clean heat activities and whether they have operational locations only in Scotland. For companies that meet both these conditions, an assessment is also made of a reasonable percentage split of turnover across the different Clean Heat sub-sectors (heat pumps, heat networks, building energy efficiency, smart-heat technology, geothermal, biomass, direct electric heat, solar thermal and thermal storage) and of its position in the supply chain (manufacturing, distribution, contractors, installers, and

consultants). For all companies in the target population, a contact name, position and telephone number were also identified (an email address was also be gathered if it is obviously available).

4. Segmenting the desk-research based company database into two parts:
 - a) Companies generating all turnover from clean heat activities and having operational locations only in Scotland
 - b) Companies with a wider range of activities where the scale of clean heat activity cannot be reasonably assessed via desk-based research.

Part a) is considered robust data and will be used further below, while part b) will not be used as it does not provide accurate data on each company's Clean Heat activities.

5. Carrying out a telephone survey, using the whole population as a target list and aiming to obtain primary data from around 20% to 25% (typical of a survey of this nature), including information on turnover, exports and jobs. The survey also included other questions to assess historic economic performance and views on the future trends. The survey asked respondents to identify the proportion of turnover that can be attributed to the Clean Heat sector and, within this, a percentage breakdown of Clean Heat turnover by sub-sector clean heat sector and position in the supply chain
6. Combining the data on turnover, exports and jobs gathered from the desk-based research with the data gathered via the primary research. Priority was given to the data collated via the company survey where data was available from both desk research and company survey
7. Calculating the turnover, exports and employment of the sample of companies by sector, sub-sector and supply chain position. To enable these calculations, relevant desk-based data and company data had to be present. In the case of the desk-based data, employment numbers were typically available for both the latest current year and two years prior to that (enabling growth trends to be identified). However, desk-based data on current turnover was less complete (even with estimated data included) and there was very limited historic data on turnover. In the case of data obtained from company survey responses, the data included point data for overall Scottish turnover and employment in Scotland. If a company did not know, or chose to withhold point data, they were asked to select from a number of ranges for turnover and employment. In the analysis, the mid-point of the range data was used as an estimate for relevant companies. In addition to this data, companies were asked to provide a breakdown of total Scottish turnover by both Clean Heat sub-sector and position in the Clean Heat supply chain. More respondents provided a supply chain position breakdown than a sub-sector breakdown and both sets of data were used to estimate GVA, turnover and jobs, resulting in two different (but similar) estimates for the sample. For exporting data and trend analysis of jobs and turnover, respondents were asked to provide further data for exports and historic data for turnover and jobs.
8. Translating company specific turnover and employment data into economic impact data (i.e. gross value added (GVA)) using data on GVA per employee for relevant two-digit SIC Code classifications published in the [Scottish Annual Business Statistics](#) (SABS), with the latest available revision of this data being for 2021. In 14 cases the two-digit SIC code was either not present on the Companies House website (due to the legal structure being a Limited Liability Partnership) or not representative of a company's actual activity (e.g. classified as 'Activities

of a Head Office' instead of an actual manufacturing facility). In these cases, the most relevant two-digit SIC code to use was assessed through examination of the company's website.

9. Estimating population level data by
 - a) Calculating a company average (mean) of GVA, turnover, exports and jobs using the data from the sample of companies (desk and primary research results combined).
 - b) Excluding outlier data by calculating the mean per company figures for GVA, turnover, jobs and exports and then excluding any outliers where data points are more than twice the standard deviation from the mean.
 - c) Recalculating the mean to identify a final set of average 'per company' estimates for GVA, turnover, jobs and exports.
 - d) Applying these figures to the number of companies in the remaining population to gross up the data to a population level.
 - e) Adding the outlier data back to allow an estimation of the economic value of Clean Heat in Scotland
 - f) A breakdown of the total population by sub-sector and position in the supply chain is made using the overall breakdown based on sample data (with outlier companies excluded from the calculation then added back to the estimated sub-sector and supply chain stage splits)

Data limitations with this methodology

Publicly available data via subscription services such as the FAME company database

The turnover, export and jobs data for each individual company identified as active in the clean heat sector was identified via the FAME company database tool. This approach has some pros and cons, as follows:

Pros

- Simple approach to access company level data, where available
- Historic company data can typically be accessed

Cons (Issues)

- Data for FAME provides total company turnover, exports, jobs data. If a company generates sales from activities that are not related to Clean Heat, then this data will over-estimate the scale of economic contribution of Clean Heat
- Data available via FAME is typically not complete. Experience suggests that not all companies will have turnover and jobs figures available. FAME does calculate estimates of turnover and jobs based on other (non-turnover) financial information in the public domain. Experience also suggests that data on jobs is likely to be the most complete dataset as all company annual accounts typically have data on employment numbers
- There is no company information from this source to enable an accurate allocation to its Clean Heat sub-sector and supply chain position. Where it is assessed that the company is only active in clean heat and only employs people in Scotland, a desk-based review of the company website is used as the basis to estimate the percentage split of both sub-sector and supply chain position. This has the potential to introduce error into the calculation, particularly in cases where the company states it is active in several clean heat sub-sectors and supply chain positions

- Companies House records provides data for the whole company across all operations within the Limited company boundaries. The data for companies with operational locations (and jobs) based outside of Scotland will overestimate the size of the Clean Heat sector to the Scottish economy

Therefore, the approach is valid to use for companies that carry out very specific activities at well-defined locations (i.e. if the company is 100% active in Clean Heat AND is only employing people in Scotland).

Gathering the economic data by surveying companies

A structured company telephone survey was used with a supporting online version of the survey.

The pros and cons of this approach are as follows

Pros

- Can obtain historic, current and future company information for Clean Heat activities in Scotland and by Clean Heat sub-sector and position in the supply chain for those companies that respond to the survey (where they provide all the data required to run the necessary calculations)

Cons (Issues)

- It is assumed that a comprehensive list of Scottish-based companies active in clean heat has been identified. However, it is likely that not all companies are actually included, particularly those where clean heat is only a small part of their overall activities. This is likely to lead to a lower total population number of clean heat companies and this is used when grossing up the sample results using average 'per company' estimates
- Time consuming approach to identify contact names, positions, telephone numbers and (where easily available) email addresses
- Time consuming approach to carry out a structured survey, contacting whole population of 400+ companies to obtain 80 to 100 responses (typical response rate is 20% to 25% for telephone surveys of this nature, based on previous experience)
- Dependent on companies agreeing to provide all the data necessary to run the calculations. For example, some companies provided overall Scottish turnover and employment but not the breakdown by sub-sector or supply chain position, meaning that an estimate for Clean Heat economic contribution could not be made for that company
- Calculation of economic data will require a "grossing-up" approach to convert survey sample data to full population data. Although this is a commonly used technique in economic analysis it does introduce some error through the use of average 'per company' estimates of GVA, turnover, jobs and export data
- Some respondents preferred to provide turnover and job numbers by selecting from a pre-defined list of range values rather than a point value. Where this occurred, a point value was estimated using the mid-point of the selected range. This has the potential to introduce error into the calculations but does increase the number of datapoints available

Our approach can, therefore, be presented as follows:

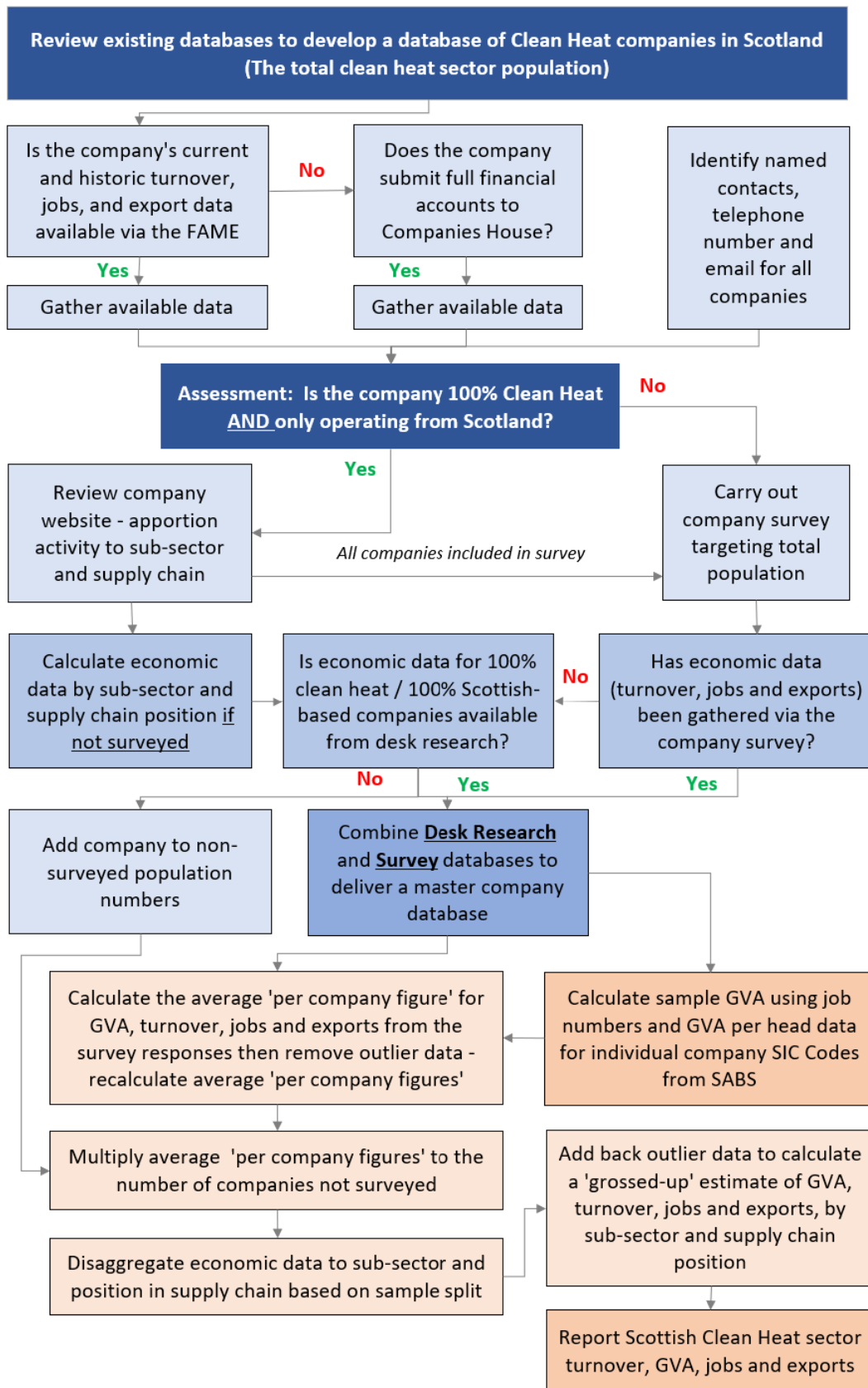


Figure 22: Economic Data Desk Research And Economic Analysis Approach

Appendix B – Company Survey Questionnaire

Scottish Enterprise: The Value of Clean Heat in Scotland

Optimat (Final version)

Background and Introduction

This survey is being carried out for Scottish Enterprise by market research consultants. Optimat Limited and CJM Research. The purpose of the research is to provide Scottish Enterprise with evidence about the how the Clean Heat sector contributes to the Scottish economy and how it can best develop support to help companies in the sector to grow. The survey should take around 7 minutes to complete. A copy of the summary report for this study will be made freely available online and can also be emailed to you, if you select this option during the survey.

For the purposes of this study, the Clean Heat sector includes companies active in heat pumps, district and heat networks, building energy efficiency, geothermal, Biomass/Biogas/Anaerobic Digestion, direct electric heat, solar thermal, thermal storage and digital tech/smart systems targeted at one or more of these sub-sectors.

The survey asks for information about turnover, jobs, exports, innovation activities and other business information. Participation is voluntary and all data will be aggregated, so no company level data will be disclosed in the report produced. Scottish Enterprise will be able to view individual company responses for the purpose of better understanding the company base performance and future needs. Any personal data collected (e.g. name, email, opinions, etc.) will be retained only for the purposes of this study and then deleted in line with Optimat's Document and Data Control procedures.

GDPR Statement

The data will be controlled and processed by Optimat Limited and Scottish Enterprise. CJM Research will also process the data. All data will be held securely in line with the data privacy policies of Scottish Enterprise, Optimat and CJM Research which are available to view online from the following websites:

<https://www.scottish-enterprise.com/help/privacy-notice>
<https://www.optimat.co.uk/privacy-policy.html>
<http://www.cjmresearch.co.uk/Data%20Privacy/>

By taking part in this survey, you agree to the use of your anonymised data for this research. Please tick the box below to show you understand the above and give permission for your data to be processed in this way. Please note you can withdraw your consent to use your personal data at any time.

GDPR **Please tick the box below to show you understand the above and give permission for your data to be processed in this way**

I agree to participate in this survey
If you do not wish to participate in this survey please close your browser window.

Please press "next" below to begin the survey.

Interview details (for interviewers only)

Company Index Number from call list

Date **Please write date of interview**

Interviewer **Please code your name below:**

Bill Gay Optimat consultant
 Deborah Marjorie Other

Your details

Please complete the following information:

Your company name
 Name of person completing survey
 Job/role title

Contact phone number
 Contact email address

Q1a Which of the following describes your company's involvement in the following Clean Heat sub-sectors? Note 'currently active' means you have already generated turnover in the selected sub-sector

		Currently Active	Not currently active but may be interested in future	Not currently active and no intention to become active in future
Q1a	Heat pumps (including ground source heat pumps with less than 200m vertical boreholes)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1b	District and heat networks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1c	Building energy efficiency (including insulation, waste heat recovery, deep retrofit, HVAC, refrigeration & cooling)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1d	Geothermal (including systems with 200m or greater vertical boreholes)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1e	Biomass/Biogas/ Anaerobic Digestion (including biomass boilers and wood fuel/pellet supply)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1f	Direct electric heat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1g	Solar thermal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1h	Thermal storage (including water storage tanks and heat batteries)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q1i	Digital technology/smart systems (with applications in any of the above Clean Heat sub-sectors)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q2 Are you involved in any other clean heat sectors?

Yes, currently active Answer Q2a Not currently active but may be interested in future .. Answer Q2a Not involved in any other sectors Go to Q5

Q2a Please tell us the other clean heat sectors you are involved in or would like to be involved in

INTERVIEWER

1. If respondent is active in any of the sectors but not interested in others they go to Q5.
2. If respondent is active in any of the sectors above continue AND they ALSO expressed interest in other sectors they should answer relevant parts of Q3a to Q4j. Then go to Q5.
3. If respondent is not currently active in any but may be interested in future for any then answer relevant parts of Q3a to Q4j then go to Q31.
4. If respondent answers 'Not currently active and no intention to become active in future' to ALL Clean Heat sub-sectors (including 'Other') then thank and end survey [not to be counted as a survey response] Online they will go to Q36.

Interest in sectors

Q3a For the Clean Heat sub-sectors you have indicated a potential interest in, which of the following best describes the likely timescale of becoming active? Tick one on each row

		Within the next year	Between 1 and 3 years	Over 3 years	Don't know
Q3a	Heat pumps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3b	District and heat networks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3c	Building energy efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3d	Geothermal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3e	Biomass/Biogas/ Anaerobic Digestion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3f	Direct electric heat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3g	Solar thermal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3h	Thermal storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3i	Digital technology/smart systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q3j	Other clean heat sectors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Q4a For the Clean Heat sub-sectors you have indicated a potential interest in, where do you intend to make sales? Tick all that apply

		Scotland	Rest of Uk	Rest of World	Don't know
Q4a	Heat pumps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4b	District and heat networks	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4c	Building energy efficiency	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4d	Geothermal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4e	Biomass/Biogas/ Anaerobic Digestion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4f	Direct electric heat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4g	Solar thermal	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4h	Thermal storage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4i	Digital technology/smart systems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q4j	Other clean heat sectors	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Supply chain

Q5 **Which of the following best describes your company's current position in the Clean Heat supply chain? Tick all that apply**

- Manufacturer of parts, components, systems or end products used in Clean Heat
- Sales/Distribution of parts, components, systems or end products used in Clean Heat.....
- Contractor (including groundworks, building construction/adaptation, etc.)
- Installer (including mechanical and electrical, clean heat systems installation/commissioning, etc.).....
- Consultant (including feasibility/design engineering, surveys, site testing, planning and EIA, legal and financial, etc.).....
- Any other (please detail).....

Q5a **Please tell us the other position in the Clean Heat supply chain you are involved in**

Employees

Q6 **Are you able to provide the number of staff you currently employ within Scotland? This is the total employment at Scottish based business operations, not just those involved in Clean Heat related activities**

- Able to provide this information Answer Q6a
- Not able to provide specific staff numbers Answer Q6b

Q6a **How many employees does your organisation currently have based in Scotland? This is the 'head count' and should not distinguish between full and part time employment. This should also not include contractors or temporary staff**

Now go to Q7

Q6b **Please estimate the number of staff you currently have based in Scotland:**

- | | | | |
|--|--|--|---|
| 0..... <input type="checkbox"/> | 26 to 50..... <input type="checkbox"/> | 151 to 200..... <input type="checkbox"/> | 750 to 1000..... <input type="checkbox"/> |
| 1 to 5..... <input type="checkbox"/> | 51 to 75..... <input type="checkbox"/> | 201 to 250..... <input type="checkbox"/> | 1000+..... <input type="checkbox"/> |
| 6 to 10..... <input type="checkbox"/> | 76 to 100..... <input type="checkbox"/> | 250 to 499..... <input type="checkbox"/> | Rather not answer..... <input type="checkbox"/> |
| 11 to 25..... <input type="checkbox"/> | 101 to 150..... <input type="checkbox"/> | 500 to 749..... <input type="checkbox"/> | |

Turnover

Q7 **Are you able to tell me your organisation's actual turnover figure for the last financial year for your operations in Scotland? This is the turnover generated by all Scottish based business operations, not just for Clean Heat related activities.**

This information will be aggregated when reported and no individual results will be reported

Able to provide this information Answer Q7a

Not able to provide specific turnover Answer Q7b

Q7a **What is the turnover generated from the organisation based in Scotland in the last financial year?**

Write this as a full number e.g. 700k should be written as 700000 with no commas and no £ sign

Now go to Q8

Q7b **Can you estimate your organisation's turnover generated from the organisation based in Scotland in the last financial year?**

- | | | | |
|--|---|--|--|
| Pre-trading or £0 <input type="checkbox"/> | £500K+ to £1m .. <input type="checkbox"/> | £10m+ to £15m.. <input type="checkbox"/> | £40m+ to £50m.. <input type="checkbox"/> |
| Less than £50K .. <input type="checkbox"/> | £1m+ to £2m..... <input type="checkbox"/> | £15m+ to £20m.. <input type="checkbox"/> | £50m+ to £100m <input type="checkbox"/> |
| £50K to £249K ... <input type="checkbox"/> | £2m+ to £5m..... <input type="checkbox"/> | £20m+ to £30m.. <input type="checkbox"/> | £100m+..... <input type="checkbox"/> |
| £250K+ to £500K <input type="checkbox"/> | £5m+ to £10m.... <input type="checkbox"/> | £30m+ to £40m.. <input type="checkbox"/> | Rather not answer <input type="checkbox"/> |

Clean Heat sub-sector breakdown and position in the supply chain

Q8 **Which of the following best describes the turnover generated by your Scottish operations?**

All turnover from our Scottish operations is generated by the sale of Clean Heat products or services..... Do not ask Q10k

Some turnover from our Scottish operations is generated by the sale of products or services that are not classed as Clean Heat Ask Q10k

Q9 **Are you able to provide an approximate percentage breakdown of your turnover from Scottish based operations by the Clean Heat sub-sectors you are currently active in, including activities not related to Clean Heat (if relevant)?**

Yes Answer Q10a to Q10j depending on the options selected at Q1a to Q1i

No..... Go to Q11

Q10 What proportion of the total turnover from your Scottish operations is attributable to the following activities?
Please write the percentage as a whole number e.g. 75% should be written as 75. If 0 please write 0 or leave blank do not write anything else. Total should add up to 100%

Q10a	Heat pumps	<input type="text"/>	%
Q10b	District and heat networks	<input type="text"/>	%
Q10c	Building energy efficiency	<input type="text"/>	%
Q10d	Geothermal (including systems with 200m or greater vertical boreholes)	<input type="text"/>	%
Q10e	Biomass/Biogas/ Anaerobic Digestion	<input type="text"/>	%
Q10f	Direct electric heat	<input type="text"/>	%
Q10g	Solar thermal)	<input type="text"/>	%
Q10h	Thermal storage	<input type="text"/>	%
Q10i	Digital technology/smart systems	<input type="text"/>	%
Q10j	Other clean heat sectors	<input type="text"/>	%
Q10k	Sales of products or services <u>not related to Clean Heat</u> (this is the difference between the above and 100%)	<input type="text"/>	%
Q10l	Total (Should equal 100)	<input type="text"/>	%

Q11 Are you able to provide an approximate percentage breakdown of your Clean Heat turnover from Scottish based operations by your position(s) in the Clean Heat supply chain (e.g. manufacturer, distributor, contractor, installer, etc.)?

Yes Answer Q12a to Q12f depending on the options selected at Q5
 No Go to Q13

Q12 What proportion of the total turnover from your Scottish operations is attributable to the following supply chain activities?
Write the percentage as a whole number e.g. 75% should be written as 75. If 0 please write 0 or leave blank do not write anything else. Total should add up to 100%

Q12a	Manufacturer of parts, components, systems or end products used in Clean Heat	<input type="text"/>	%
Q12b	Sales/Distribution of parts, components, systems or end products used in Clean Heat	<input type="text"/>	%
Q12c	Contractor (including groundworks, building construction/adaptation, etc.)	<input type="text"/>	%
Q12d	Installer (including mechanical and electrical, clean heat systems installation/commissioning, etc.)	<input type="text"/>	%
Q12e	Consultant (including feasibility/design engineering, surveys, site testing, planning and EIA, legal and financial, etc.)	<input type="text"/>	%
Q12f	Other clean heat sectors	<input type="text"/>	%
Q12g	All other activities <u>not related to Clean Heat activities</u> (this is the difference between the above and 100%)	<input type="text"/>	%
Q12h	Total (Should equal 100)	<input type="text"/>	%

Recent turnover and jobs levels related to Clean Heat

Q13 **How long has your business been trading?**

Trading for three or more years Go to Q13a

Trading for less than three years Go to Q16

Q13a **Which of the following options best describes the change in your current Clean Heat turnover, generated from your Scottish based operations now, compared to three years ago? Our current turnover from Clean Heat products and services generated from our Scottish operations has:**

Declined compared to three years ago Go to Q14

Remained at a similar level to three years ago Go to Q14b

Increased by up to 50% compared to three years ago Go to Q14

Increased by more than 50% compared to three years ago..... Go to Q14

Unsure/Don't know Go to Q14b

Q14 **Are you able to provide an approximate percentage increase or decrease in your Clean Heat turnover, generated from your Scottish based operations, over the last three years?**

Yes, able to provide figures Go to Q14a

No, not able to provide figures Go to Q14b

Q14a **What has been the percentage increase or decrease in your Clean Heat turnover, generated from your Scottish based operations, over the last three years**

Please provide an approximate percentage written as a whole number (e.g. an increase of 15% should be written as 15; a decrease of 15% should be written -15).

Q14b **Which of the following options best describes the number of staff employed in Scotland related to Clean Heat activities now, compared to three years ago?The number of staff employed in Scotland related to Clean Heat products and services has:**

Declined compared to three years ago Go to Q15

Remained at a similar level to three years ago Go to Q16

Increased by up to 50% compared to three years ago Go to Q15

Increased by more than 50% compared to three years ago..... Go to Q15

Unsure/Don't know Go to Q16

Q15 **Are you able to provide an approximate increase or decrease in the number of staff employed in Scotland, related to Clean Heat activities, over the last three years?**

- Yes, able to provide figures Go to Q15a
No, not able to provide figures Go to Q16

Q15a **What has been the approximate increase or decrease in the number of staff employed in Scotland, related to Clean Heat activities, over the last three years? This is the 'head count' and should not distinguish between full and part time employment. This should also not include contractors or temporary staff**

Please provide an approximate percentage written as a whole number (e.g. an increase of 15% should be written as 15; a decrease of 15% should be written -15).

Expected future turnover and jobs levels related to Clean Heat

Q16 **Which of the following options best describes your expectations for of Scottish based Clean Heat turnover over the next three years? Our turnover from Clean Heat products and services from our Scottish operations in three years time is likely to:**

- Decline compared to current levels
Remain similar to current levels.....
Increase by up to 50% compared to current levels
Increase by more than 50% compared current levels
Unsure/Don't know

Q17 **Which of the following options best describes your expectations for of Scottish based Clean Heat employment over the next three years? Our employment from Clean Heat products and services from our Scottish operations in three years time is likely to:**

- Decline compared to current levels
Remain similar to current levels.....
Increase by up to 50% compared to current levels
Increase by more than 50% compared current levels
Unsure/Don't know

Customers

Q18 **What type(s) of customer do you sell Clean Heat products and services to?**
Tick all that apply

- Local Authorities – Housing
- Local Authorities - all other
- NHS
- Higher/Further Education
- Other public sector (please detail)
- Registered Social Landlords/Housing Associations (non- Local Authority)
- Private sector – commercial & industrial
- Private sector – domestic households
- Other (please detail)
- Don't know/ rather not answer

Q18a **What is your other type of public sector customer**

Q18b **What is your other type of customer**

Q19 **Which geographical areas do your Scottish Clean Heat operations operate?**
Tick all that apply

- Scotland..... Go to Q20 and Answer Q21a
- Rest of UK Go to Q20 Answer Q21b
- Rest of world Go to Q20 Answer Q21c and Q22

Q20 **Are you able to provide an approximate percentage breakdown of your Clean Heat turnover from Scottish based operations by geographical location (Scotland/Rest of UK and International)?**

- Yes Go to Q21a, Q21b and/or Q21c based on options selected at Q19
- No Go to Q22 if Rest of World selected at Q19 or Q25 if Rest of world not selected at Q19

Q21 **What proportion of your Clean Heat turnover, from Scottish based operations, are attributable to the following geographical areas?**

Please write the percentage as a whole number e.g. 75% should be written as 75. If 0 please write 0 or leave blank do not write anything else. Total should add to 100%

- Q21a Scotland %
- Q21b UK outside Scotland %
- Q21c Rest of world %
- Q21d Total (should add to 100) %

If company does not sell to "rest of world" now go to Q25

Q22 Which of the following overseas geographical markets do you currently sell Clean Heat products and services into? Tick all that apply

- | | | | | | |
|---------------------|--------------------------|---------------------|--|--------------------------|---------------------------------|
| EU | <input type="checkbox"/> | Answer Q23a to Q23c | Caribbean, Central and South America | <input type="checkbox"/> | Go to Q24 |
| Other Europe | <input type="checkbox"/> | Go to Q24 | Australia or other Oceania .. | <input type="checkbox"/> | Go to Q24 |
| Middle East | <input type="checkbox"/> | Go to Q24 | Other not listed (please specify | <input type="checkbox"/> | Answer below and then Go to Q24 |
| Africa | <input type="checkbox"/> | Go to Q24 | Do not know/ rather not answer..... | <input type="checkbox"/> | Go to Q24 |
| Asia | <input type="checkbox"/> | Go to Q24 | | | |
| North America | <input type="checkbox"/> | Go to Q24 | | | |

Please list the other geographical market you currently sell clean heat to

Q23 Please name the three main EU countries you sell to (if no EU countries leave blank)

Q23a	Target country 1	<div style="border: 1px solid black; height: 24px;"></div>
Q23b	Target country 2	<div style="border: 1px solid black; height: 24px;"></div>
Q23c	Target country 3	<div style="border: 1px solid black; height: 24px;"></div>

Q24 How long has your company been exporting Clean Heat products and services from your Scottish based operations?

- Less than three years Go to Q25
- Three or more years Go to Q24a
- Don't know Go to Q25

Q24a Which of the following options best describes the current value of exports of your Scottish based Clean Heat activities compared to the export value three years ago? Our exports of Clean Heat products and services from our Scottish operations have:

- Declined compared to current levels
- Remained at a similar level to three years ago
- Increased by up to 50% compared to current levels
- Increased by more than 50% compared current levels.....
- Unsure/Don't know

Q25 Do you plan to begin or increase exporting Clean Heat products and services in the next three years?

- Yes, plan to begin exporting Go to Q25a
- Yes, plan to increase exports Go to Q25a
- No, do not plan to export over next 3 years..... Go to Q27
- Unsure/ Don't know..... Go to Q27

Q25a **Which of the following options best describes your expectations for the value of exports your Scottish based Clean Heat activities in three years time? Our future exports of Clean Heat products and services from our Scottish operations is likely to:**

- Decline compared to current levels
- Remain similar to current levels.....
- Increase by up to 50% compared to current levels
- Increase by more than 50% compared current levels.....
- Unsure/Don't know

Q26 **Please identify the top three target countries for beginning or increasing your exports of Clean Heat products and services. Please name up to three countries**

Q26a Target country 1

Q26b Target country 2

Q26c Target country 3

Innovation/ new products and services

Q27 **Which of the following best describes your company's current innovation and new product/ service introduction** *Tick all that apply*

- We have already developed a new clean heat product/service that is now being sold Answer Q27a
- We are currently developing/planning a new clean heat product/service Answer Q27b
- We have no plans to develop new clean heat products/services within the next three years Go to Q28

Q27a **Please briefly describe the Clean Heat product(s)/ service(s) you have already developed and is being sold**

Q27b **Please briefly describe the new product(s)/ service(s) you are currently developing or are planning to develop**

Your suppliers

Q28 To enable your company to sell Clean Heat products and services from your Scottish operations, do you have to buy in goods and services (excluding general office, accounting and facilities management supplies)?

- Yes Go to Q28a
- No..... Go to Q31
- Don't know..... Go to Q31

Q28a Where are your main suppliers of goods and services (excluding general office, accounting and facilities management supplies) located? (please tick all that apply)

- Scotland Go to Q29
- UK outside Scotland Go to Q31
- Rest of World..... Go to Q31

Q29 Would you be willing to identify your key Scottish based suppliers to help Scottish Enterprise develop their understanding of the Clean Heat supply chain in Scotland? These companies would not be named in the public report.

- Yes Answer Q30a to Q30c
- No, would prefer not to Go to Q31

Q30 Please name up to three of your most significant (by value) Scottish suppliers and the types of goods and services they provide. Please provide a company name and brief description of the types and goods and services supplied. The value of spend is not required

Q30a	Supplier 1	
Q30b	Supplier 2	
Q30c	Supplier 3	

Growth of Clean Heat - barriers and opportunities

Q31 Do you believe there are any barriers facing companies like yours growing sales of Clean Heat products and services

- Yes, barriers Answer Q31a
- No, barriers Go to Q32
- Do not know Go to Q32

Q31a Please briefly state any barriers your company faces in growing sales of Clean Heat products and services from your Scottish operations. If the barriers are specific to certain Clean Heat sub-sectors, then please identify this in your response.

Q32 Do you believe there are any opportunities for companies like yours to grow sales of Clean Heat products and services?

- Yes, opportunities Answer Q32a
- No, opportunities Go to Q33
- Do not know Go to Q33

Q32a Please briefly describe the main opportunities to grow sales of Clean Heat products and services from your Scottish based operations. If the opportunities are specific to certain Clean Heat sub-sectors, then please identify this in your response.

Support and provision of report

Q33 **Would your company like to be contacted by Scottish Enterprise to discuss the support they offer to support companies active, or are seeking to become active in the Clean Heat sector?**

Yes Go to Q33a

No..... Go to Q35

Q33a **Are you the best person for this initial contact?**

Yes Go to Q35

No..... Go to Q34a

Q34 **Please provide the contact information for the most appropriate person for this initial contact**

Q34a Name

Q34b Job title

Q34c Email

Q34d Telephone

Q35 **We would like to acknowledge contributors to this study in an Appendix to the report. Would it be okay to name your company as a contributor (no individuals will be named, only company names)?**

Yes, please acknowledge our company name

No, please exclude our company name from the report.....

Q36 **Would you like to receive a summary copy of the report produced as a result of this study?**

Yes, please send to the contact email provided at the start of the survey.....

Yes, please send to an alternative/additional email address

No do not want a copy of the report

Please provide the email address this should be sent to:

Q37 **Do you have any final comments or additional information to add?**

Yes Answer Below

No..... Thank and close

Please write the comments below:

Thank you for completing this survey, the results of which will improve Scottish Enterprise's understanding of the size and nature of the Clean Heat sector in Scotland and how best to support it's growth.

Appendix C – List of study contributors

This appendix includes a list of companies that consented to be named as contributors to the study. Other companies also contributed but elected to remain anonymous.

1314 Renewables Limited	Loco Home Retrofit Community Interest Company (CIC)
1st Class Gas Limited	MB Services Group (Scotland) Limited
AD Heating Limited	MCA Renewables Ltd
ADC Energy	McDonald Water Storage Ltd
Agile Energy Recovery (Inverurie) Limited	Ness Engineering Limited
Airsource1(Highland) Limited	NUERGY Ltd
Anderson Strathern LLP	Optimum Heating and Renewables Limited
Angus Biofuels Ltd	Panasonic Heating and Cooling UK
Badenoch Land Management Limited (Alvie Estate)	Power Circle Ltd
BisKit Controls Limited	Pure Energy (Regen) Ltd
Black Isle Renewables Limited	Pyro Yield Ltd
Carbon Dynamic (Scotland) Limited	R S Garrow Ltd
Castletown Law Limited	RECIRC Energy Limited
CJC Plumbing and Renewables Limited	Scottish Power (Iberdrola Group)
DBSA Ltd	Scottish Water Horizons
Dunster Biomass Heating (Scotland) Ltd	Shadeplus (Tensarc Ltd)
E.R Massie and Son Ltd	Shetland Heat Energy and Power Limited
Eco Alba Limited	Solariskit Ltd
Ferguson Energy Limited	Soltropy Limited
FES group	SSE Energy Solutions
Flexel International ltd	Star Renewables Limited
Forster Roofing Services Limited	Sunamp Limited
FWS Consultants Limited	Surface Heating Systems Limited
Gecko Glazing Ltd.	Synergie Environ Limited
Geothermal Power Limited	Teno Energy Ltd
Glendevon Energy Company Ltd	The BSS Group Limited
Greystone Energy (Scotland) Ltd	The Electric Heating Company Limited
Heating Appliances & Spares Ltd T/A HASL	The Energy Training Academy
Hemiko Limited	ThermaFY Group Ltd
Hydrock Consultants Ltd	Thermoelectric Conversion Systems Ltd
IMS Heat Pumps Limited	Total Energy Solutions Scotland Limited
Industrial Nature Ltd t/a IndiNature	Turnbull & Scott (Engineers) Limited
Innes & Black LLP t/a SimplySaveit	Vattenfall Heat UK Limited
ITPEnergised	Vital Energi
Key Facilities Management Ltd	Warmworks Scotland LLP
L W Haddow Plumbing & Heating Limited	Whittaker Engineering (Stonehaven) Limited
Latent Heat Limited	

Appendix D – Detailed results of the economic assessment

A total of 117 company survey responses were obtained, with 25 online surveys and 92 telephone surveys carried out. In addition to this, desk-based data was obtained for 47 companies assessed as being 100% active in Clean Heat and 100% based in Scotland. There were 17 companies that completed the survey and were also included in the list of companies where desk-based data was identified. For 16 of these duplicate companies, the company survey data was assumed to be more accurate and used in the analysis. In the case of one of the duplicate companies, the desk-based data was used because of the limited data provided during the survey response.

Use of range data to estimate point values

Of the 117 company survey responses, the economic data on turnover and jobs provided included:

- Employment data (total number of employees based in Scotland, not just those involved in Clean Heat)
 - 87 provided a point value for current number of employees
 - 107 provided either a point value or range value for employees (with the latter selected from a list of pre-defined employee number ranges)
- Turnover data (generated from all Scottish based operations, not just Clean Heat)
 - 31 provided a point value for the turnover in the latest available financial year
 - 94 provided either a point value or range value of turnover (with the latter selected from a list of pre-defined turnover ranges)

Whilst the level of confidence in the sample data increases as the response rate increases, it is also recognised that there is a trade-off between the accuracy of point data provided by the respondent and the potential error introduced by estimating values from data range values.

The question arises of how a point value is derived from the range data in a way that reduces either over or underestimated effects. For example, if the respondent selects turnover to be in the range £1m to £2m then it is obvious that the point value will be minimum of £1m and maximum of £2m. In order to test how the extreme points of the sample range data compare to the point value estimates of the sample, an average turnover per head was calculated using the point data, where this was provided for both turnover and employment. A total of 26 companies provided point values for both turnover and employment. The mean turnover per head from this sample is £152,711 (£135,963 with outliers removed).

A total of 55 respondents provided range values for turnover and point values for employment. The mean turnover per head was calculated for the minimum point in the selected range, the maximum point and the mid-point. This allows for comparison of these three estimates with the mean based on the point values provided. The comparison can be made both including and excluding outlier data. The results of this analysis is summarised in the table below.

	Point values	Min of range values	Mid-point of range values	Max of range values
Sample size	26	55	55	55
Mean Turnover per head (with outliers)	£152,711	£100,154	£153,565	£206,976
Mean Turnover per head (excl. outliers)	£135,963	£81,920	£120,758	£164,430

Table 1: Comparison of turnover per head estimates using different methods of estimating point values from ranges

Inspection of the data in the above table identifies that the estimates using the mid-points of the ranges are most consistent with the average turnover per head calculated using the point value data. Therefore, the mid-point values of the range data has been used to estimate point values where no point values have been provided.

There were only four responses where employment has been stated as ranges and point value provided for turnover. There is, therefore, insufficient data to carry out a similar analysis of converting range values of employment to point values. For consistency with the approach to turnover ranges, the employment ranges are converted to point values using the mid-point values.

It is useful to compare the estimates derived in the above table with the Scottish Government’s Scottish Annual Business Statistics 2021 data. For the whole economy (excluding financial sector and parts of agriculture and the public sector – as defined by SABS) the turnover per head for 2021 is £129,801 (dividing total turnover by total employment). Again the mid-point value estimate of the range is closest to this overall Scottish average.

Methods of estimating Clean Heat economic data from overall turnover and employment

The desk-based data on turnover and jobs was assumed to be 100% Clean Heat, as this was the basis for selecting the companies where the desk-based data could be used. However, companies responding to the survey were asked to provide data for their overall turnover and jobs in Scotland, then asked to apportion this to Clean Heat and non-Clean Heat activities. To address one of the key research questions for this study, the survey asked respondents to break down turnover by allocating relevant percentages to Clean Heat sub-sectors (and non-Clean Heat activities) and to positions in the Clean Heat supply chain (and non-Clean Heat activities). Different numbers of companies provided breakdowns for sub-sectors and supply chain position, as follows:

- Of the 137 companies where employment data was available (107 from survey, 30 from desk-research):
 - 86 also provided a breakdown of Clean Heat activity by sub-sector
 - 92 also provided a breakdown of Clean Heat activity by position in the supply chain

- Of the 124 companies where turnover data was available (94 from survey, 30 from desk-research):
 - 80 also provided a breakdown of Clean Heat activity by sub-sector
 - 87 also provided a breakdown of Clean Heat activity by position in the supply chain

Population estimates of turnover and jobs were estimated using both the sub-sector and position in the supply chain. Due to these estimates being based on slightly different sets of data the results also varied slightly, giving two point estimates for total current Clean Heat turnover and jobs in Scotland. It was agreed that these would be reported individually within this appendix but the value stated in the main report would be at the midpoint of the estimated figures based on the two approaches. The point value estimate is then rounded to avoid spurious accuracy. For employment, the estimate is rounded to the nearest hundred. For turnover, GVA and exporting, the estimate is rounded to the nearest billion to two decimal places.

The estimates for GVA were calculated based on employment, using GVA per head data, by two digit SIC Code, sourced from the Scottish Annual Business Survey data (latest available data for 2021).

A population level estimate for exporting of Clean Heat products and services was calculated using the Clean Heat turnover estimates by both the sub-sector and supply chain methods and combined with the data from the 36 respondents that also provided a percentage breakdown of the geographical location of their sales (enabling the proportion of Clean Heat turnover, which was exported outside of the UK, to be calculated).

Estimates of the change in turnover and jobs in the last three years were calculated using Clean Heat Turnover and jobs based on the method using the supply chain position derived data. The basis of this choice is that this is the method with a greater number of datapoints available. The change in Clean Heat GVA was calculated using the job number data combined with the GVA per head data from the SABS dataset.

Key economic data findings

A summary of the key economic data findings from the research are shown below.

	Sub-sector calculation method	Supply chain position calculation method	Point value estimate
Turnover	£1.60bn	£1.71bn	£1.66bn
Jobs	8,520	8,093	8,300
GVA	£0.72bn	£0.67bn	£0.69bn
Exports	£0.27bn	£0.25bn	£0.26bn

Table 2: Key measures of economic contribution of Clean Heat in Scotland

Key attributes of the sample data, from which the above figures were derived, are summarised below.

	Sub-sector calculation method	Supply chain position calculation method
Data sample size	80	87
Sample as percentage of population (472)	17%	18%
Mean (with outliers)	£6,020,765	£5,988,888
Median (with outliers)	£915,141	£1,023,446
Mode (with outliers)	£1,500,000	£375,000
Standard deviation	£28,943,605	£27,810,146
Definition of outlier	>£57,887,211	>£61,609,179
Mean (outliers removed)	£2,867,185	£3,094,639
Population estimate	£1,602,444,035	£1,709,575,202

Table 3: Turnover data – key attributes

	Sub-sector calculation method	Supply chain position calculation method
Data sample size	86	92
Sample as percentage of population (472)	18%	19%
Mean (with outliers)	34	31
Median (with outliers)	7	6
Mode (with outliers)	3	6
Standard deviation	143	137
Definition of outlier	>319	>305
Mean (outliers removed)	15	14
Population estimate	8,520	8,093

Table 4: Jobs data – key attributes

	Sub-sector calculation method	Supply chain position calculation method
Data sample size	86	92
Sample as percentage of population (472)	18%	19%
Mean (with outliers)	£2,747,184	£2,538,851
Median (with outliers)	£333,038	£278,316
Mode (with outliers)	£273,774	£273,774
Standard deviation	£14,169,419	£13,606,206
Definition of outlier	>£31,086,023	>£29,751,263
Mean (outliers removed)	£1,250,144	£1,154,678
Population estimate	£717,316,295	£672,352,034

Table 5: GVA data – key attributes

	Sub-sector calculation method	Supply chain position calculation method
Data sample size	36	36
Sample as percentage of population (472)	8%	8%
Mean (with outliers)	£5,743,086	£5,697,233
Median (with outliers)	£0	£0
Mode (with outliers)	£0	£0
Standard deviation	£33,581,816	£33,585,743
Definition of outlier	>£72,906,717	>£72,868,718
Mean (outliers removed)	£147,174	£100,011
Population estimate	£270,918,819	£248,705,114

Table 6: Export turnover data – key attributes

	Sub-sector calculation method	Supply chain position calculation method
Data sample size	36	36
Sample as percentage of population (472)	8%	8%
Mean (with outliers)	£1,591,789	£1,529,885
Median (with outliers)	£0	£0
Mode (with outliers)	£0	£0
Standard deviation	£6,411,567	£6,408,311
Definition of outlier	>£14,414,922	>£14,346,507
Mean (outliers removed)	£557,268	£493,596
Population estimate	£300,273,430	£270,283,851

Table 7: Rest of UK turnover data – key attributes

Recent growth in turnover over the past three years was estimated using data derived from the supply chain position breakdown. This method was selected as the supply chain position data for turnover had 87 data points compared to 80 data points for the sub-sector breakdown. However, only 13 respondents also provided turnover from three years ago, reducing the data sample size to 3% of the population of the 472 Clean Heat companies. Based on this data, it is estimated that Clean Heat turnover from Scottish based operations has increased by 52% over the last three years.

Recent growth in employment was calculated using the supply chain position derived data (with 92 datapoints on current employment compared to 86 if using the sub-sector breakdown method). Of the 92 companies providing data on current Clean Heat employment, only 39 also provided employment numbers for three years ago (8% of the population of 472 Clean Heat companies). Based on this data, it is estimated that employment in Scottish based Clean Heat sector has increased by 68% over the last three years.

Recent growth in GVA was calculated by using the jobs data derived from the supply chain position breakdown, combined with GVA per head data sourced from the Scottish Annual Business Statistics for 2021 (at a two-digit SIC Code level). Three companies did not have a SIC Code recorded in Companies House as they were Limited Liability Partnerships. In these cases, the most appropriate SIC Code was assigned based on experience of the consultant. A further 11 company SIC Codes were changed from what was recorded in Companies House as it was assessed that an alternative SIC Code would be more accurate (for example, Companies House recording a SIC Code of 9609, 'Other Service Activities not elsewhere classified' when SIC Code 3511 was more relevant 'Production of electricity'). Based on this approach, it is estimated that Scottish Clean Heat GVA has increased by 69% over the last three years.



Business
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