

Heating and Cooling Installer Study (HaCIS):

Literature Review



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Executive Summary

The UK Government commissioned IFF Research and ACE Research (ACE-R) to deliver the Heating and Cooling Installers Study (HaCIS). The aim was to help Government develop their understanding of the existing heating and cooling installer workforce in England and the extent to which they wish to, and can, be upskilled to install heat pumps. The study will inform Government policy on supporting the heating and cooling installer workforce as they transition to low carbon technologies. The study will also inform policy to support apprentices, create new green jobs, and support the Government's levelling up agenda.

As the first stage in the project, the ACE-R team conducted a literature review. This has helped the project to establish an in-depth understanding of what is known about the heating and cooling installer workforce. The review involved the synthesis of information from 73 sources of literature, including 63 academic 'white' papers and 13 pieces of industry produced grey literature. This report provides a summary of this evidence for BEIS and sets the context for the rest of the research.

A keyword search of the literature was combined with stakeholder engagement, which helped to identify and secure additional and emerging evidence and data.

The review aimed to answer five key research questions (RQs):

1. What are the characteristics and activities of heating and cooling installers?
2. How can installers be categorised into distinct archetypes based on their willingness to install heat pumps, and the upskilling required to do so?
3. To what extent can heating and cooling installers be upskilled to work on heat pumps?
4. What are heating and cooling installers' attitudes towards standards and accreditation for low carbon heating and what factors influence these views?
5. How might installer business models need to change to effectively install heat pumps, and what challenges could this pose for installers?

The quality and quantity of evidence relating to each research question was highly variable. The literature focused primarily on domestic installations and some sources were not specific to the heat pump sector. There was also a lack of quantitative data to substantiate claims.

Summary of Key Findings

The sector is dominated by SMEs and micro-businesses, and this will affect willingness and ability to upskill

The heating and cooling workforce is primarily made up of SMEs. SMEs can be cautious and risk-averse, preferring to work with known technologies and techniques rather than to innovate.

There is a high degree of confidence in the literature, and amongst stakeholders interviewed, that the existing workforce could be upskilled to work on heat pumps. However, willingness to be upskilled may be influenced by several factors. These include customer awareness of and demand for a product or service, the availability of funding to support installations, and funding and support for installers to upskill. The evidence also suggests that SMEs are incentivised by stability of employment rather than growth. This leads to reluctance to upskill due to the loss of revenue whilst undertaking training, but also the possibility that, if upskilling is seen to extend business longevity, it may become attractive. Some employers are also reluctant to train employees who may then move on to their competitors.

Current installers do have transferable skills, but they will require some additional heat pump specific training

Installers have transferable skills that are relevant to installing heat pumps. However, they will need to learn some of the technical aspects that are specific to heat pumps.

Heat pump training in the past is considered to have been inadequate. Several sources also note the lack of standardisation and consistency in training and the industry preference for a 'learning by doing' approach is noted in the literature and by stakeholders. The Heat Pump Association launched a new Heat Pump Installer training course in 2021. It is too early to see if this will address some of the issues with previous training courses that have been identified.

The evidence from the literature and stakeholders also explores the need for the installer workforce to have a range of soft skills such as marketing and sales and customer liaison. In addition, to meet customer requirements and deliver heat decarbonisation, an understanding of whole-house approaches to retrofit will be needed.

The current workforce lacks diversity

There are very few women in the installer workforce. Some stakeholders noted increased ethnic diversity, but progress also needs to be made in terms of disabilities. The lack of diversity reduces the talent pool and also reduces the sector's attractiveness to potential new entrants. The required influx of new workforce entrants, through apprenticeships and T-levels, provides an opportunity to improve diversity.

Heat pump installers will be a mix of existing heating engineers and new entrants to the market

The current heating and cooling installer workforce is ageing, with 35 per cent of gas heating installers, for example, over the age of 50. A large proportion of these installers will likely retire over the coming five to 10 years. Therefore, efforts to encourage new entrants to train as heat pump installers will be important, alongside encouraging the existing workforce to retrain.

Certification can support good customer experiences, but only if it is accessible and attractive to the majority of installers

The evidence suggests that good customer experiences could be achieved through the expansion of existing installer certification schemes. However, existing heating installers are wary of further regulatory burdens. Certification is viewed as overly complex, costly, and time-consuming. The literature highlights that common reasons for choosing one certification scheme over another included minimising the cost of accreditation and minimising the cost of training provided.

Gaps in the evidence base

This literature review provides an evidence synthesis of 73 sources of literature, including 63 peer-reviewed 'white' papers and 13 pieces of grey literature. The quality and quantity of evidence relating to each research question was highly variable. The literature was often not specific to the heat pump sector, was focused predominantly on the domestic market, and offered little quantitative data to substantiate claims.

Some of the most important gaps include:

- A lack of quantitative data on a range of issues of interest such as the skills, specialisms, experience, and qualifications of installers and diversity within the workforce, including numbers of employees with all types of disabilities or impairments (see Appendix C: Summary of Conclusions for all data gaps);
- A lack of differentiation into specific installer archetypes, including how to target and support the industry to aid upskilling;
- Information on the factors that determine whether installers are willing to undertake training on heat pumps; and
- Information on how business models will need to change in the future, with consideration of whole-building retrofits.

The wider HaCIS project will seek to fill these evidence gaps through:

- An employer survey, to collect information on workforce characteristics, employer training, offerings and business models, and organisational views on heat pumps;
- A workforce survey, to understand installers' and engineers' attitudes to training, their current skills, views and experience of heat pumps and accreditation bodies, and to gather demographic information in addition to developing installer archetypes;

- Workforce in-depth interviews, to expand on and delve into workforce survey findings;
- Stakeholder workshops, to seek views on
 - the categorisation of installers into distinct archetypes
 - how these archetypes can be used to then target engagement and support,
 - how organisations' business models may need to change, and the challenges that this may pose for the sector; and
- Employer and workforce focus groups to
 - test and gather feedback on archetype-specific policy recommendations and wider government and industry strategies to support the workforce through the net-zero transition;
 - explore the attitudes towards training, accreditation, new business models and ways of working, and potential challenges for the future.

Introduction

In 2019, the UK Government set a legally binding target to achieve net-zero greenhouse gas emissions across the UK economy by 2050. This made the UK the first major economy to legislate for a net-zero target. The UK has already made progress towards this target, reducing emissions by 40% between 1990 and 2018. The UK continues to show international leadership on climate change, recently announcing the world's most ambitious legally binding target, to reduce greenhouse gas emissions by 78% by 2035 (BEIS, 2021a). This follows the Climate Change Committee's (CCC) sixth Carbon Budget advice and "will ensure that Britain is on track to end its contribution to climate change by 2050", fulfilling commitments under the Paris Agreement (CCC, 2020).

Heat in buildings is responsible for over a fifth of UK greenhouse gas emissions (BEIS, 2021b). Meeting the Government's net-zero target will require virtually all heat in buildings to be decarbonised, and heat in industry to be reduced to close to zero carbon emissions. As a result, the way heat is supplied to over 28 million homes, businesses, and industrial users will need to change. Over the next fifteen years, the UK will gradually move away from fossil fuel boilers toward lower carbon alternatives (HM Government, 2020a).

Heat pumps will play a significant role in this transition. The Government's '10 Point Plan for a Green Industrial Revolution' and December 2020 'Energy White Paper' set out Government's ambition to grow the clean heat market to 600,000 heat pump installations per year by 2028 (HM Government, 2020b). As well as cutting emissions, heat pumps have the potential to improve air quality, create jobs and support economic growth.

To deliver the 2028 target, the UK will need to significantly increase the overall size of the trained heat pump installer sector. Existing heating and cooling engineers may form part of this sector. Therefore, it is important to understand whether they are willing to install heat pumps, and what training they will need to enable this. Examining the sector to determine this is also an opportunity to consider other desirable changes, such as an increase in diversity.

The current workforce is ageing and nearing retirement. A large portion of installers over the age of 50 will likely retire in the coming five to 10 years. Therefore, efforts to encourage new entrants to train as heat pump installers, via apprenticeships and T-levels (DfE, 2021), will also be important. Cooling installers with experience in air-conditioning or refrigeration may also identify opportunities to diversify into heating systems.

As the heat pump sector expands, it will need to maintain high standards to give consumers confidence in this relatively unfamiliar technology. Most heating installers already have many of the skills needed to install heat pumps and require only a few days of additional training to become fully qualified.

Recent research commissioned by BEIS surveyed heating installers who work in off-gas grid properties. It found that 72% of those surveyed would upskill to install heat pumps if demand for fossil fuel heating systems decreased, and 50% of those surveyed have considered

upskilling. The research found high levels of support among installers for potential policy interventions to promote heat pump training (e.g. low carbon training vouchers and mandatory low carbon training modules for future installers). This research also found that installers experienced barriers to upskilling for heat pumps. These included proximity to retirement, cost and time involved to train, a lack of confidence in the future demand for heat pumps, and negative past experiences with training providers (BEIS, 2021c).

This report

Government commissioned IFF Research and ACE Research (ACE-R) to deliver the Heating and Cooling Installers Study (HaCIS). The aim of this study was to help Government develop their understanding of the existing heating and cooling installer workforce in England. The study will be used to inform Government policy on:

- Increasing the uptake and quality of training for current and future heat pump installers;
- Removing barriers to diversity in the sector;
- Ensuring all heat pumps are installed to good quality; and
- Support for installers and businesses as they transition to installing low carbon heating, creating new green jobs, and supporting the Government's Levelling Up agenda.

As the first stage in this work, the ACE-R team has conducted a review of existing relevant literature to help the project establish a good understanding of what is known about the heating and cooling installer workforce. Note that, whilst this project is interested in installers working in all types of buildings, the literature found in our search was focused primarily on domestic installations.

This report summarises the evidence from the literature and identifies gaps. The remainder of the project (reported on separately) aims to address these gaps.

Methodology

This literature review provides an evidence synthesis of 73 sources of literature, including 63 peer-reviewed ‘white’ papers and 13 pieces of industry produced grey literature. The findings provide a summary of evidence for Government and set the context for the HaCIS research. Early findings were fed into the development of other elements of the research including the design of the surveys, workshops, and focus groups.

Research questions

The literature review examined evidence linked to five key research questions (RQs):

What are the characteristics and activities of heating and cooling installers?

How can installers be categorised into distinct archetypes based on their willingness to install heat pumps, and the upskilling required to do so?

To what extent can heating and cooling installers be upskilled to work on heat pumps?

What are heating and cooling installers’ attitudes towards standards and accreditation for low carbon heating and what factors influence these views?

How might installer business models need to change to effectively install heat pumps, and what challenges could this pose for installers?

Each research question has a set of sub-questions that define sub-themes within the scope of each RQ. These sub-questions are detailed in the chapters below.

Evidence gathering

A keyword search of the literature was complemented by stakeholder engagement. The latter aimed to identify and secure additional and emerging evidence.

Desk-based research

Keywords for the literature search were developed by the research team and then refined through stakeholder engagement and exploration of identified literature. The team accessed a wide range of both grey and white literature. Appendix A provides details of the search strategy that was used.

Two academic databases, Web of Science and SCOPUS, were used for searching white literature. Both broad and targeted (on organisations known to be active in this area) Google searches were used for the grey literature. Search results were augmented by suggestions

from stakeholders and literature previously identified by team members. Findings were logged thematically and structured according to the five Research Questions for this study.

Stakeholder engagement

The research team mapped a range of stakeholders from across the sector. Stakeholders representing 55 organisations were then contacted by email to ask if they would be willing to be interviewed. Categories of stakeholders included:

- Trade associations across the decentralised energy sector, including heat pump, heating and ventilation and plumbing-specific trade bodies;
- Heat pump manufacturers;
- Consultants;
- Bodies involved in skills and standards;
- Academics;
- Policymakers; and
- Wider decarbonisation supply chain actors.

A short topic guide was developed. This provided a structure within which the team could discuss with stakeholders the project's research questions and identify any additional evidence that they could provide or point to, and any additional stakeholders that should be engaged.

Nine stakeholders were keen to provide commentary, and this evidence has been added to the literature review. These stakeholders represented:

- Standards and accreditation (1)
- Heat pump manufacturing (2)
- Heat pump trade body (4)
- Heat pump consultant (1)
- Wider decarbonisation supply chain (1)

Some stakeholders declined to be interviewed but instead shared links to literature, which were subsequently added to the Literature Review.

Results from evidence gathering

73 documents were deemed relevant for this study, 60 from the white literature and 13 from the grey literature.

As detailed above and in Appendix B, the research team gathered written and verbal evidence from nine stakeholders.

The team used a spreadsheet database to capture basic details of each document (title, authors, year, etc). Evidence from each document was recorded here, organised according to which of the research questions it addressed.

Key findings

RQ1: What are the characteristics and activities of heating and cooling installers?

State of the evidence

The quality and quantity of evidence to answer this research question was mixed. There was more information on some sub-questions than others and, overall, a lack of quantitative data to substantiate claims. Some surveys (for example one specifically looking at microgeneration installers) were very small scale. Others gathered evidence that was very skewed towards sub-sectors (e.g., oil heating installers). There was a total of 18 references that offered information of relevance to this question. Eight sources were from white literature and 10 from grey literature. Most were from commentators or organisations that have a high level of understanding of this issue.

Findings

The heating and cooling installation sectors are primarily, but not exclusively, made up of SMEs. SMEs can be cautious and risk-averse, preferring to work with known technologies and techniques than to innovate.

Installers in the workforce have transferable skills but will require upskilling in the technical elements specific to heat pumps.

There are very few women in the installer workforce. The stakeholders we interviewed commented that the sector is not diverse in gender or representative in terms of people with physical disabilities. However, some stakeholders stated that there is ethnic diversity. A significant proportion of the workforce is nearing retirement age.

Installers working on gas appliances are spread across the country in proportion to the general population, excepting regions where the use of gas is relatively low.

Gaps in the literature

There is a lack of specific information and quantitative data regarding:

- The skills, specialisms, experience, and qualifications of installers;
- Diversity within the workforce, including numbers of employees with all types of disabilities or impairments as stated in Section 6 of the Equality Act 2010;
- The proportion of installers' activities spent on heat pumps and other heating technologies, and how this is expected to change in the future;
- The split of installers working across different types of buildings, and
- The geographical spread of installers working with non-gas appliances.

RQ2: How can installers be categorised into distinct archetypes based on their willingness to install heat pumps, and the upskilling required to do so?

State of the evidence

There was limited evidence in the literature relating to this question. There was a total of six references; four were white literature sources and two were grey literature. Most sources were from commentators or organisations that have a high level of understanding of this issue, but the literature did not suitably address some of the research sub-questions.

Findings

There was very little information within the literature to appropriately archetype the market and willingness to upskill. However, the literature does refer to the use of archetypes to target engagement and support for installers through the low carbon transition.

The literature highlights the barriers that SMEs face to including new technologies in their offering to consumers. It offers suggestions about the use of incentives, paid for training and other methods of de-risking the transition that will be relevant in the heating and cooling market.

Gaps in the literature

The literature tends to make generalisations about the nature of installers and does not differentiate them into distinct archetypes.

There is also little or no evidence within the literature reviewed regarding:

- Attitudes to diversity in the sector;
- Any regional variations in distances that installers would travel to undertake work, and
- How installers can be encouraged to advise on and recommend heat pumps as appropriate to their customers.

RQ3: To what extent can heating and cooling installers be upskilled to work on heat pumps?

State of the evidence

There was a total of 36 references that offered information of relevance to this question. This is more than for any of the other research questions. Thirteen were from white literature sources and 23 from grey literature sources. All sources were from commentators or organisations that have a high level of understanding of this issue. Note that one of the key sources of evidence here drew on a survey where around 60% of respondents were registered oil heating installers.

These installers are only a small proportion of the workforce, and so findings on willingness to upskill to install heat pumps should be treated with caution.

Findings

The literature and the stakeholders interviewed here express a high degree of confidence that existing installers can be upskilled to work on heat pumps if they are willing. The literature suggested several factors influencing whether installers are interested in upskilling, in particular requirements of accreditation schemes and customer demand for new products. Willingness to train on new technologies may be limited when installers have sufficient existing work and cannot afford to take time out from this.

Several sources highlighted a lack of standardisation and consistency in training. It is important to note that, historically, training on the specifics of heat pump installations, such as hydraulics and sizing calculations, has not been adequate. Also, low carbon retrofit Vocational Education and Training generally has failed to provide the broad range of skills needed, such as problem-solving across disciplines. In 2021 the Heat Pump Association launched a new Heat Pump Installer training course, but it is too early to see if this addresses some of the issues identified.

While the quality and quantity of evidence in the literature was quite high regarding this research question, it is important to stress that most literature predates the introduction of the Heat Pump Association's training course, and this may well have addressed some of the issues raised in the literature.

Gaps in the literature

- There is no quantitative information on the proportion of existing installers who are willing to upskill to install heat pumps;
- The literature offers several factors that contribute to installers' willingness to upskill to install heat pumps. However, it is not clear which of these may be dominant in different situations;
- There is very little evidence on how costs and location of training courses affect willingness to upskill, or how this compares with other training options;
- There is no evidence on whether installers may prefer to specialise in any specific technology or to remain flexible, and on the factors that influence this decision;
- There is very little evidence on factors that influence employers' willingness to take on an apprentice, and who they take on (incl. diversity), and
- There is no evidence on installer confidence in explaining to consumers how to choose the right electricity tariff for their heat pump.

RQ4: What are heating and cooling installers' attitudes towards standards and accreditation for low carbon heating and what factors influence these views?

State of the evidence

A total of 16 references offered information of relevance to this question: seven were from white literature sources, and nine were from grey literature sources.

However, the quality of information was poor with a very limited amount of substantial evidence to support claims made. The HaCIS installer workforce survey could provide an opportunity to answer this research question, in particular regarding which accreditation bodies installers belong to and why.

Findings

All heat pump installations should be installed in compliance with Building Regulations. The literature suggests that a minority (around 30%) of heat pump installations are conducted by certified heat pump installers. The literature does not specify which certification body, but this may refer to the MCS certification required for installers to use Government grant funding.

There is a general wariness amongst existing heating installers towards further regulatory burdens associated with certifications. Certification is seen to be overly complex, costly, and time-consuming. One of the findings in the literature was that the common reasons for choosing one certification scheme over another included minimising the cost of accreditation and minimising the cost of training provided.

The literature also suggested that expanding existing installer certification schemes could help to ensure good customer experiences if the issues of complexity were addressed so that more installers join the schemes.

Gaps in the literature

- There was no evidence about which accreditation bodies installers belong to, and why (aside from Gas Safe as this is a legal requirement for gas boiler installers);
- There was very little evidence on the factors that influence decisions to join/not join specific schemes, and
- There was very little evidence on whether installers would want schemes to change or be consolidated or replaced.

RQ5: How might installer business models need to change to effectively install heat pumps, and what challenges could this pose for installers?

State of the evidence

There was a total of 21 references addressing this question, with ten sources from grey literature and 11 sources from white literature.

A lot of the evidence was quite generic, referring to business models in general rather than being specific to heat pump installers. This literature did point to regulatory and policy changes which could enhance the economic viability of the heat pump installer market. However, there was limited evidence considering what businesses could do in practice.

Findings

The evidence highlights the need for the installer workforce to have the technical skills to install heat pumps, but also a range of soft skills such as marketing, sales, and client/customer liaison. Installers, and consumers, need to be aware that a whole-house approach to retrofit is required. Few alternative business models were suggested within the literature but one that was discussed was the use of a heat pump rental model to overcome the initial cost barrier to installations.

Another model that was suggested was segmenting building types. Segmenting the building stock and targeting certain building types could help installers in their approach to the heat pump market. Several of the industry stakeholders interviewed focused on this topic, detailing a hierarchy of approaches to domestic buildings and individual market segments that could be targeted (new build properties; those recently built; and all other remaining domestic properties).

Gaps in the literature

The literature offered only partial answers on:

- The potential approaches, risks, opportunities, and business planning considerations for transitioning to becoming a heat pump installation business, and
- The challenges faced by different types of installation businesses to install heat pumps.

There is very little or no evidence in the literature on:

- Affiliation with a manufacturer or energy supplier and/or other major factors that influence which equipment installers choose;
- Whether installers offer smart controls, radiators, or other additional energy efficiency measures;
- How installers work alongside other professions; which of these are in-house, and which are external; and expectations about how this may change in the future;

- The main factors driving cost and time to install a heat pump and how these could be reduced;
- The main sources of business for installers;
- The extent to which businesses may be expected to specialise in certain technologies, and
- How businesses can take steps to improve diversity within the sector.

Objectives

Objective 1: To develop a comprehensive understanding of the characteristics and activities of the heating and cooling installer workforce

RQ1: To develop a comprehensive understanding of the characteristics and activities of the heating and cooling installer workforce

RQ1: What are the characteristics and activities of heating and cooling installers?

RQ1 sub-questions:

What are their demographics and backgrounds?

What skills, specialisms, experience, and qualifications do installers have?

How diverse is the workforce in terms of age, gender, race, and disability? (And does this vary?)

What proportion of installers' activities is spent on heat pumps and other heating technologies? (Including how they split their time across installation and maintenance). How do they expect this to differ in 5- and 10-years' time and why?

How do the installer workforce split their work across different types of buildings (e.g. off gas grid, new build, domestic, non-domestic, listed, urban, rural, houses, flats)?

Where are installers located geographically? Do regional variations exist?

a) What are their demographics and backgrounds?

The literature did not present much information which addressed this research question; therefore, we will be looking to the results from the HaCIS surveys to address this.

It is likely that most businesses which operate in this space are SMEs. According to the Gas Safe Register (GSR) in 2011 “the qualified workforce consists of 73 per cent sole traders, 19 per cent small businesses, and only 8 per cent large businesses” (Gas Safe Register, 2012). However, it is important to note that GSR will only list businesses working with gas systems. One small scale study specifically on microgeneration installers suggested that 75 per cent of firms in the market had 10 employees or fewer, and 75 per cent had 10 years or less experience installing microgeneration (Hanna, et al., 2018). Another survey involving members of several heating trade associations (OFTEC, 2019) found that most respondents were sole traders or worked in very small companies.

b) What skills, specialisms, experience, and qualifications do installers have?

A study conducted by Eunomia Research found that “a high proportion of the sector self-rate as ‘very experienced’ in the technologies they currently work with” (Eunomia, 2020a). The same study reported that 71% of participants rated themselves as ‘very experienced’ gas boiler installers. It also noted that 17% of participants rated themselves as ‘very experienced’ heat pump installers and 43% had no experience in heat pump installation. Please note that the research involved sending a survey to 130,000 fossil fuel heating system installers, which yielded 827 responses, so it is unlikely to be representative of the workforce as a whole.

The transferable skills that are held by those in the sector are in high demand and there is strong competition for skills between sub-sectors (Chitchyan & Bird, 2021). The report on the Eunomia study states, “the UK’s boiler manufacturing sector is supported by a strong engineering base, design consultants, and a network of installers that would be ideally placed to develop and deliver heat pump projects, given the right installation training and upskilling is undertaken” (Eunomia, 2020a). This upskilling would need to include heat loss calculations, hydraulic balancing, and system sizing (Hanna, et al., 2018).

According to (Zuhaib, et al., 2016) “existing skills in the construction sector are of high quality, yet they are not sufficiently aligned with the approach of low-energy building.”

c) How diverse is the workforce in terms of age, gender, race, and disability? (And does this vary?)

According to the Gas Safe register Decade Review and the stakeholder interviews, a significant proportion of the current workforce is nearing retirement age. Whilst the average age of a gas installer in 2016 was around 45 (close to the average age of UK workers in general), the median age was 55. The review notes that engineers start to retire or leave the Gas Safe Register at around this age (Gas Safe Register, 2017). BEIS analysis of a Gas Safe Register dataset suggests 35 per cent of installers involved in domestic gas heating are over the age of 50. The 2019 trade associations’ survey (OFTEC , 2019) is consistent with this evidence: a large proportion of its respondents were close to retirement age, and it had no responses from installers under the age of 20.

Through stakeholder interviews with members of the supply chain, we know that there is a lack of gender diversity in the installer workforce, but that ethnically the workforce is seen to be diverse. Gas Safe Register data shows that 99.6% of engineers on their register in 2017 were men (Gas Safe Register, 2017).

The “latest available statistics show that of the 1,120 heating, ventilation, air conditioning and refrigeration apprenticeships started in 2014/15, just 20 were taken up by women” (OFTEC , 2019).

A recent nationwide survey of 626 UK-based tradespeople reported that only 1.7% of the electricians in the UK in 2021 were women. These women had an average annual pay of £20,336 whereas men in the same trade earned an average of £37,543. Less than 2% of plumbers and heating engineers in 2021 were women. These women earned an average of

£21,900 annually whereas men in the sector earned an average of £35,979 annually (Rated People, 2022). While these figures show a clear lack of gender diversity and significant income disparity, the report's methodology does not indicate whether the sample surveyed is representative of tradespeople as a whole.

The literature suggests that a lack of diversity can reduce the talent pool but also reduces the attractiveness of the sector overall and therefore other career paths may appeal more to graduates (WSP Parsons Brinkerhoff & DNV-GL, 2015).

There is no specific data in the literature regarding diversity related to disability.

d) What proportion of installers' activities is spent on heat pumps and other heating technologies? (Including how they split their time across installation and maintenance). How do they expect this to differ in 5- and 10-years' time and why?

The literature review did not find specific information on how installers split their time across low carbon heating technologies and therefore we will be looking to the HaCIS workforce surveys to address this.

One survey conducted on microgeneration installers found that most installers only install a small number of heat pump systems each year (the actual number or proportion of time spent on heat pump installations was not specified). The number of installations was dependent on the level and availability of government incentives (Hanna, et al., 2018).

The literature did not address the question of how installers expect the situation to differ in five to ten years. However, one study found that manufacturers believed that the industry could change rapidly should it choose to, citing the example of the transition from combination to condensing boilers (Bergman, 2013).

e) How does the installer workforce split their work across different types of buildings (e.g. off-gas grid, new build, domestic, non-domestic, listed, urban, rural, houses, flats)?

The literature review did not present much information which addressed this research question; therefore, we will be looking to the HaCIS workforce surveys to address this.

It is clear from what evidence there is in the literature that current domestic heat pump installations are mostly found in new build, off mains gas, and in rural areas (or other houses with adequate space).

f) Where are installers located geographically? Do regional variations exist?

Data from Gas Safe records (Gas Safe Register, 2017) on the proportion of installers in each region of the UK can be compared against the geographical spread of the UK population generally in 2020 (Statista, 2020). This comparison shows that the numbers of installers are generally proportionate to the population as a whole. A variation that stands out is that there are slightly lower numbers of installers in Northern Ireland and Scotland, corresponding to far

lower gas use in both these regions. In addition, the number of installers is slightly lower in London and higher in the Southeast compared to the general population; this can be explained by installers living outside of London and travelling in for work.

The review did not find data on the geographical spread of installers of non-gas heating and cooling appliances.

Objective 2: To segment the heating and cooling installer workforce into distinct archetypes which can be used to inform strategies to support and encourage installers through the low carbon heating transition

RQ2: To segment the heating and cooling installer workforce into distinct archetypes which can be used to inform strategies to support and encourage installers through the low carbon heating transition

RQ2 How can installers be categorised into distinct archetypes based on their willingness to install heat pumps, and the upskilling required to do so?

RQ2 sub questions:

How can an understanding of these distinct archetypes be used to target engagement and support for installers through the low carbon transition?

What factors could encourage these groups to upskill, install more heat pumps or take on heat pump apprentices?

Do any groups consider themselves specialists, distinct from the wider sector?

What are the attitudes of these groups to diversify in the sector?

Which sources of information do installers trust or rely on (to share their attitudes)?

How far would installers travel to undertake work? (i.e., what regional granularity should be considered when assessing skills needs to different groups?)

How can installers be encouraged to advise on and recommend heat pumps as appropriate to their customers?

a) How can an understanding of these distinct archetypes be used to target engagement and support for installers through the low carbon transition?

There is not enough evidence in the literature to enable the definition of a set of archetypes. The literature highlighted below refers to some key elements we would expect to see in the archetypes.

The organisational culture of the smaller businesses that tend to dominate the installer market may be a barrier to engagement due to lack of resources and reluctance to innovate. As previously outlined, SMEs are often focused on ensuring their businesses are economically viable and are risk averse towards adopting new technologies, investing time and resources in learning new skills, and purchasing new equipment (HM Government, 2020c). Such attitudes can act as a barrier to greater contractor involvement in transitions, especially when customer demand is not clear (Thorne, 2003).

b) What factors could encourage these groups to upskill, install more heat pumps or take on heat pump apprentices?

Industry stakeholders considered that there is neither the consumer demand nor a push from a highly skilled supply chain for low carbon retrofit because market development is at too early a stage. One study, focused on energy efficiency retrofits, suggested that incentives are needed to encourage contractors to undertake new types of work and to invest in upskilling or hiring staff and purchasing new equipment that is associated with this (Brocklehurst, et al., 2021) (see question 3b for why incentives are needed). This would then stimulate the push from the supply chain and build consumer confidence that there is a highly skilled workforce able to deliver decarbonisation solutions. This would in turn help to build consumer demand.

De-risking market entry would have a marked impact on encouraging groups to upskill or increase installations and on encouraging businesses to take the first steps into the sector. Strategies that have been deemed to be successful in developing an installer base in America include offering financing or other assistance with the purchase of necessary tools and equipment; providing strong marketing leads; and giving compensation for the time it takes to establish relationships with other contractors and make the necessary referrals (Thorne, 2003).

Funding training and accreditation for a set period would also attract new entrants to the market and increase the capability of the supply chain. For example, the Scottish Government's MCS certification fund provides heating engineers with an interest in installing heat pumps (either air, ground, or water source) with a grant to become MCS certified on heat pumps (Energy Saving Trust, 2022).

It has been noted that SMEs are incentivised "by stability of employment rather than growth" and therefore could be encouraged to upskill if they were convinced it would ensure longevity of their business (Owen, et al., 2014).

c) Do any groups consider themselves specialists, distinct from the wider sector?

Heating installer (or heating engineer) is a professional identity used within the heating industry. Heating engineer is used as a term of professionalism within the industry. This is especially true of gas engineers where Gas Safe Registration is legally required. However, even for other technologies where professional certification is not a legal requirement, many heating engineers will use the term to distinguish themselves from those without appropriate heating expertise. E.g. heating engineers see themselves as distinct from plumbers.

Although heating installers are not differentiating themselves from the 'wider sector' by comparing themselves to unregistered professionals, the difference is very significant to them. Heating installers are wary of the damage caused to the industry by 'Cowboys' - a term that is often used to describe illegal gas fitters. According to an installer interviewed by Wade et al (2016) 'Cowboys' did not do the industry "any favours whatsoever". The evidence from the literature on RQ4 (see below) echoes this. Installers think accreditation and certification is important to ensure that customers have a reliable supply of heat, that work is delivered to approved standards, and that illegal work (which could affect the industry's reputation) is reduced.

Within the heat pump installer industry, there has been a distinction between specialists and regular installers. Specialists included designers, manufacturers or thermogeologists that understand commercially available software for the design of Ground Source Heat Pumps (GSHPs) (Curtis, et al., 2013).

Some heat pump installers see themselves as more specialised than others because there are various types of certifications and accreditation for heat pump installers, which allow for different levels of competence in design and/or installation.

d) What are the attitudes of these groups to diversity in the sector?

There is no evidence in the literature which addresses this question.

e) Which sources of information do installers trust or rely on (to shape their attitudes)?

According to recent research on heat pump manufacturing supply chains, installers often rely on the experience of other contractors that have established successful businesses. Builders' or plumbers' merchants may be a useful setting where individuals can acquire and share knowledge in a non-competitive way (Owen, et al., 2014).

f) How far would installers travel to undertake work? (i.e., What regional granularity should be considered when assessing skills needs for different groups.)

There is little evidence in the literature which addresses this question.

From the literature that has been identified it was suggested that most installers tended to install microgeneration in homes mainly or exclusively within the region of their business location. This applied particularly to heat technologies, such as Air Source Heat Pumps (ASHP), which require regular servicing (Hanna, et al., 2018).

g) How can installers be encouraged to advise on and recommend heat pumps as appropriate to their customers?

There is no direct evidence in the literature to answer this question. However, there is some evidence on the factors that may be important. One academic analysis found that the factors that shaped an installer's advice to a household included cost, preference for a given

manufacturer and “the fit between their technical understanding of the technology and what they believed their customers valued and would therefore pay for” (Owen, et al., 2014).

Objective 3: To understand the extent to which heating and cooling installers can be upskilled to work on heat pumps in the future

RQ3: To understand the extent to which heating and cooling installers can be upskilled to work on heat pumps in the future

RQ3: To what extent can heating and cooling installers be upskilled to work on heat pumps?

RQ3 sub-questions:

How many are willing and able to be upskilled to work on heat pumps?

What factors influence willingness and suitability to upskilling for heat pumps?

What influence installers' attitudes towards training and apprenticeships?

What factors influence these archetypes' decisions to upskill or increase the number of heat pump installations? How far would they be willing to travel, pay or spend time doing so? How does this compare to other available options?

What are experiences of those who have undertaken specific training in heat pumps? How can these courses be improved? (Cost, affordability, time, content)

Would installers prefer to specialise, or remain flexible across technologies? What factors influence this?

What factors influence their willingness to take an apprentice, and who they take on (incl. diversity)?

How confident would an installer be explaining to a consumer how to choose the right electricity tariff for their heat pump or signposting them to someone who could? (Or explaining how to use a heat pump alongside other related technology such as solar panels, batteries, or electric vehicles chargers?) What additional information or resources could be provided to support this?

a) How many are willing and able to be upskilled to work on heat pumps?

The literature does not provide data on how many installers are willing to be upskilled. The HaCIS surveys will address this.

There is evidence that the need to upskill in the wider construction sector is recognised: in a survey undertaken for the CITB, 78 per cent of respondents considered that there are skills gaps in their occupations/professions related to decarbonisation (Eunomia, 2021).

The ability to train the workforce will depend on sufficient availability of appropriate training courses in suitable locations. The Heat Pump Association (HPA) membership includes 22 training centres with the ability to train an estimated 7,000 heat pump installers per year. The HPA estimates that the growth in new installers will peak at around 9,000 new installers in 2030. The HPA believes that existing training centres provide the capacity to meet the considerable growth needed.

HPA suggests that “with the right signals from government and market development in the years building up to this, the heat pump industry is confident in being able to step up to deliver this capacity” (HPA, 2020a).

b) What factors influence willingness and suitability for upskilling for heat pumps?

The literature is unclear on what may be the dominant factors here. Some evidence suggests that upskilling will be driven by the need to gain new skills to remain accredited, whilst other evidence points more towards market barriers such as lack of demand for heat pumps or sufficient work installing other types of heating appliance.

One of the key pieces of research used to address this research question was an Installer Skills Survey conducted by several heating industry trade bodies. It found that the factors that installers rate as very important in influencing the decision to retrain are ‘obligatory training for organisation membership’ (58 per cent), ‘new mandatory installation standards’ (50 per cent), ‘future mandatory installation standards’ (42 per cent) and ‘demand from customers’ (38 per cent) (OFTEC, 2019).

The literature also highlighted that one of the reasons for the lack of skilled and capable individuals in the retrofit supply chain was the “lack of access and willingness to incur the costs of training, which includes time away from income-earning work” (Brocklehurst, et al., 2021). Indeed, the loss of earnings may be a greater barrier than the costs of the training course (Norman & Regan, 2022). A recent study from the Social Market Foundation carried out 20 in-depth interviews with gas heating and heat pump installers. This study found that ‘desire to retrain is commercial’ and installers would focus on retraining as long as there was a viable business case for heat pumps, which in turn would provide job security and opportunities in an emerging market (Norman & Regan, 2022).

Increasing market confidence through government backing for new technologies and other support such as grants and subsidies, together with support for training, can increase willingness to upskill to install new technologies (Nösperger, et al., 2011). One relevant supply chain study found that consistent policy support may encourage the sector to invest the necessary time and resources in building the required skills (Brennan & Limmer, 2015).

Some types of heat pump require very specific additional skills. For example, a potential shortfall in F-gas certified installation engineers in the UK (of which there are currently

~50,000) could have an impact on the type and rate of ASHP deployed, as split systems installations require F-gas certified installation engineers, whilst other heat pump types do not (Eunomia, 2020a). Any shortage could lead to market distortions, but it is important to note that split systems are expected to be a small proportion of installs and therefore this impact may be limited.

Attitudes to training could be influenced by a lack of general awareness of low carbon heating technologies amongst the general public, and also amongst architects, builders, property developers, heating installers, and policymakers (Eunomia, 2021).

The Social Market Foundation study mentioned above supports the claim that installers are influenced by public awareness and without a strong demand for low-carbon heating technologies such as heat pumps, installers are unlikely to retrain (Norman & Regan, 2022).

Some installers show unwillingness to retrain because they believe heat pumps “are primarily considered as suitable for new builds” as opposed to a technology fit for an existing building. Given that groups of installers work primarily on existing buildings, training is not a priority for them (Norman & Regan, 2022).

There is also some suggestion that older installers may be less willing to retrain. A survey conducted by Gas Safe (Gas Safe Register, 2017) was sent to 71,870 Gas Safe Register contacts, with 2,690 responses received. When engineers were asked about the issues the gas industry will face in the future, they talked about the physical aspects of their job, with around half (51 per cent) saying new technology will be an issue – particularly for older engineers. A similar number (49 per cent) said there will be a need to update ageing appliances, also of more concern to those aged over 55 (55 per cent). It is assumed that this will present a barrier to finding innovative ways to decarbonise and therefore the sector needs to attract highly skilled new entrants to the workforce who can implement advanced decarbonisation and energy efficiency technologies.

c) What influences installers’ attitudes towards training and apprenticeships?

The evidence found here focuses on the barriers to training and apprenticeships. Installers’ employers may be reluctant to invest in training, as this may increase the likelihood of employees moving to other firms. A recent IPPR report noted, “given the regularity with which workers move around within the installer sector, there is a lack of incentive for companies to provide training for their current employees who are likely to not be retained” (Emden & Murphy, 2019).

Perhaps linked to this, as noted by the Association of Plumbing and Heating Contractors, many companies are not using their allocated fund given to them through the apprenticeship levy. The Association urges companies to ensure that they spend the funds to support new entrants into the installer base (APHC, 2019).

Attitudes to training could be influenced by lack of general awareness amongst the general public, and also amongst architects, builders, property developers, heating installers, and policymakers (Eunomia, 2021). A key challenge, which is also an opportunity, relates to raising

awareness and understanding of T levels amongst the public and businesses to a similar level to their understanding of A levels. However, there is currently a lack of resource for this, particularly in engaging with SMEs (Taylor, et al., 2021).

d) What factors influence these archetypes' decisions to upskill or increase the number of heat pump installations? How far would they be willing to travel, pay or spend time doing so? How does this compare to other available options?

One stakeholder interviewed suggested the sector was dominated by the self-employed or SMEs. Research conducted for BEIS found that there is often little incentive or capacity for self-employed builders to invest their time in skills development and therefore may be less willing to spend time doing so than other archetypes (Brocklehurst, et al., 2021).

The incumbent workforce has also been described as “very conservative with a resistance to innovation or change and a wariness of new technologies” (Killip, et al., 2020). According to research conducted by BEIS in 2021, installer confidence is based on repeat experience and therefore unfamiliarity with new technologies and lack of supply chain expertise in both installation and use of technologies is leading to reluctance to install (BEIS, 2021d). This is echoed in a further study conducted by several industry associations which demonstrated that 74 per cent of installers do not rate themselves as ‘very confident’ in recommending and choosing the best low carbon options to their customers (OFTEC, 2019). This is partly driven by low consumer demand with 69 per cent of installers saying they are rarely or never asked about low carbon heating, renewable energy, or carbon emissions.

Beyond these general comments on reluctance or lack of capacity to engage with newer technologies, the literature offered no evidence to answer this question.

e) What are the experiences of those who have undertaken specific training in heat pumps? How can these courses be improved?

The literature demonstrates that there is a lack of standardisation and consistency in training for microgeneration design, installation, and maintenance (Hanna, et al., 2018).

According to a report written by BEAMA, “there has been a variety of heat pump training courses with different service providers working to different standards, resulting in variable quality” (BEAMA, 2021). The same report states, “there has been a concern that there is not enough focus on low carbon heating, with little emphasis placed on heat loss calculations, hydraulic balancing and the need to address the system requirements for low temperature operation.”

Martiskainen et al (Martiskainen, et al., 2021) also suggest that, while there is training available for installers, this is not considered to be of high quality. However, the research did not give specific examples of why this was the case. Another study draws on examples where, on many sites, installers had ‘failed to correctly apply the heat pump’, which emphasised the need for improved training (Staffel, et al., 2015).

A practical “Learning by Doing” approach is particularly relevant for acquiring the relevant background technical skills for heat pump installation (Chitchyan & Bird, 2021) (BEIS, 2018a). Martiskainen et al (2021) noted that the training on offer to installers did not provide opportunities to get practical installation experience. Vocational Education and Training (VET) is seen across the EU as a successful skills development programme through school-based and work-based learning. VET supports an easier transition from school to work while also reducing school dropouts. VET programmes are also available as part of Adult Learning courses which include a specific focus on sustainability and green jobs (Interagency Working Group, 2012). It is important to note however that a study of 10 EU countries found VET “to be fragmented and uncoordinated, limited in occupational range and geographical reach, with most courses at higher levels and catering to those with some existing technical training.” The study also noted that “the nature of training is often very narrowly based, developing specific skills only and lacking breadth of what is required for retrofit, including problem-solving across disciplines” (Clarke, et al., 2019).

In August 2021, the Heat Pump Association launched a new training course “that will overhaul the route to becoming a heat pump installer in the UK” (HPA, 2021). The new training course “aims to equip the heating industry with the additional skills needed to deliver on the UK’s installation targets and deliver low carbon heat to hundreds of thousands of British homes.” The course may address some of the prevailing issues regarding training, but it is too early to see evidence of this.

Signals from government that there is policy support for training and upskilling in low carbon technologies can influence installation business. Some literature suggests that previous government programmes have resulted in installers that fit only one type of microgeneration and hence have a commercial interest in maximising sales of that option, rather than taking a more whole house perspective (Hanna, et al., 2018). This would suggest that training for installing low carbon heat should be designed to build skills that are relevant across a range of technologies rather than just focusing on specific options.

f) Would installers prefer to specialise, or remain flexible across technologies? What factors influence this?

There is no evidence in the literature to answer this question.

g) What factors influence their willingness to take on an apprentice, and who they take on (incl. diversity)?

Very little was found in the literature which addresses this question.

It is possible that the current qualification requirements for apprenticeships could act as a barrier to businesses taking on apprentices. The need for qualifications in Maths and English could exclude applicants with practical skills (Jackson & Mellors-Bourne, 2018).

Recent changes to the Skills Bill mean that those who don’t meet the prerequisite levels ahead of starting a training course have to wait until they retest and meet the requirements.

There was concern from industry that this would cause delays in getting large numbers of people qualified to fulfil the requirements of the workforce (Weale, 2020).

h) How confident would an installer be explaining to a consumer how to choose the right electricity tariff for their heat pump or signposting them to someone who could? What additional information or resources could be provided to support this?

The literature contains no evidence to answer this question.

BEAMA note “Significant knowledge is needed on the metering, storage capacity of the heat pump, communication protocols and time-of-use tariffs” (BEAMA, 2021) and installers will have a role to play in supporting their customers in choosing the right options in terms of tariffs, but they do not comment on the extent to which current installers feel able to do this.

Objective 4: To explore heating and cooling installers’ attitudes towards standards and accreditation for low carbon heating and identify what factors influence these views

RQ4: To explore heating and cooling installers’ attitudes towards standards and accreditation for low carbon heating and identify what factors influence these views

RQ4: What are heating and cooling installers’ attitudes towards standards and accreditation for low carbon heating and what factors influence these views?

RQ4 sub-questions:

What accreditation bodies do installers belong to, why do they belong to these bodies and what are their experiences of accreditation? (e.g., Gas Safe, MCS, competent person schemes, consumer codes such as RECC and HEIS, TrustMark)

What factors influence decisions to join/not join specific schemes?

Would they like these schemes to change, or be consolidated/replaced?

What perceptions do installers have of installation quality issues within these schemes?

What steps can be taken to ensure high quality heat pump installations and good customer experiences?

a) What accreditation bodies do installers belong to, why do they belong to these bodies and what are their experiences of accreditation? (e.g., Gas Safe, MCS, competent person schemes, consumer codes such as RECC and HIES, TrustMark)

The research did not provide evidence to answer this question beyond the proportion of installations that are carried out by an accredited installer.

According to a report published by BEAMA “only an estimated 30% of heat pump installations are undertaken by an accredited installer, as MCS standards or equivalent are only mandatory for Government support schemes” (BEAMA, 2021). One industry source suggested that “this leaves the other 70% of installations at risk of being subject to inconsistent quality standards from untrained and non-accredited installers with the potential concomitant effect of the industry gaining a poor reputation”. We should note however, that all heat pump installations are subject to compliance with Building Regulations.

Industry and academic studies report that certification schemes are perceived to be overly complex, costly and time consuming. According to National Association of Professional Inspectors and Testers (NAPIT) more needs to be done to make schemes more streamlined “to develop a strong and competent workforce, that can be relied upon to deliver the installations required to meet the net-zero targets” (NAPIT, 2021). The need to design certification schemes that are administratively simple is particularly important to encourage more installers to get involved. SEA suggests that this could be achieved through a simple digital platform which reduces the administrative burden of accreditation (NAPIT, 2021). It is of note that NAPIT themselves run a certification scheme.

b) What factors influence decisions to join/not join specific schemes?

Building tradespeople are wary of further regulatory burdens that can be associated with certification and accreditation. There is the perception that anything beyond health and safety requirements will be seen by a tradesperson who already has plenty of work as unwarranted bureaucracy or as an expense that adds little value to the business (Owen, et al., 2014).

One recent academic study found that the typical reasons for choosing one certification scheme over another included minimising the cost of accreditation and training provided (Hanna, et al., 2018).

c) Would they like these schemes to change, or be consolidated/replaced?

There is very little evidence in the literature to address this question although one study reported that some installers call for “a consistent Microgeneration Certification Scheme (MCS) that is not regularly changing its rules”, to ensure that installers can comply with requirements (Eunomia, 2020b).

d) What perceptions do installers have of installation quality issues within these schemes? What steps can be taken to ensure high quality heat pump installations and good customer experiences?

Installers reported variable levels of quality in the inspections carried out by the certification bodies and apparent variations in the levels of technical expertise of the inspectors (Hanna, et al., 2018).

The government response following a call for evidence on decarbonising heat in buildings noted that there can be a considerable variety in skills and knowledge of installers who become accredited in certification schemes (BEIS, 2018b).

The Social Market Foundation notes that there is a lack of clear standardisation in training provision, and that this can result in an “inconsistently skilled workforce of varying competence”. One source cited a lack of concern around illegal gas work (even if it is a regulated industry) and suggested that it is plausible that a lack of mandated standards could result in unqualified “cowboy” installers entering the heat pump market (Norman & Regan, 2022). The report notes the potential impact on industry reputation. This point was echoed by initial stakeholders interviewed by ACE-R, who claimed that there is an “industry-wide fear” that “cowboy” installers will give the heat pump industry a bad reputation at a time when consumer awareness is already low.

The views in the NAPIT report (NAPIT, 2021), mentioned in section a) above, suggest that encouraging more installers to join accreditation schemes is a route to ensuring high quality installations and good customer experiences. Other commentators also recommend the expansion of existing certification schemes (Killip, et al., 2020) and ensuring that certification schemes cover both heat pumps and installers (Sovacool & Martiskainen, 2020).

There is evidence in the literature that existing schemes improved the expertise and credibility of the industry in the early 2000s (Sovacool & Martiskainen, 2020). Progress in standards has also been seen; a good case study is the PAS 2030 standard which addressed the need to look at ventilation alongside energy efficiency; PAS 2035 also represents a major step forward (CCC, 2020).

Curtis et al (Curtis, et al., 2013) note that, in the past, difficult to use software packages were rarely used and this led to performance issues during field trials of domestic GSHPs in the UK. As a result, the UK government and GSHP industry agreed that simpler design tools and training should be available for installers. This led to the creation of the UK Microgeneration Certification Scheme’s Microgeneration Installer Standard for heat pumps MIS3005.

There are learnings from international examples which could be applied to the UK sector as ways to improve quality assurance. For example, Sweden set up an independent complaints board, run by the Swedish Heat Pump Association, which enables customers to bring claims against installers when heat pumps do not perform as expected. Where the claim is upheld, the installer must rectify the problem and cover the customer’s (small) costs of bringing the claim. Decisions are made public, so that substandard installers can be identified. (Hanna, et al., 2016).

Objective 5: To understand how installer business models may need to adapt in the future to effectively install heat pumps, and explore potential challenges arising from these changes

RQ5: To understand how installer business models may need to adapt in the future to effectively install heat pumps, and explore potential challenges arising from these changes

RQ5: How might installer business models need to change to effectively install heat pumps, and what challenges could this pose for installers?

RQ5 sub-questions:

What are the challenges faced by different types of installation businesses to install heat pumps?

What are the potential approaches, risks, opportunities, and business planning considerations for transitioning to becoming a heat pump installation business over time?

Are they affiliated with a manufacturer or energy supplier? If not, are there other major factors in choosing which equipment to use?

Does the installer offer smart controls, radiators, or other additional energy efficiency measures?

How do installers work alongside other professionals? (e.g., retrofit advisors, builders, electricians, plumbers, renewables installers). Which of these are in-house and which are external? How do they expect this to change in future?

What are the main factors driving the cost and time to install a heat pump? How could these be reduced?

What are the main sources of business? (e.g., referrals, via manufacturer etc.)

How far should we expect businesses to specialise in certain technologies?

How can businesses take steps to improve diversity within the sector?

a) What are the challenges faced by different types of installation businesses to install heat pumps?

A key challenge facing the industry is skills deficits. In 2019/20, the UK heat pump sector employed around 2,000 workers and the HPA estimates that there will be a potential requirement for 69,500 heat pump installers by 2035 to meet net zero ambitions (HPA, 2020a; Eunomia, 2020a). A decade ago, only a small percentage of installers were becoming accredited and there was a lack of competence to install heat pumps among traditional

installers (heating engineers and plumbers) (Bergman, 2013). As already noted under Objective 4 above, stakeholders highlighted the need for “soft skills” in addition to the more technical skills to be a successful heat pump installation business.

A second challenge is the lack of an established market for heat pumps and other low carbon heating technologies. Studies of building retrofit programmes have found that national scale ambition is essential for market stability, whilst local action is equally essential for implementation. Mapping national frameworks to local circumstances is an area of policy and programme design that needs more attention (Gillich & Mohareb, 2018). Another study, specifically focused on renewable heat, found that regulatory and bureaucratic barriers such as a bottleneck in approval of heat pump products and equipment, and the lack of grants in the hiatus between the Low Carbon Buildings Programme (LCBP) and the Renewable Heat Incentive (RHI) can be key challenges for heat pump installer businesses. When questioned as part of the study, market actors suggested that upfront capital costs and the lack of grant funding were the main barriers to the heat pump market growing, especially for GSHPs (Bergman, 2013). Another study noted concerns over whether heat pumps would deliver sufficient energy bill savings to pay back the initial investment (Zuhaib, et al., 2016).

Industry bodies and researchers considering the heat pump market noted that there is a lack of customer awareness of heat pumps which is a key challenge faced by installation businesses (HHIC, HWA & MARC, 2021) (Bergman, 2013).

Installer companies may find it difficult to meet customer expectations when installing heat pumps. One small study, carried out a number of years ago, considered the satisfaction levels amongst tenants in housing where heat pumps had been installed with the technical support from heat pump installer/suppliers. The results indicated that technology support still needed to improve (Zhang, 2015). 162 GSHP users were surveyed and 21 per cent of tenants were found to be unsatisfied with the technology support. Among tenants who were unsatisfied or strongly unsatisfied, half were not provided with any information on GSHP and only four tenants were shown how to operate it.

The importance of providing high-quality advice and technical information to buildings' residents on their GSHP has also been highlighted by the Carbon Trust (Carbon Trust, 2020).

Heat pump installations in addition to whole house retrofit need post-installation monitoring, adjusting, and optimising for a couple of years (Killip, et al., 2020). This is a potential issue, given that the supply chain is dominated by small and medium-sized enterprises (Brocklehurst, et al., 2021), and SMEs and micro-enterprises find aftercare to be particularly problematic for “there is usually no revenue stream attached to such activities, but the costs, of time, can be considerable” (Owen, et al., 2014).

b) What are the potential approaches, risks, opportunities, and business planning considerations for transitioning to becoming a heat pump installation business over time?

Industry research indicated that there is recognition from some installers of the impact and opportunities of moving away from high carbon technologies. However, it suggests that more

needs to be done to raise awareness and communicate the opportunities of such a transition (OFTEC , 2019). Attracting and educating forward-thinking contractors seeking new business models that improve sales closure rates, increase the average job size, and enhance services they offer to their customers is all key to the development of the market (Thorne, 2003).

The evidence base offers several opportunities for installers looking to develop new business models.

Several stakeholders considered that segmenting and targeting certain building types could help installers in their approach to the heat pump market. They detailed a hierarchy of approaches to domestic buildings and individual market segments to target. New build properties are one clear segment to target, given enhanced insulation levels, reduced space heating demand and standard property and services (electrical and plumbing) layouts. With existing buildings, stakeholders suggested that recently built properties with similar layouts and services, and better than average energy performance levels, would be another segment for installers to target.

This review did not find any evidence on how to segment and target the large proportion of existing buildings outside this ‘nearly new’ category. It may be relatively easy to identify niches, such as BEAMA’s suggestion of targeting reversible heat pumps to homes with heating and cooling needs, undergoing a whole house refurbishment, and with solar PV and battery storage to offset the load on the local grid (BEAMA, 2021). However, business model development for most installers is likely to require less specific target markets.

One stakeholder noted a potential risk for smaller businesses, linked to segmenting and targeting: larger companies would most likely follow a cluster mentality – targeting “easier” properties – and leave the more difficult segments of the market for smaller firms. The cost of acquisition for these smaller firms would be considerably higher as a result.

Heat pump installation businesses could take the rental model approach as a way of building consumer confidence and increasing demand in a way that is seen to be low risk by the consumer. According to (Nelson, 2019) a model such as this would “use a low rental fee, single point of contact, and an integrated supply chain to make renting easy, worry-free, and affordable and attempt to reduce information asymmetry between consumers, installers, and manufacturers”.

c) Are they affiliated with a manufacturer or energy supplier? If not, are there other major factors in choosing which equipment to use?

We found no evidence about formal affiliations with manufacturers or energy companies, but there is evidence to show that installers build up a relationship of trust with existing manufacturers and may avoid experimenting with new manufacturers and their products (Zuhaib, et al., 2016).

d) Does the installer offer smart controls, radiators, or other additional energy efficiency measures?

There was no comprehensive or quantitative evidence found that related to this question.

However, one study found that installers did not (routinely) provide users with information about time varying pricing or direct control of heat pumps; similarly, trial leaflets did not mention either of these forms of demand response but did describe the features of smart controls (Parrish, et al., 2021). Some of the literature also suggests that contractors may worry that selling efficiency may reduce the bottom line on jobs because customers can then downsize their new heating or cooling systems (Thorne, 2003).

e) How do installers work alongside other professions? (e.g., retrofit advisors, builders, electricians, plumbers, renewables installers). Which of these are in-house and which are external? How do they expect this to change in future?

There was no evidence found in the literature that addressed this question directly.

One piece of literature, examining heat pump market development in France, does however illustrate the impact of a new technology on the established system of professions (Nösperger, et al., 2011). It explains that home heating and cooling used to be divided among electricians, plumbers and air-conditioning professionals but fitting a heat pump requires joint competencies in electricity, centralised water-based heating systems, and thermodynamic properties of the house and its use. None of these trades used to have all these competencies. From a technical point of view, air conditioning specialists would be the most suitable trade, but they usually prefer to deal with large installations. Therefore, the residential heat pump fitting market is imperfectly split between these three trades.

f) What are the main factors driving cost and time to install a heat pump? How could these be reduced?

There was no evidence found in the literature to address this question.

g) What are the main sources of business? (e.g., referrals, via manufacturer etc)

The literature did not offer any evidence on this question that is specific to heat pump or heating and cooling installation.

h) How far should we expect businesses to specialise in certain technologies?

The literature does not offer evidence that answers this question.

i) How can businesses take steps to improve diversity within the sector?

There is no evidence in the literature which addressed this question for this sector.

There does seem to be increasing interest amongst women in becoming tradespeople, and increasing consumer demand for female builders, plumbers, and electricians (Rated People,

2022) but it is not clear whether this results from steps taken by businesses to improve diversity or from other changes.

Influence of the literature review on the HaCIS project

As the first phase of the project, the Literature Review performed several functions for the project:

Provided a strong context for the study and ensured readers of the report have an accessible summary of existing publications exploring heat pump skills development.

Informed the content of the primary fieldwork, particularly by assessing where there were gaps in existing literature and research.

In addition to providing a summary of evidence for Government, setting the context for the project, early findings from the Literature Review were fed into the development of other elements of the research (the employer and workforce surveys, stakeholder workshops, in-depth interviews and focus groups).

Conclusion

This literature review has enabled the project to create a picture of the state of knowledge on the key research questions prior to the project. As the sections above have demonstrated, there is some understanding of the sector and the potential for existing heating and cooling installers to transition to installing heat pumps. However, the quality and quantity of evidence varies across the areas of interest, and none of the questions posed could be entirely answered by the existing evidence. Appendix C summarises the key findings and remaining gaps in understanding.

Appendices

Appendix A: Literature Review Search Strategy

Literature Review Search Strategy

The research team developed search terms for each research question, in agreement with BEIS.

RQ1: characteristics and activities	RQ2: archetypes	RQ3: upskilling	RQ4: standards / accreditation	RQ5: business models
heat* OR	heat* OR	heat* OR	heat* OR	heat* OR
cool* OR	cool* OR	cool* OR	cool* OR	cool* OR
pump OR	pump OR	pump OR	pump OR	pump OR
supply chain OR	supply chain OR	supply chain OR	supply chain OR	supply chain OR
install* OR	install* OR	install* OR	install* OR	install* OR
demograph* OR	train* OR	skill* OR	low carbon OR	low carbon OR
divers* OR	skill* OR	upskill* OR	skill* OR	business model* OR
age OR	upskill* OR	qualif* OR	upskill* OR	challenge* OR
gender OR	qualif* OR	chang* OR	attitude OR	risk* OR
race OR	chang* OR	apprent* OR	standard* OR	business plan* OR
disab* OR	apprent* OR	willing* OR	accredit* OR	OR
train* OR	engage* OR	influenc* OR	Gas Safe OR	transit* OR
skill* OR	support OR	attitud* OR	MCS OR	partner* OR
qualif* OR	carbon OR	geograph* OR	Trustmark OR	affiliat* OR
build OR	transit*	locat* OR	competent person* OR	supplier OR
off-gas OR	special* OR	region* OR	scheme OR	equip* OR
			consumer code* OR	

RQ1: characteristics and activities	RQ2: archetypes	RQ3: upskilling	RQ4: standards / accreditation	RQ5: business models
new build OR exist* OR domestic OR non-domestic OR list* OR urban OR rural OR house OR flat* geograph* OR locat* OR region* OR carbon OR transit* OR activit* OR workforce*	divers* OR attitude OR geograph* OR locat* OR region* OR information OR advice OR customer OR archetype OR workforce*	travel OR tim* OR workforce*	RECC OR HIES OR scheme*OR chang* OR installation OR quality OR customer satisf* OR customer experienc* OR workforce*	smart control* OR radiator* OR efficiency* OR trade* OR profession* OR retrofit advisor* OR builder* OR electrician* OR plumber* OR renewable* OR cost OR time OR cost reduc* OR referral* OR lead* OR special* OR divers* OR workforce*

Appendix B: Stakeholder Engagement Summary

The purpose of the stakeholder engagement was to gather expert views on the research questions and source additional literature. This process was not intended to be representative of the sector.

The team's stakeholder mapping involved using knowledge from within the team, including the inclusion of stakeholders from other supply chain research, and was supplemented by cascading information from within the literature.

Stakeholder Engagement

At the beginning of the project, the research team mapped a range of stakeholders from across the sector. Stakeholders representing 55 organisations were then contacted by email.

All stakeholders who responded were invited to participate in a short interview using a topic guide (see below). Some stakeholders declined to be interviewed but instead shared links to literature sources, which were subsequently added into the Literature Review, or provided written responses to the headline research questions.

Topic guide

A short topic guide was developed. This provided a structured resource for the team to discuss the project's research questions, asking stakeholders whether they were the right questions and whether there were any gaps, as well as seeking specific evidence to support their commentary and any additional stakeholders that should be engaged.

Stakeholders engaged

As above, the team engaged with a range of stakeholders representing 55 organisations, which have been broken down by category:

- Trade associations across the decentralised energy sector including specific heat pump, heating and ventilation and plumbing specific trade bodies
- Heat pump manufacturers
- Consultants
- Bodies involved in skills and standards
- Academics
- Policy makers
- Wider decarbonisation supply chain actors.
- Summary of stakeholder commentary

Some stakeholders provided links to white and grey literature and additional stakeholders to engage with. Other stakeholders were keen to provide commentary (either written or verbal). The latter is summarised below. This commentary was shared and discussed within the ACE

Research team, and with the wider HACIS project team, to support the development of qualitative and quantitative research strands, including the workforce and employer surveys, in-depth interviews and stakeholder workshops.

Stakeholder reference	Stakeholder category	High level overview of stakeholder commentary (Responses to specific research questions are references with RQ number)
1	Standards and accreditation representative	<p>RQ1:</p> <p>Lack of diversity in the sector.</p> <p>Engineers may perhaps be a more appropriate term than installers, as many deliver more services that just installation work.</p> <p>Both Gas Safe Register and Competent Person Scheme monitor engineer competence which permits the self-certification of certain works to provide a pathway for compliance to elements of the building regulations.</p> <p>Heating engineers of course includes those already working with renewables such as solar PV and solar thermal, often as an extension to their work with the fossil fuels above. Registration with MCS is a requirement where deliveries are within environments that demand this (RHI, ECO etc).</p> <p>Activities of engineers working in these arenas will be a mixture, including some/all of the following based on consumer demand and business model services:</p> <ul style="list-style-type: none"> - Heating/cooling system design - System installation, servicing, maintenance, and repair - Appliance installation, servicing, maintenance, and repair - Commissioning works with the use of specialist equipment to prove both safety and efficiency - General plumbing is often a portfolio add-on, likewise limited electrical works (some of which require registration with a Competent Person Scheme) <p>Some may offer both office hours and emergency type call out services.</p> <p>The more professional engineers will supply installation, servicing and maintenance works record that may contain key test result data for the consumers' reference.</p>

Stakeholder reference	Stakeholder category	High level overview of stakeholder commentary (Responses to specific research questions are references with RQ number)
		<p>RQ2:</p> <p>This could be achieved by representatively polling the sectors and then by extrapolation based on the numbers of businesses/individuals know the be operating in the sectors.</p> <p>RQ3:</p> <p>Extensively, whilst heat pump technology is different to traditional heating technology there is a similarity to air-conditioning principles. Both heating and cooling engineers are technically minded people with transferable base skills.</p> <p>Traditional heating engineers are not in the main aware or engaged with the fabric first approach that is applicable to properties where the installation of a heat pump may take place. MCS certified businesses (in theory at least) are more engaged with fabric first approach due to the sensitivities required for good performance heat pump installations in dwellings.</p> <p>The current engagement around fabric first with traditional heating engineers is a challenge that will need responding to as part of any upskilling process.</p> <p>RQ4:</p> <p>Attitudes are expected to be relatively positive as standards and accreditation are an accepted existing requirement in general in these areas (see response to Q1). Positivity and take up would be driven based on good and clear understanding of the overarching needs to install heat pumps, the market opportunity that exists and the decline of the more traditional heating and cooling trades. It is really important that the sectors understand the opportunity available to them and the need to change but this needs a sustainable marketplace.</p>

Stakeholder reference	Stakeholder category	High level overview of stakeholder commentary (Responses to specific research questions are references with RQ number)
		<p>RQ5:</p> <p>Primarily heat pump installations will need to be preceded by fabric improvement trades based on property types and needs. This may represent diversification opportunities for some via broadening the range of services currently offered. Alternatively, cooperative type business models will need to be created.</p> <p>The challenges will include simple desire and willingness to embrace change and/or the development of fabric first skills and services; or developing networks with those who can deliver these services as part of a heat pump project.</p>
<p>2</p>	<p>Heat pump manufacturing representative</p>	<p>RQ2:</p> <p>There are currently 500 MCS certified companies that install heat pumps in the UK and there are 123,000 Gas Safe companies that install boilers. Some Gas Safe companies may be trained up to deploy heat pumps too, but we need a better understanding of demographics behind how many of these companies have a workforce ready to retire because there will be no upskilling there.</p> <p>RQ4:</p> <p>MCS certification doesn't feel fit for purpose. Organisation works with third party company to support training and accreditation services. The accreditation process seems quite difficult and expensive and can easily put off independent installers.</p> <p>RQ5:</p> <p>There is a strong onus now on deploying heat pumps in new build and it is possible that BEIS will be able to get 40 to 50% of their annual installation target coming from new build. However, it seems very difficult to invigorate a market for the existing housing stock.</p>

Stakeholder reference	Stakeholder category	High level overview of stakeholder commentary (Responses to specific research questions are references with RQ number)
3	Heat pump trade body representative	<p>RQ5:</p> <p>Market segmentation to target the easier installation opportunities.</p> <p>Considered that there could be around 10 segments to look at, including: 1. new build, domestic family homes, 2. post 1990 family homes, 3. opportunities with 70-85°C district heating with centralised heat pumps.</p>
4	Heat pump trade body representative	<p>RQ1:</p> <p>An industry not known for its diversity in terms of gender but is ethnically diverse. The workforce is ageing and there is a lack of new young entrants to the installer market.</p> <p>RQ5:</p> <p>Market segmentation to target the easier installation opportunities.</p>
5	Heat pump trade body representative	<p>RQ5:</p> <p>Market segmentation to target the easier installation opportunities.</p>
6	Heat pump consultant representative	<p>RQ1:</p> <p>An industry not known for its diversity in terms of gender or race.</p> <p>RQ2:</p> <p>The industry is made up of SMEs or the self-employed.</p> <p>RQ5:</p> <p>Need for harmony between supply and demand.</p>

Stakeholder reference	Stakeholder category	High level overview of stakeholder commentary (Responses to specific research questions are references with RQ number)
		<p>Market segmentation to target the easier installation opportunities.</p> <p>In terms of installations, this representative was concerned that larger companies would focus on the low hanging fruit, namely domestic properties built after the 1990s. This would reduce technical risk for such companies. In addition, this representative considered that larger companies would most likely follow a cluster mentality – targeting “easier” properties – and leave the more difficult segments of the market for smaller firms. The cost of acquisition for these smaller firms would be considerably higher as a result.</p> <p>Other:</p> <p>Concerns about greenhouse gas emissions from heat pump refrigerant fluids. We should be transitioning to reduce substances with high global warming (GWP) potential, and there should be strong standards and accreditation.</p>
7	Wider decarbonisation supply chain actor	<p>RQ1:</p> <p>An industry not known for its diversity in terms of gender, race, or physical disabilities.</p>
8	Heat pump manufacturing representative	<p>RQ1:</p> <p>An industry not known for its diversity in terms of gender.</p>
9	Heat pump trade body representative	<p>RQ1:</p> <p>An industry not known for its diversity in terms of gender, race or physical disabilities.</p>

Stakeholder reference	Stakeholder category	High level overview of stakeholder commentary (Responses to specific research questions are references with RQ number)
		<p>RQ5:</p> <p>Need for harmony between supply and demand, otherwise companies are not going to respond to BEIS signals.</p> <p>There is a need for “soft skills” in addition to the more technical skills to be a successful heat pump installation business.</p>

Appendix C: Summary of Conclusions

Research Question	Key Findings	Evidence Gaps
<p>What are the characteristics and activities of heating and cooling installers?</p>	<p>The heating and cooling installation sector is primarily, but not exclusively, made up of SMEs. SMEs can be cautious and risk-averse, preferring to work with known technologies and techniques than to innovate.</p> <p>Installers in the workforce have transferable skills but will require upskilling in the technical elements specific to heat pumps.</p> <p>There are very few women in the installer workforce. The stakeholders we interviewed commented that the sector is not diverse in gender or representative in terms of people with physical disabilities. However, some stakeholders stated that there is ethnic diversity. A significant proportion of the workforce is nearing retirement age.</p> <p>Installers working on gas appliances are spread across the country in proportion to the general population except, unsurprisingly, in regions where use of gas is relatively low.</p>	<p>There is a lack of specific information and quantitative data regarding:</p> <ul style="list-style-type: none"> • The skills, specialisms, experience, and qualifications of installers; • Diversity within the workforce, including numbers of employees with all types of disabilities or impairments as stated in Section 6 of the Equality Act 2010; • The proportion of installers' activities spent on heat pumps and other heating technologies, and how this is expected to change in the future; • The split of installers working across different types of buildings, and • The geographical spread of installers working with non-gas appliances.
<p>How can installers be categorised into distinct archetypes based on their willingness to install heat pumps, and the upskilling required to do so?</p>	<p>There was very little information within the literature to appropriately archetype the market and willingness to upskill.</p> <p>The literature highlights the barriers that SMEs face to including new technologies in their offering to consumers. It offers suggestions about the use of incentives, paid for training and other methods of de-risking the transition that will be relevant in the heating and cooling market.</p>	<p>The literature tends to make generalisations about the nature of installers and does not differentiate into distinct archetypes. However, the literature does refer to the use of archetypes to target engagement and support for installers through the low carbon transition.</p>

Research Question	Key Findings	Evidence Gaps
		<p>There is little or no evidence within the literature reviewed regarding:</p> <ul style="list-style-type: none"> • Attitudes to diversity in the sector; • Any regional variations in distances that installers would travel to undertake work, and • How installers can be encouraged to advise on and recommend heat pumps as appropriate to their customers.
<p>To what extent can heating and cooling installers be upskilled to work on heat pumps?</p>	<p>The literature and the stakeholders interviewed here express a high degree of confidence that existing installers can be upskilled to work on heat pumps if they are willing. The research suggested several factors influencing whether installers are interested in upskilling, in particular requirements of accreditation schemes and customer demand for new products. Willingness to train on new technologies may be limited when installers have sufficient existing work and cannot afford to take time out from this.</p> <p>Several sources highlighted a lack of standardisation and consistency in training. It is important to note that, historically, training has not been adequate for the specifics of heat pump installations such as hydraulics and sizing calculations.</p> <p>Also, low carbon retrofit Vocational Education and Training generally has failed to provide the broad range of skills needed, such as problem solving across disciplines.</p>	<ul style="list-style-type: none"> • There is no quantitative information on the proportion of existing installers who are willing to upskill to install heat pumps; • The literature offers several factors that contribute to installers' willingness to upskill to install heat pumps. However, it is not clear on which of these may be dominant in different situations; • There is very little evidence on how costs and location of training courses affect willingness to upskill, or how this compares with other training options; • There is no evidence on whether installers may prefer to specialise in any specific technology or to remain flexible and on the factors that influence this decision;

Research Question	Key Findings	Evidence Gaps
	<p>In 2021 the Heat Pump Association launched a new Heat Pump Installer training course, but it is too early to see if this addresses some of the issues identified.</p> <p>While the quality and quantity of evidence in the literature was quite high regarding this research question, it is important to stress that most literature predates the introduction of the Heat Pump Association's training course.</p>	<ul style="list-style-type: none"> • There is very little evidence on factors that influence employers' willingness to take on an apprentice, and who they take on (incl. diversity), and • There is no evidence on installer confidence in explaining to consumers how to choose the right electricity tariff for their heat pump.
<p>What are heating and cooling installers' attitudes towards standards and accreditation for low carbon heating and what factors influence these views?</p>	<p>All heat pump installations should be installed in compliance with Building Regulations. The literature suggests that a minority (around 30%) of heat pump installations are conducted by certified heat pump installers. The literature does not specify which certification body, but this may refer to the MCS certification required for installers to use Government grant funding.</p> <p>There is a general wariness amongst existing heating installers towards further regulatory burdens associated with certifications. Certification is seen to be overly complex, costly, and time-consuming.</p> <p>One of the findings in the literature was that the common reasons for choosing one certification scheme over another included minimising the cost of accreditation and minimising the cost of training provided.</p>	<ul style="list-style-type: none"> • There was no evidence about which accreditation bodies installers belong to, and why (aside from Gas Safe as this is a legal requirement for gas boiler installers); • There was very little evidence on the factors influence decisions to join/not join specific schemes, and • There was very little evidence on whether installers would want schemes to change or be consolidated or replaced.

Research Question	Key Findings	Evidence Gaps
	<p>The literature also suggested that expanding existing installer certification schemes could help to ensure good customer experiences if the issues of complexity were addressed so that more installers join the schemes.</p>	
<p>How might installer business models need to change to effectively install heat pumps, and what challenges could this pose for installers?</p>	<p>The evidence highlights the need for the installer workforce to have the technical skills to install heat pumps, but also a range of soft skills such as marketing, sales, and client/customer liaison. Installers, and consumers, need to be aware that a whole-house approach to retrofit is required.</p> <p>Few alternative business models were suggested within the literature but one that was discussed was the use of a heat pump rental model to overcome the initial cost barrier to installations.</p> <p>Another model that was suggested was segmenting building types. Segmenting the building stock and targeting certain building types could help installers in their approach to the heat pump market. Several of the industry stakeholders interviewed focused on this topic, detailing a hierarchy of approaches to domestic buildings and individual market segments that could be targeted (new build properties; those recently built; and all other remaining domestic properties).</p>	<p>The literature offered only partial answers on:</p> <ul style="list-style-type: none"> • The potential approaches, risks, opportunities, and business planning considerations for transitioning to becoming a heat pump installation business, and • The challenges faced by different types of installation businesses to install heat pumps. <p>There is very little or no evidence in the literature on:</p> <ul style="list-style-type: none"> • Affiliation with a manufacturer or energy supplier and/or other major factors that influence which equipment installers choose; • Whether installers offer smart controls, radiators, or other additional energy efficiency measures; • How installers work alongside other professions; which of these are in-house, and which are external; and expectations about how this may change in the future; • The main factors driving cost and time to install a heat pump and how these could be reduced;

Research Question	Key Findings	Evidence Gaps
		<ul style="list-style-type: none">• The main sources of business for installers; and• The extent to which businesses may be expected to specialise in certain technologies; and how businesses can take steps to improve diversity within the sector.

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