

# Supply change

Seizing opportunity in the UK heat pump supply chain

Niamh O Regan

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## ABOUT THE AUTHORS

### **Niamh O Regan**

Niamh joined the SMF research team in August 2021. Since joining the SMF Niamh has primarily worked on projects relating to education and skills and Net Zero. She is also interested in migration, security and the UK-EU relationship

Prior to joining the SMF, Niamh worked in higher education and had conducted research on nuclear issues. Niamh holds an MA in Intelligence and International Security from King's College London, and a BA in Politics, International Relations and Irish from University College Dublin.

## EXECUTIVE SUMMARY

### **Though still in its infancy, recent global developments have shown the need for the UK to scale up its heat pump supply chain**

- The UK heat pump supply chain is much thinner and newer than in mainland Europe and Asia, where heat pumps are more established. In the UK heat pumps are currently predominantly imported, and the installation and consumer experience largely mimics that of gas boilers.
- The pandemic and the war in Ukraine have shown the vulnerability of the global supply chain and the need to move away from volatile fossil fuel markets. Many countries have begun to reassess how they heat their homes.
- There is potential for the UK to capitalise on the increase in demand as other countries decarbonise. Speaking to stakeholders, we identified economic, innovation and security opportunities for industry across manufacturing/production, installation and the consumer offer.

### **Firstly, there is significant economic and security potential in increasing manufacturing**

- Manufacturing presents significant market opportunity. With government ambitions of reaching 600,000 heat pumps installed a year by 2028, the domestic market is set to grow and has not yet been captured by any single manufacturer.
- As well as potentially contributing £5.5 billion to the UK economy by 2035, domestic manufacturing can lead to job creation and have positive knock-on effects for UK research and development.
- Beyond the initial economic benefit, domestic manufacturing could spur innovation in heat pump design, such as models specifically designed for UK homes. Domestic manufacturing also helps reduce UK reliance on imported heat pumps, reducing the impact of supply chain shocks.
- The greatest challenge, however, is convincing manufacturers to begin heat pump production at scale in the UK.

### **Second, improving the installation and skills element of the supply chain could make heat pumps cheaper for consumers**

- Stakeholders see installation as a key area for reducing the cost of heat pumps. Innovation in home assessment can reduce the time it takes to establish a quote, and therefore the overall cost.
- The size of the heating installer workforce is set to increase, presenting great opportunity for green jobs to grow, both in heat pump installation and in system design. Bringing together these elements creates the opportunity for developing a new workforce structure and greater integration and relationships between manufacturers and installers.
- Development of any new workforce structure, however, is hampered by a lack of skilled installers in home heating, an aging workforce and, crucially, insufficient new entrants.

## **Finally, developing new consumer offers could further help to make heat pumps more attractive to the public**

- New consumer offers such as heat as a service, where consumers pay for heat rather than for fuel, may make running a heat pump more affordable. “Whole home” energy packages where the heat pump cost is included in the monthly fee would make installing a heat pump a much more viable option for many.
- New means of financing heat pumps, through asset leasing or property linked finance, could also provide an answer to reducing the cost barriers consumers face.
- Some stakeholders however expressed concerns about the difficulties of a leasing model for owner occupied homes and also concerns that property linked finance could come up against legal issues when it came time to sell a property.

## **To make these opportunities reality, we recommend the following policy measures**

### **To persuade manufacturers to invest, government needs to provide certainty on the future of heat pumps**

- Recent policy changes have cast doubt on the place of heat pumps in the UK’s future, which is unhelpful for providing the certainty that industry has asked for.
- Heat pumps should be named as a minimum requirement in the Future Homes Standard, so that all homes built from 2025 onwards will definitely have heat pumps.
- The Clean Heat Market Mechanism needs to work on developing all elements of the supply chain and should be paired with an information campaign for consumers to drive up demand. Any fines for non-compliance with the mechanism should be fed back into the supply chain, e.g. to fund installer training or to contribute to the pot for the Boiler Upgrade Scheme.
- When considering investments for net zero, government needs to think about a long-term approach, moving beyond Treasury spending review cycles.

### **To make the most of employment opportunities and consumer options, Government needs to consciously develop the future installer workforce and new market structures**

- Developing the low carbon workforce should be a priority, and government should work with industry and training providers to design a strategy for scaling the workforce.
- Government should facilitate the development of a new market structure for the consumer offer, investigating the viability of heat as a service and asset leasing.

### **Government needs to ensure compatibility with secondary markets to maximise the potential for opportunities to succeed**

- Policymakers need to improve the business case for heat pumps through energy price restructuring, making heating through electricity a more financially viable option for much of the public.

- Policymakers should support the creation of innovative financial products such as property linked finance, and work to ensure they don't encounter the same issues as previous schemes. Doing so will make customers more willing to take on a heat pump, benefitting the economy and contributing to net zero.



## CHAPTER ONE – INTRODUCTION

### Heat pumps are necessary for reaching net zero

Decarbonising home heat in the UK is necessary to help achieve net zero by 2050. Domestic heating alone accounts for about 14% of the UK's annual greenhouse gas emissions, and as Britain has the draftiest and leakiest homes in Europe, it often means we need to burn more gas in order to keep warm. It is a significant task, which presents a vast range of opportunities to seize and challenges to mitigate. This task of decarbonising homes amounts to an investment of around £250 billion by 2050 – £9 billion a year from the late 2020s – for 29 million homes.<sup>1</sup> As previous SMF research has highlighted, there is also a desperate need for a skilled workforce capable of insulating homes and installing low carbon alternatives to gas boilers.<sup>2</sup>

The scale, complexity, and cost of the task engender a range of heating solutions depending on geography, house type, and heating system. It is clear however, that heat pumps are expected to play a significant role in providing low-carbon heating for UK households – not least because the government claims so in its 2021 Heat and Buildings Strategy. The strategy describes the government's target of installing 600,000 heat pumps a year by 2028 as 'no- and low-regrets action', which "will be needed in all paths to net zero".<sup>3</sup> This has come with financial support to help households to install heat pumps through the Boiler Upgrade Scheme (BUS).<sup>4</sup> More recently, the Net Zero Review urged the government to adopt a 10-year mission to make heat pumps a widespread technology, calling for the end of all new gas boilers by 2033 "at the latest", two years earlier than had been previously suggested by then prime minister Boris Johnson.<sup>5</sup>

Under the Climate Change Committee's Balanced Pathway scenario, heat pumps are expected to represent around 75% of low-carbon heat installations (and 60% of all heat installations) in homes by 2030.<sup>6</sup> This scenario estimates a potential market of 5.5 million heat pumps in just eight years, rising to around 27 million by 2050. UK consumer awareness of heat pumps is growing, and there has been a consistent increase in heat pump installations. Simultaneously, global demand for heat pumps has risen significantly in the last few years, with many countries enacting policies that encourage a rapid conversion to low carbon heating, in an effort to reduce their emissions.<sup>7</sup>

Beyond the environmental benefits that heat pumps bring – cutting greenhouse gas emissions and improving air quality – scaling the market also has economic benefits and could improve the energy security of the UK. There is scope for expanding heat pump manufacturing, creating new jobs and harnessing UK innovation. The exposure to volatile gas markets demonstrates why we should be seizing the opportunity to decarbonise our heating. It would save consumers money and shield them from volatile price shocks by reducing dependence on gas for heating. UK renewables are already seeing significant progress, with the UK a world leader in offshore wind.<sup>8</sup>

These benefits have yet to be realised. The Net Zero Review finds that the UK could do a lot more to harness the economic benefits of net zero.<sup>9</sup> Although heat pumps are already a proven technology installed across the world, this report reveals that the UK market is much less developed. In 2021, just 55,000 heat pumps were installed compared to nearly 1.7 million gas boilers.<sup>10</sup> This report explores what the domestic opportunity for scaling up heat pump supply chains is, and investigates what the constraints are.

### Box 1: Understanding heat pump technologies

Heat pumps are an established heating system, that uses technology similar to fridges or an air-conditioning unit.<sup>11</sup> While there are different heat pump technologies, all of them will contain a refrigerant, a compressor and a heat exchanger. The two main technologies are Air Source Heat Pumps (ASHPs) and Ground Source Heat Pumps (GSHPs)

Heat pumps extract heat energy from the environment around them, causing the refrigerant to become a gas. The gas is compressed, which makes it hotter, and then moves over a heat exchanger, creating the heat for the home.<sup>12</sup>

**ASHPs** extract heat energy from the air around them. This can include waste heat from factories or transport systems. The heat can be delivered to the home through a wet central heating system using radiators (this is known as air-to-water) or through fans (this is known as air-to-air).<sup>13</sup>

**GSHPs** extract heat energy from liquid circulating in a network of underground pipes. Heat is delivered through radiators and/or underfloor heating.<sup>14</sup>

Heat pumps are a more environmentally friendly and efficient way to heat a home compared to traditional methods. They capture and transfer heat that already exists, rather than burning fossil fuels to generate heat.<sup>15</sup>

### Navigating the current political context

The move away from fossil fuel heating systems is a particular policy area that has come under fire in media, with heat pumps in the middle of the storm. More right-leaning sections of the media in particular appear highly sceptical of heat pumps. Heat pumps are often framed as a new and untested technology, and their suitability for British homes is regularly questioned.<sup>16</sup> Reports often focus entirely on high cost and disruptive installations. Despite the fact that the majority of those with heat pumps are satisfied with them (even those in older homes), there is a greater focus on those who are not happy or who do not intend on installing a heat pump.<sup>17</sup>

The media are not alone in their attitudes, which migrate to the political as well. Despite numerous analyses saying that reaching net zero will require substantial investment and clear direction, over the past few years policy announcements have often been vague, light on funding and heavy on hope.

Summer warnings that the government may row back on green pledges, were realised in mid-September, with the Prime Minister scrapping previous commitments on minimum energy efficiency requirements and delaying bans on the sale of petrol and diesel cars.<sup>18</sup> Crucially for the context of this report, the ban on the installation of new fossil fuel boilers in off grid homes has been pushed back by nine years, to 2035. It was also announced that an estimated 20% of the housing stock will be permanently exempt from switching to low carbon heating. These two factors could significantly depress heat pump demand in future. At the same time support available through the BUS (which can be used to replace a fossil fuel boiler with a heat pump) has increased from £5,000 to £7,500.

While the Labour Party were unhappy with the nature of the policy announcements, they have also been rolling back on green commitments. Shadow chancellor Rachel Reeves suggested that Labour's pledge of spending £28 billion a year on green initiatives if they win the next election would only come in during the second half of their parliamentary term.<sup>19</sup> At the time of writing, the Labour Party had said they would not reinstate original targets scrapped in the Prime Minister's announcements.

Net zero has also started to become a dividing line in politics, and there has been concern from some corners that dropping green commitments could be used by both government and opposition in a strategy to win votes, despite the fact that the public is largely supportive of climate policies.<sup>20</sup>

## Methods

To understand the existing knowledge and arguments for the UK heat pump supply chain, we conducted a review of existing literature. However, there is a dearth of research exploring how the UK can better develop its supply chain. Understandably, much research focuses on barriers to the uptake of heat pumps and their impact on the UK's carbon emissions, rather than on supply chains.

This report is therefore primarily informed by qualitative research and engagement with researchers, businesses, industry bodies, manufacturers, and wider stakeholders in the heating, ventilation and air conditioning (HVAC) industry and private finance. We conducted 16 in-depth interviews with industry stakeholders throughout July and August 2022. Interviewees were asked to reflect on where they felt there were opportunities for the UK to further develop the heat pump supply chain and what challenges there may be to this scaling. This group included manufacturers, industry group representatives, financiers, innovators, energy representatives, an installation company, and policymakers.

After our initial interviews concluded, the policy landscape changed slightly. In the US, new legislation aimed at increasing domestic production of environmental products, including heat pumps, was announced, followed by a response from the EU. Announcements in the Autumn 2022 budget included additional funding for low carbon heating, greater R&D tax credits and the creation of an Energy Efficiency Taskforce. The Spring Statement, which followed a winter characterised by a worsening energy crisis, announced a three-year extension to the BUS. Given these changes, we conducted a roundtable in late spring 2023 to investigate how and if stakeholder attitudes had changed.

This report begins with an overview of the historical and policy context of home heat manufacturing in the UK, which is followed by a reflection on the UK heat pump supply chain, and where there are opportunities within it. It also examines risks and challenges to those opportunities. The report summarises the chapters as follows:

- **Chapter Two** provides an understanding of the existing global and domestic heat pump supply chains, and an overview of UK policy in relation to heat pumps.
- **Chapter Three** explores the opportunities for the UK in the manufacturing sector of the supply chain.
- **Chapter Four** investigates what opportunities the UK might have in scaling up the installation and the consumer offer elements of the supply chain.
- **Chapter Five** suggests policy considerations for the government.

## CHAPTER TWO – UNDERSTANDING THE HEAT PUMP SUPPLY CHAIN

### Global and domestic supply chains are similar on the surface, but in reality are far apart

#### The global heat pump supply chain is well developed, particularly in the upstream

The global heat pump supply chain is well established and very international in nature. This is particularly the case at the upstream of the supply chain, in components and manufacturing, which tends to be dominated by a small number of global or regional players. At the other end, installation and the consumer offer vary greatly from country to country.

Component manufacturing is a truly global operation. Less specialised components such as fans, pumps, conventional controls and pipework are produced globally and at scale. More specialised components, such as compressors and refrigerants, are produced by a much smaller selection of manufacturers (some heat pump manufacturers will make these in-house). Specialised components are not always unique to the heat pump supply chain. Many of the components used in heat pumps have wider application, including in automotives and refrigeration.<sup>21</sup>

The production and assembly of heat pumps is dominated by a small number of global players. The leading manufacturers are Carrier, Daikin, Mitsubishi, and NIBE. All have global manufacturing facilities, and production and assembly of the heat pump unit tends to be concentrated relatively close to the point of sale or installation.<sup>22</sup> Location of manufacturing is important for logistics. Fully built heat pumps are best shipped by means other than air, and closer proximity of manufacturing to consumer means that the logistics supply chain faces fewer shocks. Where shocks are encountered, they are easier to weather.

Installation and skills can vary depending on location. Some places will require a set training course, an accreditation from installers, as well as skills development. In addition to individual installers and installation companies, there is often overlap with industries involved in home retrofit, as well as housebuilders, to ensure a home is appropriately insulated, ventilated and designed to house a heat pump.

As with installation, consumer experience can vary greatly depending on location and how consumers receive their heating. Many consumers may have an individual heat pump system in their home, which they pay for and then pay for the energy used. Other consumers may receive "heat as a service" (HaaS), with greater involvement from energy companies, or be part of a heat network.

**Figure 1: Structure of the global heat pump supply chain**



Source: SMF

### UK policy has not stimulated demand for electric or low carbon heating sources

Heat pumps have been in widespread use across northern Europe since the 1970s and are used extensively in Asia. While the number of installations are increasing, heat pumps are yet to gain serious traction in the UK market and the heat pump supply chain is still in its relative infancy.

Policy gives an insight as to why this may be the case. British homes have been publicly supplied with gas since the late 19th Century, and gas boilers remain the dominant means of domestic heating. Approximately 86% of domestic properties in the UK use gas to heat their homes. As a result, there has been a longstanding demand for gas boilers and a history of gas boiler manufacturing and innovation in the UK.<sup>23</sup> Four UK boiler manufacturers produced 55% of the near 1.7 million boilers sold in the UK in 2019. In 2021 boiler sales increased to 1.75 million.<sup>24</sup>

Heat pumps by contrast have a much lower take-up, with only 55,000 domestic hydronic heat pumps installed in 2021.<sup>25</sup> Where historically gas has been relatively cheap, electricity has been more expensive, taxed four times as heavily as gas for residential energy use, making it a more expensive fuel for home heating.<sup>26</sup>

### UK heat pump supply chain is heavily reliant on imports

The lack of demand is reflected in the UK's underdeveloped heat pump supply chain, which largely mimics the boiler supply chain, but with lower levels of manufacturing. The domestic manufacturing and installation of heat pumps is largely seen as a "cottage industry" with smaller specialist manufacturing outfits.<sup>i 27</sup>

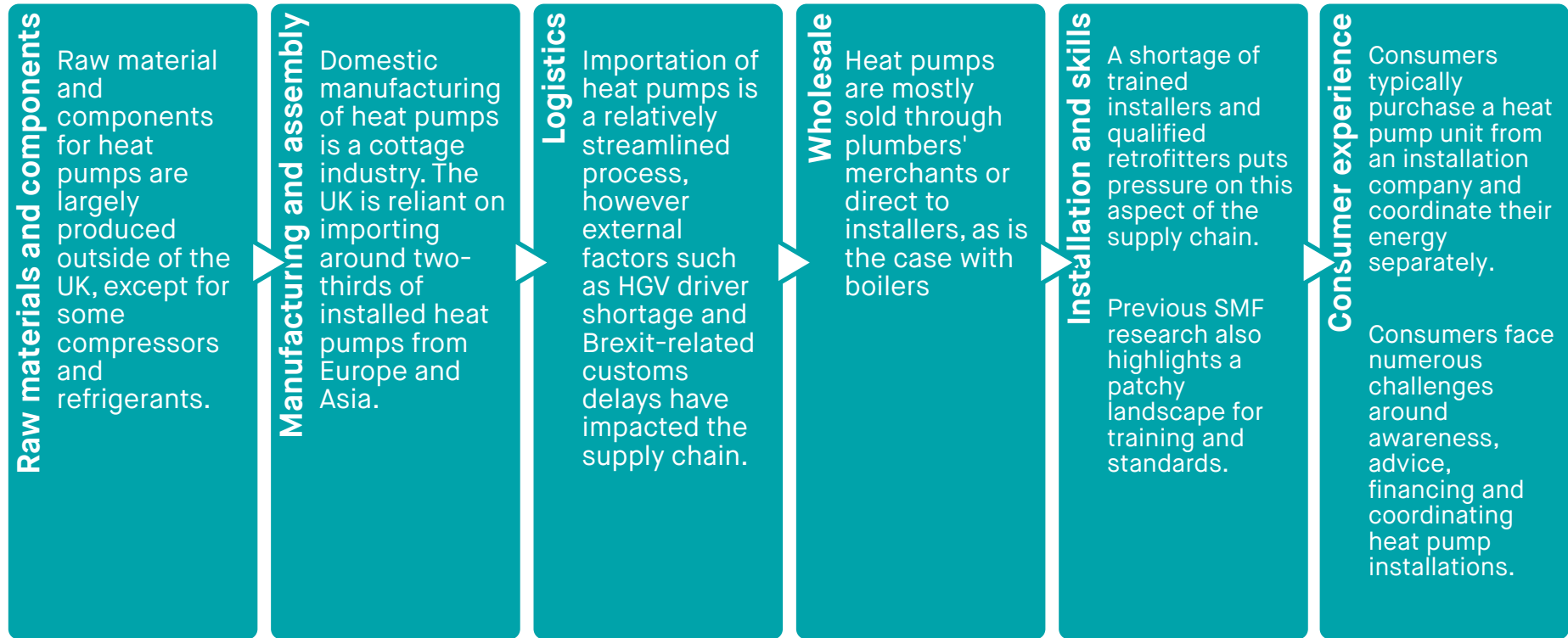
Some manufacturing does take place in the UK. In 2019, 10,830 heat pumps were produced domestically, 32% of the total UK heat pump sales.<sup>28</sup> The UK manufacturing space is dominated by two players, Mitsubishi manufacturing air source heat pumps in Scotland and Kensa manufacturing ground source heat pumps in Cornwall. The remaining two-thirds of heat pumps are imported from manufacturers in continental Europe and Asia.<sup>29</sup>

The downstream elements of the supply chain largely mimic the dominant gas heating supply chain. There is a focus on individual or sole trader installers<sup>30</sup> (although installation companies are emerging) who will buy a heat pump direct from a wholesaler or plumbers merchant, or in some cases from the manufacturer. As with the gas heating supply chain, there is pressure on this supply chain due to shortages of trained installers. Customers will pay for the unit and its installation. As with gas, they will then pay for the units for energy used to run the system, and separately pay a heating engineer to resolve any maintenance issues that arise.

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<sup>i</sup> Even though Japanese manufacturing giant Mitsubishi makes heat pumps in their Livingstone factory.

**Figure 2: The UK heat pump supply chain**



Source: SMF

## Recent developments have highlighted the need for the UK to scale up its supply chain

### There is growing global demand for heat pumps and a desire to come off of fossil fuels, particularly gas

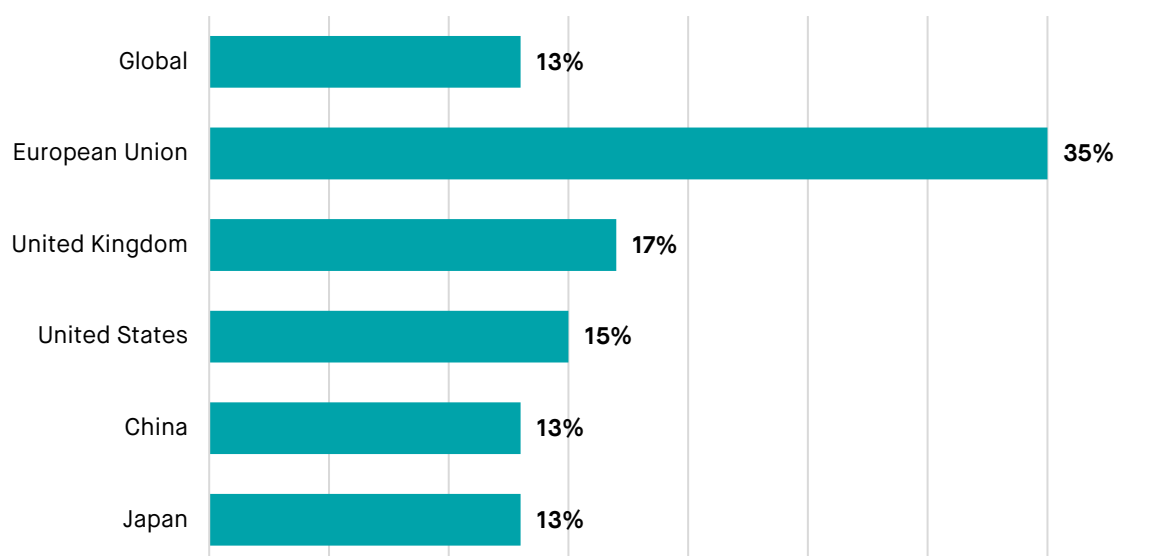
The decision of governments across the world to set dates to reach net zero carbon emissions, combined with concerns of energy security, have set them racing towards low-carbon heating options, and the global heat pump market has seen a surge in demand that is not expected to slow down any time soon.<sup>31</sup>

Demand has been driven by both environmental policies as well as global events. Like the UK, many countries are committed to reducing their national carbon emissions and now have strategies in place to achieve this.<sup>32</sup> Spiking gas prices caused by the war in Ukraine have made gas heating much more expensive, even for those who do not buy their gas from Russia. For those who are accustomed to importing gas from Russia, the threat of gas supply being cut off at any moment has become a greater risk. Many European countries are therefore looking to wean themselves off gas as fast as possible. This comes both from the need to improve internal energy security and stability, and a desire to stop financing the war by buying gas imported from Russia.<sup>33</sup>

### Increased sales in other parts of Europe show the potential growth for the UK market

Europe is leading the charge in increased heat pump sales. 2021 was a record year with a 34.5% increase in heat pump sales on 2020, bringing the total number of heat pump sales in Europe that year to 2.81 million.<sup>34</sup> France (537,000) and Italy (380,000) saw some of the biggest sales figures after respective increases of 36% and 63%.<sup>35</sup> The UK also saw strong growth, with a 17% increase in heat pump sales just ahead of global (13%) and non-European markets (15% in the US, 13% in China and Japan).

**Figure 3: % increase of heat pump sales in selected regions 2020-2022**



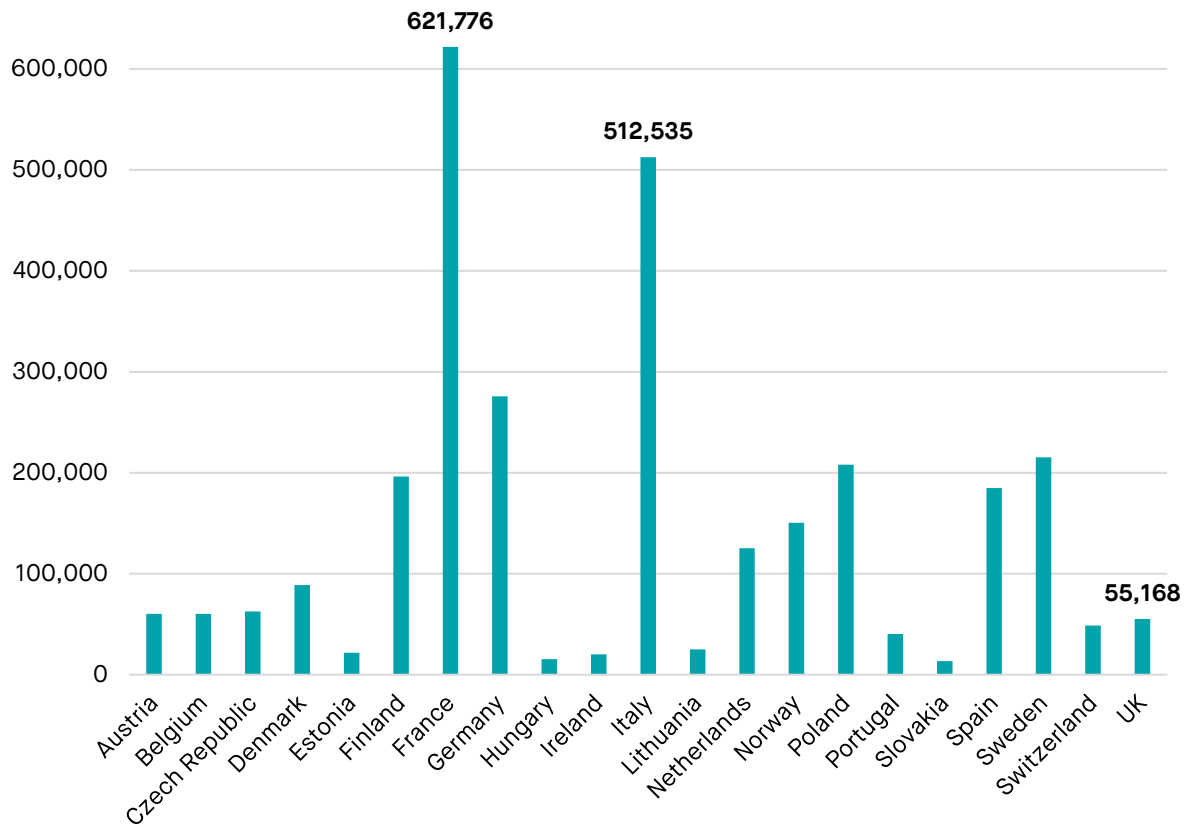
Source: SMF analysis of International Energy Agency (IEA) and European Heat Pump Association (EHPA)



Estimates from 2022 (displayed in Figures 4 and 5) indicate that strong European growth is continuing. Globally sales grew 11%, and Europe sales grew almost 40%. Belgium and the Czech Republic both experienced gains of over 100% in 2022, while in France heat pumps outsold fossil fuel boilers for the first time. Poland, which not long ago was a nascent market for heat pumps, saw the fifth highest number of heat pumps sold in Europe in 2022, with a 112% increase on sales from the previous year,<sup>36</sup> making heat pumps the heating system of choice.<sup>37</sup> Ireland and the Netherlands (which both have similar climates to the UK) saw 2022 sales rise to 10.35 and 15.06 heat pump sales per 1,000 households, compared to the UK's 1.90 sales per 1,000 households.<sup>38</sup>

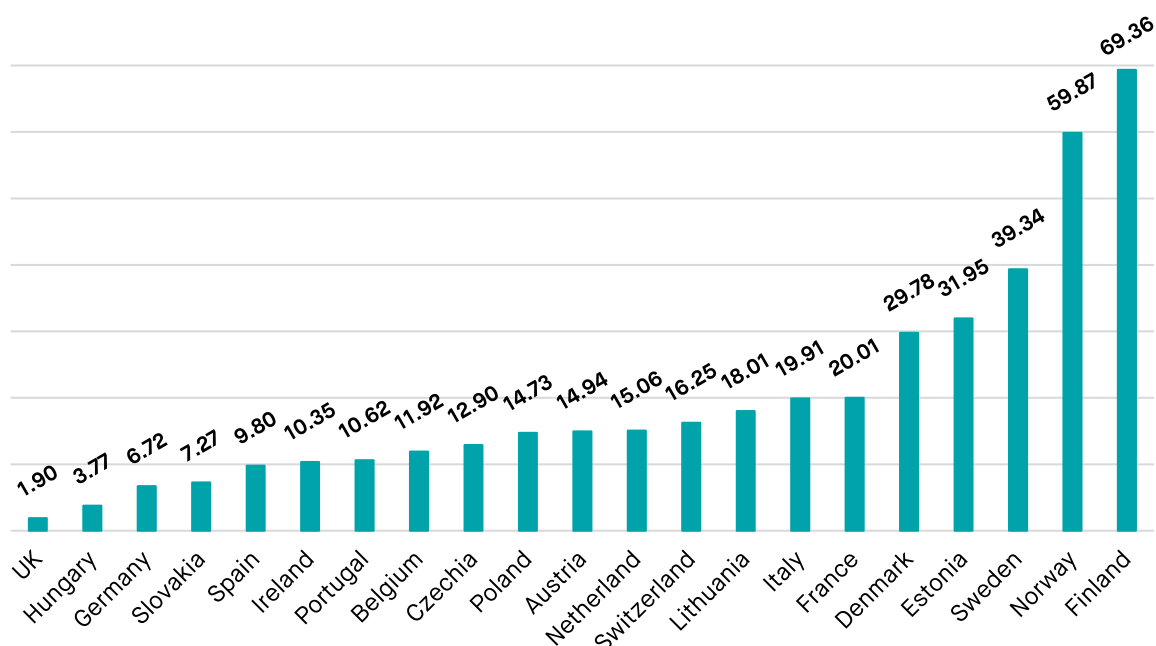
Judging by the speed of growth seen across the rest of Europe, it is clear there is great potential for heat pumps in the UK to grow – and to grow dramatically and rapidly, if sufficiently motivated.

**Figure 4: Heat pumps sold in 2022 per country (Europe)**



Source: EHPA Market Report 2023

Figure 5: Heat pumps sold per 1,000 households in 2022 (Europe)



Source: EHPA Market Report 2023

Key to increasing sales seems to be pro-heat pump policies. Regulatory policies that focus on phasing out fossil fuel heating systems are not uncommon. The Netherlands is set to require all boiler replacements from 2026 to be hybrid heat pumps, for example.<sup>39</sup> Regulations on phasing out coal have led to increased uptake of heat pumps in Poland, which was further accelerated by the invasion of Ukraine and a move away from Russian gas.<sup>40</sup>

### External factors have highlighted the need to capitalise on domestic opportunities

COVID-19 highlighted vulnerabilities in the global supply chain. Production slowed in many industries as workplaces closed or operated on reduced capacity. Combined with choked ports and export delays, supply chains had to contend with greater uncertainty and longer delivery times.<sup>41</sup> Supply chain issues have been further compounded by Russia's invasion of Ukraine, and energy security has been thrown into sharp relief.

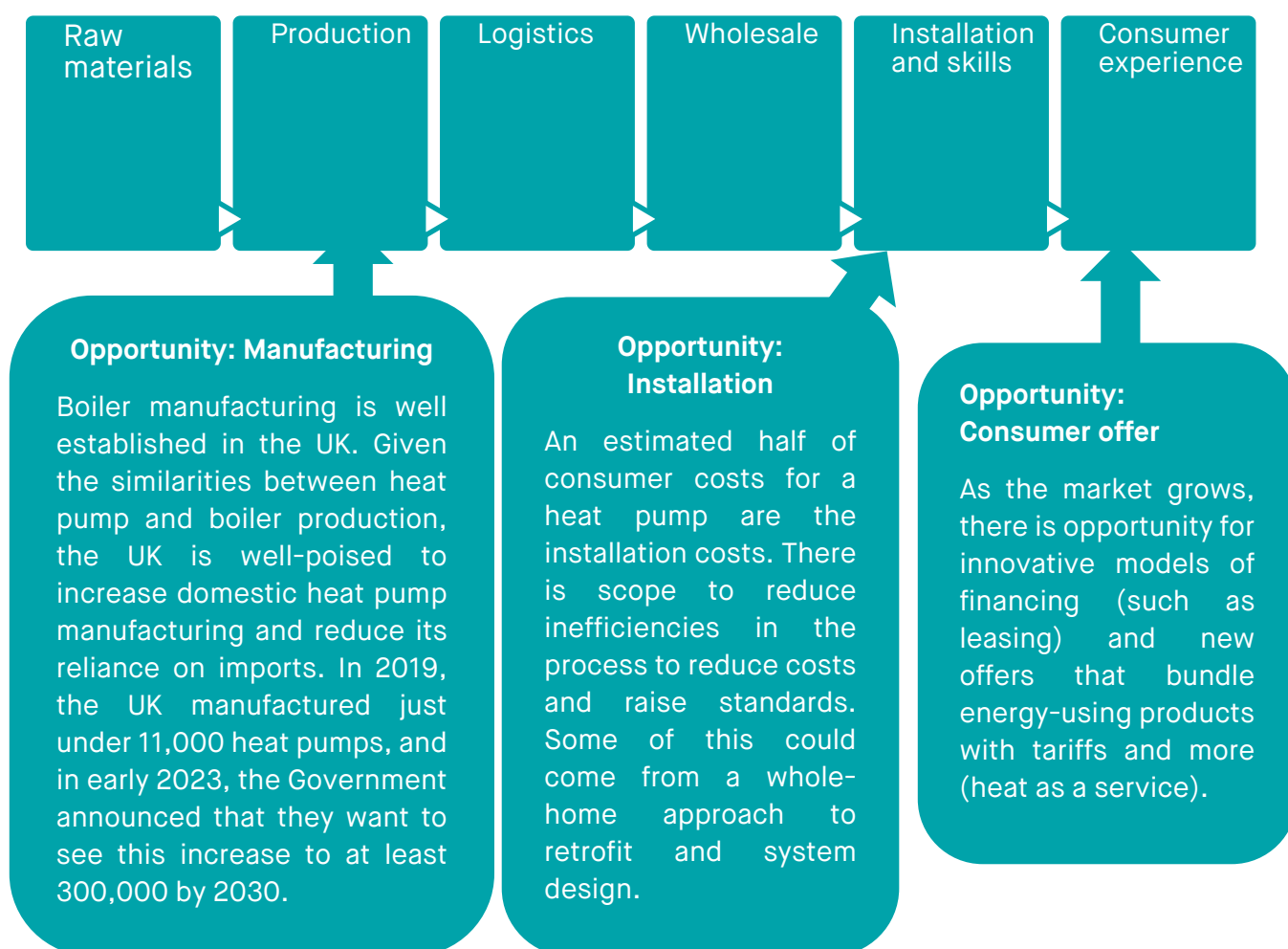
Responses to these factors have focused on bringing supply chains closer to home. In the US, the Defense Production Act named heat pumps as a critical technology, and its Inflation Reduction Act (IRA) provides subsidies for US manufacturing of green technologies including heat pumps. In the EU, the Green Industrial Plan includes proposals for regulatory reforms making it easier for governments to provide net zero subsidies and approve new factories and facilities, both of which make manufacturing in the EU more attractive. As an SMF briefing note has highlighted, while much of the UK was initially rattled by IRA, concerned by the effect it could have on UK manufacturing, the EU response is the one we should be more concerned about.<sup>42</sup>

## There are opportunities to develop the UK supply chain in three key areas

Given how well established the global supply chain is, building an entirely UK-based supply chain is likely to be unwise. The question is where within the supply chain can the UK have the most impact.

Examining the limited literature that exists on the supply chain and our conversations with stakeholders gave us an insight on where the UK could do its best work. Previous research by the then-Department for Business Energy and Industrial Strategy (BEIS) found that there was some increasing manufacturing of heat pumps and components.<sup>43</sup> However, stakeholders we spoke to felt the components side of the supply chain was relatively set, particularly on specialised components, but there was greater wiggle room for manufacturing heat pumps themselves. They felt the next best parts of the supply chain for the UK develop were in installation and the consumer offer. Together these three areas present the best opportunity for the UK to innovate and potentially cut the cost of a heat pump.

**Figure 6: Opportunities in the supply chain**



Source: SMF

If the UK successfully scales the heat pump supply chain, it brings with it environmental benefits, but also a strong economic opportunity. In a 2020 report on the manufacturing supply chain, BEIS estimated that manufacturing two-thirds of the UK's heat pump demand could contribute £5.5 billion to the UK's economy by 2035.<sup>44</sup> Analysis from Greenpeace in 2021 on the Climate Change Committee's Balanced Pathway scenario estimated that shifting to low carbon heating such as heat pumps and implementing energy efficiency measures could contribute £2.4 billion to UK GDP by 2025 and £4.8 billion by 2030.<sup>45</sup> The government also expects that meeting installation targets would support 90,000 jobs by 2035.<sup>46</sup>

## CHAPTER THREE – THE MEANS OF PRODUCTION: TAKING THE OPPORTUNITY IN MANUFACTURING

### **There is a guaranteed market**

As discussed in Chapter One, the UK heat pump market is still relatively young. But demand for heat pumps has consistently risen year on year.<sup>47</sup> With the phase out of gas boilers in new-build homes starting in 2025, there is a guaranteed market for heat pumps in the UK, bringing with it substantial economic opportunity. The size of this market and the opportunity is now in doubt, however. Given the government's changes to the fossil fuel boiler phase-out, it is uncertain if the aim of installing 600,000 heat pumps a year by 2028 still stands.

Conversations with stakeholders indicate that demand for heat pumps is currently outstripping supply. Even with relatively low demand, the UK already imports more heat pumps than it produces. With new policies aimed at phasing out fossil fuel boilers, the number of heat pumps the UK will need is set to grow, indicating that there is significant scope for increased manufacturing and opening the opportunity for new entrants into the heat pump market.

The lure of a guaranteed market could attract new international heat pump manufacturers to establish facilities in the UK. Existing UK boiler manufacturers may have a head start if they act quickly. As heat pumps and gas boilers share many components, supply chains are already well established. These manufacturers also have the advantage of being household names in the UK, with a consumer and installer base who are familiar with their products and who trust them to provide home heating solutions.

Domestic boiler manufacturers we spoke to recognised that heat pumps did present a market opportunity and many of them have already developed their own heat pump models. One manufacturer, Vaillant, while best known in the UK for boilers, has already begun to manufacture heat pumps in the UK in response to rising demand.

*“We have a lot of the knowledge here to do it... It's still a cottage industry. You are bringing together expansion valves, compressors, copper and fittings, wiring looms chassis to fit them in all those sort of bits and pieces. It's not beyond the wit of man to do it here in the UK.” (Heat pump industry representative)”*

There is also scope for new players to enter the manufacturing space. Energy supplier Octopus, for instance, has begun to manufacture their own heat pumps after buying manufacturer RED in Northern Ireland.

Figure 7: Heat pump manufacturing locations, Europe



Source: EHPA

Alongside serving the UK market, some manufacturers felt there was potential for the UK to become a heat pump exporter. The International Energy Agency (IEA) estimates that global manufacturing of heat pumps will need to quadruple by 2030.<sup>48</sup> Heat pumps made in the UK are already exported, covering approximately 0.5% of all heat pump sales in north western Europe. With the combination of higher global demand and greater manufacturing output, it is easy to see how this share could grow.<sup>49</sup>

However, stakeholders caveated that they saw export as a minimal opportunity. Most felt that any new or expanded heat pump manufacturing facilities in the UK would be to serve the domestic market, with some scope to export to Ireland and potentially the Netherlands, two countries with similar climates. As can be seen in Figure 7, heat pump manufacturing is already well established in continental Europe, often by the same organisations involved in boiler manufacturing in the UK.

*[on export potential] “For any of the major manufacturers, I would say no, because we've all got parent companies and production facilities elsewhere in the continent... We won't be manufacturing anything for export, from here [manufacturing] is going to be for the local market only.” (boiler manufacturer)*

### **Domestic manufacturing could help establish the heat pump as a trusted heating system**

Our conversations with stakeholders, and in our previous work with heating installers, indicate that the British public do not prioritise British-made heating appliances, focusing instead on price and performance. Installers, however, are more interested and like to be able to see how a product is developed. Manufacturing in the UK could give installers a greater opportunity to see this, and to build their trust and knowledge of heat pumps. Building installer trust in product is vital from a sales perspective, as we will refer to in the next chapter.

### **Greater manufacturing will contribute to the creation of green jobs, could have a knock-on effect on related industries and has the potential to reduce costs**

#### **Growing heat pump production grows job opportunities**

Increased heat pump manufacturing has already had a positive effect on jobs. The recent expansion of Mitsubishi's operations in Livingston in 2021 led to a 17% increase in the number of heat pump manufacturers, and in 2022 Kensa doubled the number of their employees.<sup>50</sup> The decision of boiler manufacturer Vaillant to begin heat pump manufacturing in the UK is expected to create 300 jobs by 2027.<sup>51</sup> A reported 20,000 manufacturing jobs in the Black Country could be at risk by the move to net zero, from industries that would be phased out. More fossil fuel manufacturers moving to heat pumps will not only create more jobs, as can be seen with Vaillant, but also help to preserve existing ones that might otherwise be threatened.

#### **Heat pump research and development opportunities could grow**

Greater heat pump production could spur research and development into more efficient heat pumps, less environmentally damaging refrigerants and into adapting heat pumps to operate on higher flow temperatures. Manufacturers we spoke to are already looking at continuous innovation in heat pumps to make them a sleeker, quieter and more viable technology for many households.

Research and development can happen within manufacturers themselves, but also through collaboration with local colleges and universities. Such collaboration can extend to improving heat pump system design and installation training. Some of this can already be seen, with Ideal Heating partnering with Derby College to deliver heat pump installation training.<sup>52</sup> There is also potential for a positive knock-on effect on related industries, such as retrofit and power generation spurring on the creation of further green jobs in and developing green skills. This matching of manufacturers with local education and training, and with other local businesses has the potential to help create net zero clusters of innovation.



### Domestic manufacturing could contribute to a reduced cost of heat pumps and an opportunity to address UK specific issues

Government research has suggested that, if sufficient volumes of heat pumps are manufactured in the UK, there is scope for manufacturers to invest in automation, reducing the cost of labour.<sup>53</sup> A stakeholder we spoke to felt that some costs could be reduced as shipping parts could be cheaper than shipping whole heat pumps, and contingency for damage of parts (versus contingency for damage of fully assembled heat pump units) could also help to bring down the cost. When manufactured in the UK, servicing heat pumps could also become cheaper. One manufacturer informed us that, where there is a fault in a heat pump, servicing will happen in factory rather than on site.

In our previous report, *Installing for time*, many installers expressed a concern that a large portion of UK homes would not be suitable for heat pumps. Lack of space, poor energy efficiency and the need for whole home retrofits were some of the factors cited. In making the UK a manufacturing hub for heat pumps, however, there is an opportunity to create a “fit for UK” heat pump model.

Manufacturers we spoke to had a mixed response to UK focused innovation. Some stakeholders we spoke to do see an opportunity to carve out a niche and build a model designed specifically to suit the needs of the UK housing market in terms of reliance on gas, size and space constraints. Such models could be applicable beyond the UK, in the Netherlands and Ireland for example, given that they have similar climates and gas grid connectivity.<sup>54</sup>

*“we're in the middle of designing a UK, more friendly UK and more price-based UK range of heat pumps” (boiler manufacturer)*

Others felt that taking the time to develop a UK model would be unnecessary, as current heat pump models do work well in the UK. In their view, ongoing innovation is better focused on addressing wider issues and elements that are more important to a larger market, such as coping with home retrofit and creating units that are smaller, quieter and prettier. Models which were more aesthetically pleasing had some traction among stakeholders. Several manufacturers reported that they are already in the process of developing models that fit these different market niches.

*“We know the kind of the market requirement is sort of the same as the European market requirement. There's no, there's no real difference between a heating system in the UK and the Netherlands, no difference at all.” (international heat pump manufacturer)*

*“The rate of innovation is fast... As the market gets bigger, all of the niches will start to become viable” (heat pump manufacturer)*



Stakeholders felt that one area that great potential for innovation was in developing a heat pump that would work better for retrofit properties. Given the difficulties that have been expressed in retrofitting some of Britain’s properties to make them heat pump-suitable, this space could be a real win for manufacturers. Solutions to these issues could make the transition to heat pumps much smoother and could potentially be used in other regions where some properties face the same issues (albeit not on the scale of the UK).

Innovation around heat pump components is already ongoing, in particular refrigeration. Stakeholders informed us that work is underway to design refrigerants that are less environmentally damaging and that can run at higher flow temperatures. The ability to run on higher temperatures could result in less need to retrofit (e.g. pipes may not need to be changed), providing solutions to a greater number of homes.

*“The retrofit market is the real prize ... products aimed more specifically at the retrofit market will typically have higher flow temperature capabilities, and low noise runs along with that... Apartments are a difficult one at the moment and ... terraced houses is a classic situation where you can put the heat pump on that. And I think solutions to that, you know, will be forthcoming.” (heat pump manufacturer)*

*“high temperature heat pumps will be quite a key thing to help with the retrofit costs. So we’ve got a big innovation going on with that ... think we’ll probably see quite a lot of innovation in that respect, which will be useful for most of the European market but will be quite well suited to the UK for sure” (manufacturer)*

## **An uncertain policy landscape hinders manufacturing progress**

### **Domestic manufacturers still need to be convinced of the market opportunity to scale manufacturing**

There is substantial pessimism among manufacturers about scaling up heat pump production, at least in the short term. One of the key factors is uncertainty of policy. While heat pumps look as though they have a secure place in the UK’s future, this does remain uncertain. The planned 2025 boiler phase-out in new builds does not guarantee that heat pumps will be in place. The Future Homes Standard has yet to be finalised and published and so the position of heat pumps there remains uncertain.

The 2026 ban on installation of new fossil fuel boilers in off-grid homes has been delayed to 2035, which is currently stands as the date for fossil fuel phase-out for on-grid homes. However, this date is now also in doubt, especially as the Prime Minister has introduced an exemption for properties where it is deemed too difficult to transition. We do not yet know what “too difficult” would mean, but it is estimated that 20% of houses would be exempt. None of this provides certainty on the future of heat pumps in the UK for manufacturers, at home or abroad. Finally, while there are indications that hydrogen is more likely to be the fuel used by heavy industry rather than homes, a decision on the future of hydrogen will only be made in 2026. Domestic boiler manufacturers are backing both horses and will go where the market directs them, with many feeling that the route is not yet clear.

*“If we end up in a situation where you know... [we have] a prohibition on even hydrogen-ready boilers at a certain point, then we're going to have to redeploy staff to do something else. So, I think there's a natural segue into heat pump manufacturing in very, very late 20s, early 30s anyway, as a result of that, that that shifting dynamic there” (boiler manufacturer)*

Boiler manufacturers that already have production lines in the UK are also reluctant to fully commit to transitioning to heat pump manufacturing prematurely, as they do not yet see sufficient demand for it. One manufacturer we spoke to stated that once the UK reached 100,000 heat pumps installs a year, they would be happy to manufacture in the UK and feel confident in transitioning some of their boiler manufacturing lines.

*“Manufacturers will manufacture, if there's demand for it, you know, they're not stupid. If there's money in it, they'll manufacture ... I think a lot of it is actually building up that consumer face in the first place” (energy researcher)*

The market-based mechanism (see Box 1) may change this somewhat, but there was trepidation and scepticism from some stakeholders on how effective the mechanism would be. There is some concern that, if the government's plan is to introduce the mechanism from 2024, they are not leaving a great deal of time for manufacturers to get their act together.

*“our concern with it [MBM] is it's going to trigger a price war and a race to the bottom in the UK market ... what we could potentially see happening is maybe one or two of the majors importing product.. and undercutting everybody ... makes a really difficult financial case to invest in the UK” (boiler manufacturer)”*

Beyond manufacturers, other stakeholders we spoke to did not believe that the mechanism itself would necessarily spur on demand from consumers.

*“If the market is not there, they're [heat pumps] just going to sit there gathering dust. If you create the market, they'll [manufacturers] do 100% heat pumps, **if** the market demands it.” (heat pump industry representative)*

## Box 2: Market Based Mechanism

The government's commitment to a market-based mechanism might mean that manufacturers will not necessarily have to be convinced of the opportunity to manufacture heat pumps, but they will be obliged to manufacture. Broadly, a market mechanism is a policy tool that is used to influence what the market sells. One example of a successful market mechanism is the Zero Emissions Vehicles (ZEV) mandate in California, which required car manufacturers selling in California to ensure a share of their vehicle sales were "ZEVs". The mechanism has been very successful and, as a result, sales in California of battery powered electric cars are three times the US average. It has been so successful that earlier this year the mandate was ratified on a federal level in the US.

The government has committed to a "Clean Heat Market Mechanism" (CHMM) to encourage heat pump manufacturing in the UK. The specifics of the mechanism have not yet been confirmed, but the general overview is that it will "place an obligation on the manufacturers of heating appliances to meet targets for the proportion of low-carbon heat pumps they sell each year, relative to fossil fuel boilers."<sup>55</sup> The preferred option would have low first year targets, to help manufacturers adjust to the obligation, which then would increase year on year. In the first year manufacturers would need heat pumps sales equivalent to 4% of gas boiler sales over 20,000 unit and of oil boiler sales over 1,000 units. In the second year, the target would increase to 6%.<sup>56</sup> Notably, only heat pumps sold to the UK market and installed in the UK will count, as exports are exempt.

The consultation proposed the first year of the scheme to be 2024/25. However, at the time of writing, the details and dates of the CHMM have not been finalised.

### International manufacturers do not see the UK as an attractive place to invest

International manufacturers we spoke to were less confident about new production facilities in the UK. Several stakeholders felt that manufacturing in the UK is not seen as an attractive proposition for manufacturers that are not currently based here. Practicality and trade policy both play a role here. Many manufacturers are growing their production capacity but are doing so in their existing facilities, which are mostly in continental Europe, where heat pump manufacturing is well established. This may also be further compounded by manufacturing subsidies that have been made available for heat pump manufacturers in the US and potentially in the EU. Relatedly, the uncertainty of future trade policy and Brexit means that manufacturers would prefer to remain where they have easy access to a wider market. Finally, most manufacturers we spoke to felt that the export opportunity from the UK was minimal.

*“I don't think there's any policy incentive to [manufacture in the UK], and as far as I'm aware, you know, there's no, there's no impetus to do it here rather than somewhere else.” (energy researcher)*

*“I do just think at the moment, from a commercial point of view, you would look at it and be like, it's a mess over there. They don't know what they're doing, you know, there's no solid policy, why would we go and build a brand new factory there when we mightn't be able to easily export to our other markets?” (energy researcher)*

*“it's [non-UK manufacturing] due to the B word. So effectively, we would still be producing outside of Europe ... it looks to me like there's a bit of a migration of heat pump manufacturers to set up plants in Poland ... the reason I think that's really likely, it's because we've already got domestic appliance plants there. So we'll follow that.” (heat pump manufacturer)*

### **Domestic manufacturing does not necessarily mean cheaper heat pumps**

The majority of stakeholders felt that domestic manufacturing would not have a significant effect on heat pump costs. Contingency costs added to shipping could reduce, but the effect would not be dramatic. Manufacturers were not convinced that the cost of making a heat pump would be notably reduced.

*“I can't see any innovation out there, which would suddenly make a heat pump half the price of what it is today” (boiler manufacturer)*

*“There's no there's no hidden £5000 ... it's an illusion, it's utterly wrong. There is some saving, unquestionably there will be more competitiveness the more installers we get, it probably would be cheaper for us to make heat pumps in the UK after the initial investment ... But again, nowhere near what BEIS like to believe” (boiler manufacturer)*

Additionally, as many industries transition to net zero, some component parts are in greater demand while other components, such as semiconductors, have been affected by the chip shortage. This has meant the price of some components has been rising.<sup>57</sup> Any automation will naturally come into conflict with job creation as increased automation tends to reduce the number of workers needed on the shopfloor. It is also worth questioning how much automation could be done, and the effect this would actually have on costs. Heat pumps are produced at scale across Europe and have been for some time, but an air source heat pump in Europe still costs in the region of €8,000-€12,000.

### **Failure to stimulate manufacturing could make the net zero transition more difficult**

Increased heat pump sales are inevitable, but increased heat pump manufacturing in the UK is not. Failure to stimulate greater heat pump manufacturing domestically will mean that the UK will continue to be reliant on imports to power the switchover to heat pumps. Continued dependence on imports makes the supply chain more vulnerable to external shocks, and delays. This could be further exacerbated by growing demand in the global market. The risks of dependence are especially key if manufacturing and policy for manufacturing do not start soon. Both the Inflation Reduction Act in the US and response measures from the EU on investment in green technology may prompt investors and manufacturing companies to move to where they can avail of greater subsidies. It is worth noting that even among the boiler manufacturers located in the UK, many are part of global manufacturing groups, and the decision to grow heat pump manufacturing does not necessarily rest in the UK office. If the business case for manufacturing heat pumps in the UK does not stack up, they may not invest in facilities here.

*“they {government} obviously are concerned that boiler manufacturing jobs in the UK could be lost to imported heat pumps if the market takes off.” (boiler manufacturer)*

## CHAPTER FOUR – MAXIMISING OPPORTUNITY IN INSTALLATION AND THE CONSUMER OFFER

### **Installation and skills has significant opportunity area for market development, but contains some of the greatest pinch points**

The downstream stage of the heat pump supply chain represents the greatest opportunity area for market development in the UK, as flagged by industry stakeholders. However, this stage of the supply chain also contains some of the most entrenched pinch-points which will require sustainable long-term policy to resolve. This chapter details the opportunities, challenges and risks related to installing heat pumps with a particular focus on the workforce.

### **There is scope to move towards a new market structure for skilled installer workforce, moving away from the “merchant model”**

The installer workforce is a key part of the supply chain and central to the development of the heat pump market in the UK. However, currently it is highly fragmented with notable levels of self-employment particularly among gas workers (77%).<sup>58</sup> The current market structure comprises sole trader gas installers who purchase boilers on the wholesale market (such as through a merchant) and carry out a simple, often like-for-like boiler swap that requires minimal system design or wider retrofit.<sup>59</sup> A consolidated structure could provide a more streamlined end-to-end consumer experience with greater quality assurance over installation. Sales are a key constraint in the supply chain. As it stands, these same home heating installers are largely responsible for boiler sales to customers. Installers will recommend brands that they trust and that they know will work for a property, but they tend not be employed by the manufacturers.

Heat pump installations are starting to mimic this process, but heat pumps do require greater system design and often need wider retrofit. As discussed in our *Installing for time* report, some heat pump installers may have sufficient training to conduct a home assessment, but others may only be trained in the actual fitting and controls of a heat pump.<sup>60</sup> As both parts are necessary for a properly sized and installed heat pump, a move away from the sole trader model may be inevitable.

The link between manufacturers and installers is important for direct sales and training to ensure heat pumps are installed to a high standard to run efficiently. There is a reputational risk for manufacturers if heat pumps perform poorly due to poor fabric fit or system design. Many heat pump manufacturers do require installers to complete a training course on their systems or products for the unit to qualify for the warranty, but don't have their own band of installers.

As a result, businesses are starting to think about how to develop and improve this relationship, with suggestions that greater vertical integration could be likely. Installation companies and entech (environmental technology) companies have shown greatest interest compared to manufacturers. Energy company Octopus, by contrast, is starting to demonstrate an end-to-end supply model that extends from production through to the consumer offer, with in-house manufacturing, installation and energy provision.<sup>61</sup> Their role as a market disruptor has arguably spurred some competition. British Gas have now moved into this space too. They offer whole home assessment, retrofit and installation of a heat pump from a partner manufacturer by their in-house trained installers.<sup>62</sup> There are few other large businesses in the UK opting for this sort of vertical integration and it is particularly notable that it is largely energy suppliers who seem to be the market disruptors, rather than for example, manufacturers.

### **Innovation in installation and home assessments could reduce the cost of installation**

Industry experts estimate the overall cost of fitting a heat pump is split 50/50 between the unit and the installation labour cost. Government officials estimated that the overall cost is comprised of one-third unit, one-third installation labour and one-third ancillary costs (such as pipes). It was suggested that these costs have high margins as it is a nascent market, but there is scope to reduce these costs through training centres and innovative assessment technology. As discussed in the previous chapter, many of the costs, such as those of heat pumps or ancillary components, are set.

### **Innovation in installation and home assessment could speed up the process and reduce labour costs**

Some manufacturers feel that they can reduce the time it takes to install a heat pump through their manufacturing, such as through split heat pump units. Others feel that their approach to training will significantly reduce costs, accelerating a four-day installation with a team of four installers to just two days. This, they argue, would reduce the cost of getting a heat pump. This would likely be a benefit of a consolidated workforce, where teams are deployed rather than coordinating individual sole traders across plumbing heating, electrics and construction.

Second, there is strong scope for innovation and technology in lowering the cost element of establishing an initial quote. The labour needed to install a heat pump is not just for the physical installation process, but also in the preparatory work in assessing the suitability of a property, such as room-by-room heat loss calculations and determining the right sized heat pump. Conversations with stakeholders indicated that there is scope for a lot of innovation in this space, easing the process for both installers and consumers:

*“There’s a huge role that the tech industry can play into heat pumps, it can specifically manage sizing surveying, which is a big chunk of the time that you spend on it” (energy researcher)*



*“the way this has been expressed to me is it costs about £250 to send someone out to do a survey for a heat pump install.. on your house.. That's not too bad if you win every job, but if you only win one in 10, then actually that survey to win that job has cost you £2500” (heat pump manufacturer)*

*“We're working with people who are trying to utilize the software and use utilizing sensors to figure the heat loss in the heat requirement of your building without having to go out” (heat pump manufacturer)*

### Box 3: Innovation in home assessment: Local energy area mapping in Oxford

An example of innovation in home assessment can be seen in Oxford. Recognising the need for a local, place-based approach in the net zero transition, Local Energy Oxfordshire are developing spatial mapping tools to assist with local area energy planning. As part of the EnergyRev Plus project, Oxford Brookes University developed designed a Local Area Mapping Tool (LEMAP) that helped to visual energy flows in a local area.<sup>63</sup> The tool combines information from over 150 data sets on energy demand, energy resources, building demographics, fuel poverty, electricity networks and the socio-demographics of residents.<sup>64</sup> The result provides a comprehensive picture of energy use and generation.

There are three technical layers to the tool. First is “baselining”, which identifies local energy flows and how they vary depending on socioeconomic characteristics and dwelling type. Second is “targeting”, which identifies which properties are suitable for different low carbon technologies. Finally, the tool conducts “forecasting” of energy demand if the low-carbon technologies are implemented (including heat pumps), as well as forecasting energy demand profiles.<sup>65</sup>

*“We're proving high density heat pump deployment in retrofit within a, within a limited geographic area. ... they recommend got a tool that can from publicly available data, categorize a residential area by household income stats, and by energy usage stats, they can kind of say, who is predisposed to, to a pumping station, which kind of really narrows down what's going on” (heat pump manufacturer)*

## The opportunities in installation will need to overcome some significant challenges before they are realized

### Recruiting a workforce of fully qualified heat pump installers is an uphill battle

For any sort of new market structure to work, there needs to be sufficient numbers of heat pump installers. Neither industry nor government actually know how many heat pump installers there are in the UK.<sup>66</sup> Nesta estimated that in 2022 there were between 3,000 and 4,000, falling short of the near 8,000 engineers required for that year under the CCC's Balanced Pathway trajectory.<sup>67</sup> Scaling the workforce to an adequate size is necessary to cope with installations, but also for innovations in the installer side of the supply chain to take off.



Previous SMF research has highlighted various challenges for growing this workforce, with recruitment being a key difficulty.<sup>68</sup> Upskilling the existing largely gas, heating installer workforce is one solution, but this is an ageing workforce and many do not see heat pumps as being a part of their business for the years they plan to remain working.<sup>69</sup> Given the policy uncertainty, even younger installers 20 years from retirement are unsure if they will ever need to train on heat pumps.<sup>70</sup>

Encouraging existing installers to retrain is compounded by past negative experiences. Stakeholders spoke to us about how policy failures of previous schemes such as the “solar coaster” had caused scarring, resulting in a low trust in policy and an unwillingness to invest where there was uncertainty. Previous policy commitments to solar and renewables, such as through the Feed In Tariff, led many installers to invest heavily in solar technologies and training.<sup>71</sup> However cuts to subsidies and the subsequent drop-off in solar installations risked many jobs in the industry, with engineers missing their return on investment. The impact of the so-called “solar coaster” has made many hesitant to commit to heat pumps and the costs that training and business development may incur.

Recruiting new entrants is no easy feat either. Securing sufficient new entrants is a barrier in and of itself. A recent SMF report on careers guidance in England showed that awareness of apprenticeships and how to access them is low.<sup>72</sup> This concern was shared in our roundtable discussion, where attendees had found that, often, the students who could be the heat pump installers of tomorrow didn't even know it was an option.

*“We've also just done some research what Gen Z want from a green job with, with specific focus around getting people into not just installing but all the ancillary services around renewable technology. And what came out of that quite clearly, which is quite worrying is there's a real void. They just don't know about this as an option. How do you get people into the sector if it's not even on their radar?” (renewable energy representative)*

The second issue in creating a qualified workforce is around the training itself. Installing heat pumps requires a greater focus on system design rather than ‘plug in and play’, which has come to define the nature of boiler installation in the UK. For heating engineers who are already trained in plumbing and heating, the Heat Pump Association believes that at least five days should be sufficient for training in both system design and retrofit.<sup>73</sup> For entirely new entrants the process is naturally longer. Up until recently there was not a direct route into training on low carbon technologies without starting on gas, through a traditional plumbing route. As of August 2023 a Level 3 Low Carbon Heating apprenticeship has been approved for delivery, but starts on the apprenticeship were not yet possible. One installation company told us that their greatest difficulty in providing training is in being able to afford apprentices. As a smaller company, they feel that the costs of taking on an apprentice are too great, which is contributing to a choked supply chain.

### **Sales are a key constraint in the supply chain, and consumer awareness of and trust in heat pumps is lacking**

Currently, many businesses view installers as the core salespeople for heat pumps. With a gas boiler, installers will normally recommend a boiler to the homeowner, which more often than not the homeowner will purchase. Gas boilers are familiar, and customers will not usually need much persuading. One manufacturer highlighted that the cost of sale is significant to the business, as it takes longer to build customer knowledge of and trust in the product to complete the sale.

As referred to in Chapter One, consumer doubt is further amplified by misleading media on heat pumps, and there is insufficient work from government countering these narratives. What would not help, however, is if low-quality installations increase bills and damage trust in heat pumps. As it stands there is no official accreditation scheme for heat pump installers to ensure installations are held to a minimum standard. MCS certification has effectively become a proxy for accreditation, as installers need it in order to claim for the BUS, but there are still risks for those who are not using these schemes, or when the schemes end. Building the reputation of heat pumps among innovators and early adopters is crucial to bring more consumers on board.

### **Labour is still expensive, even with innovation**

While some innovation may reduce the time and therefore cost of installs, labour is still required and remains expensive. One installer company cautioned that Octopus are “creating a hype” that the cost of heat pumps can significantly be reduced when labour is still currently expensive. Advertising cheaper installs based on lower hanging fruit would create false hope for consumers. In our spring roundtable, the reduced cost element also raised concerns for the viability of smaller installation businesses operating in this area.

*“I think one thing that people often forget is the gas boiler and installations are far easier and currently an awful lot more profitable than heat pump installations ... Now, that has a real impact when you start to talk all the heat pump installation getting cheaper ... Well, I'm looking at the current prices, and I'm not sure how I'm going really make much of a profit. That's a real a real challenge.” (heat pump installation company)*

### **There is still a misunderstanding of what it means for a house to be “heat pump ready”**

There are two main concerns around whether a house is suitable for a heat pump. The first concern is around the heating system, pipework and radiators. Traditionally, heat pumps have operated at lower flow temperatures than gas boilers. Depending on what is currently in place and how big the room is, pipes and radiators sometimes need to be replaced in order to heat the room effectively. Owing to advancements in heat pump technology, this is becoming less common. The second and more prominent concern is around efficiency. There is a common misconception that heat pumps will only operate effectively in well insulated homes with a very high energy rating. Advances in heat pump technology means that heat pumps can still perform well in properties with lower energy ratings. That being said, all heating systems benefit from greater efficiency, and more efficient properties tend to have a lower rate of heat loss and as a result cheaper bills. There are currently 14.1 million homes rated EPC D or below, and the cost of bringing these up to a C rating is between £50bn and £139bn, depending on what measures are used.

*“The government has tied insulating to the fitting of a heat pump. If a house can be heated, a heat pump can heat it, it doesn't have to be over insulated.”  
(heat pump industry representative)*

### **Delays in the supply chain do not inspire confidence**

This trust may be even further difficult to achieve if the constraints at the upstream part of the supply chain are not adequately addressed. Relatively low demand and possibly changing lead times on components means installers are not drawn to the market. Customer quotes include a fair contingency to accommodate for this, but it can slow a project and ultimately make it more expensive.

### **The consumer offer can evolve to provide a heating model that better supports heat pumps**

#### **New consumer models such as heat as a service could provide a dynamic solution**

Energy is increasingly considered part of the heat pump supply chain. There is an opportunity to combine the installation, tariff and customer relationship elements of the supply chain through creating a system of “heat as a service” (HaaS). Rather than focusing on “inputs” such as energy used, HaaS considers heat outcomes, such as warmth. Some models focus only on the outcome; customers pay a set amount for the heat or their level of warmth, but homeowners are still responsible for the heat pump itself. Other models are entirely end-to-end, with a service provider taking ownership and responsibility for the heat pump itself and consumers being charged on the output (i.e. per unit of heat generated) or outcome (i.e. customers paying for a guaranteed level warmth or comfort).<sup>74</sup> In entirely end-to-end models, the service provider is responsible for the installation and maintenance of the heating unit. As it is their asset and their reputation, it is in the interest of the company who owns the heat pump to ensure it is installed to a high standard and is appropriately maintained.

*“we're all looking at heat as a service, we've all got something in the background, which we could dust off and roll out. And it's waiting for someone to do it first, because it's going break them all to an extent ... we would get a lot of people if one of the major [manufacturers] suddenly goes direct, and then changes the business model.” (boiler manufacturer)*

#### Box 4: Two different heat as a service models

**Energy Systems Catapult and Bristol Energy** designed a heat as a service trial in Bristol. Homes participating in the trial received smart heating controls that could feed back data to Bristol energy about thermal performance and hour-by-hour consumption. This enabled Bristol energy to calculate costs of a heating plan, bespoke to each household. There were two different pricing options. The first set a price a fixed number of warm hours, based on their existing heating schedule. The second plan offered a pay-as-you-go model, where the hours weren't fixed, but the price per hour was.<sup>75</sup>

The **Danish Energy Agency** introduced a scheme where, with the help of a government subsidy, energy service providers finance, install, operate and maintain a heat pump. The consumer, meanwhile, pays an initial upfront fee for the installation of the heat pump, annual heat pump repayments and a fixed price for the heat output, based on MWh of heat delivered. Depending on the business model of the service provider, all payments may be wrapped up in one monthly fee. Early indications show that more heat pumps have been installed than would have been without the scheme, but service providers say that without the subsidy they would not have offered the service.<sup>76</sup>

### Creating innovative financing models could help to reduce cost barriers for consumers

The cost of installing a heat pump is often cited as the greatest barrier to uptake. Some financial assistance is available through the BUS, which contributes up to £5,000 to the cost of installing a heat pump. For many households, the remaining cost can still be too much. As a result, even some of those interested in the scheme are unable to avail of it.<sup>77</sup> Financing heat pump installation has been instrumental in raising installation levels across the world, with grants, income tax or VAT rebates and low interest loans to cover the upfront cost of heat pumps, available in 30 countries.<sup>78</sup> If the government is not willing to go beyond the BUS, however, other financing options are needed.

### Asset leasing, second-hand markets and new financing structures could make heat pumps much more affordable

One method suggested was for heat pumps to be leased heat pumps to housebuilders or developers for new builds. “Asset leasing”, as this can be known, means that the provider, rather than the customer, owns and takes on the financial and technical risks of the heat pump.<sup>79</sup> This removes the upfront cost for the homeowner, who pays for renting the unit every month, with the assurance that this fee also covers any maintenance costs. Leasing does not remove the additional costs that homeowners may encounter such as replacing radiators (if necessary), but it could make the overall process more affordable. In 2021, German heating solutions provider Thermondo launched a heat pump leasing system for their customers, partnering with LG Electronics. Homeowners pay a fixed monthly fee for leasing a heat pump, which includes two years of maintenance and remote diagnostics in case of faults, and then pay for the energy the pump uses.<sup>80</sup>

One manufacturer saw that leasing could pave the way for a second-hand, refurbished heat pumps market. Once a leased heat pump had reached the end of its warranty, it could be refurbished and sold on at a cheaper rate. This could open options for households that aren’t keen on leasing a heat pump, but would be open to buying a cheaper, used one.

*“our product comes with a seven-year parts and labour warranty ... the heat pump is not finished off after seven years, it’s got a longer lifespan than that, but it’s warrantied for seven years. One of the things we do with domestic appliances in a private rented situation is we automatically replenish those products after [the warranty period] why don’t we take that approach with heat pumps? After seven years, take that heat pump out, we could then refurbish it, that could then be a cheaper secondary market there. We then update that property, to a new heat pump, let’s say, again, with a seven year warranty....once we get into heat pump systems, that changeover is a really cheap thing to do. And you’re kind of getting much more down to the cost of installing the gas boiler” (heat pump manufacturer)*

Another option is through the creation of property linked finance (PLF). In this instance a loan would be taken out in order to fund energy efficiency measures, such as a heat pump, but rather than the loan being tied to the person, the loan is tied to the property. If and when the property is sold, the loan is sold with it and passed on to the next property owner. The Green Finance Institute have argued that, as PLF is secured against the property rather than a person, there is a lower risk of lending, which enables longer repayments and capitalisation through public funds.<sup>81</sup>

### Box 5: Examples of successful property linked finance

**American Property Assessed Clean Energy (PACE) scheme (USA):** Funding covers the full cost of a project, and the scheme has a long-term repayment plan of up to 20 years. Repayments are made through a property tax bill and, like other property taxes, can be transferred to a new owner upon sale. PACE programmes are administered locally and programmes can link homeowners with trusted contractors to carry out required work. <sup>82</sup> Currently PACE is operating in 38 US states, with programmes in development in a further two and legislation enabled in a further three. Most offerings are currently commercial, but some states also offer funding for residential properties<sup>83</sup>

**GVR/Gemeentelijke Verduurzamings Regeling (Municipality Sustainability Scheme) (Netherlands):** Aimed at helping homeowners to make their homes more sustainable without the need for upfront investment. All measures are focused on reducing heat and energy demand and preparing homes to switch to alternative heating and away from gas. Schemes are administered by municipal authorities and the financing is backed by BNG Bank. Repayments are made over the course of 30 years through a municipal levy. The scheme is linked to the home and passes on to the next homeowner when the property is sold. It is also possible to pay whatever funding is left through a lump sum.

<sup>84</sup>

**Any new consumer offer would need to be properly supported to it to take off**

#### **Third-party ownership could make heat as a service and asset leasing a greater challenge for privately owned housing**

The biggest concerns for stakeholders focused on potential legal difficulties and risk management when it comes to asset leasing. Taking on the cost of many heat pumps is a significant financial risk and those responsible would need to be persuaded of the certainty of the investment. Considering the cost of manufacturing and installing a heat pump, whoever leases the heat pump takes on a degree of risk that is not insignificant.

Stakeholders we spoke to were concerned about how a full scale HaaS model could work in private homes, as a third party owning the system could cause issues when it came to selling. They saw HaaS therefore as perhaps more suitable for social housing or buy-to-let properties, where the owner of the property is unlikely to change as often. Some manufacturers also expressed concerns around whether they could be guaranteed access to the unit when such access was necessary. While some maintenance may be possible externally, if it was necessary to enter a property, homeowners could prevent the heat pump owner from entering the home and accessing to the unit. There were questions over the implications if a customer failed to pay their bills, on how or if the asset could be recovered. One manufacturer was also unsure of how leasing model would work in the current legislative framework, as a lease agreement for a heat pump could easily be five years long.

*“the product itself lies on your asset sheet. So you need to be able to have access to that product whenever you want. It could well be that the indoor apparatus or the heat pump, the homeowner may say, No, I'm not letting you in. Legally, it becomes a very difficult thing to sell heat as a service to a private household ... I've had people who have done this and when they wanted to sell their house, they've met difficulties.. as soon as the solicitor found finds there's a charge or a tie on the house, such as a boiler which isn't actually owned or paid for by the house or a heat pump, that then legally starts things getting a bit complicated.” (boiler manufacturer)*

### **The business case for leasing is a difficult sell**

Leasing works best when the leased unit is running cost savings. The higher price of electricity compared to gas, combined with a monthly leasing fee, is unlikely to incentivise customers unless the unit cost of electricity comes down. The government has accepted the need for rebalancing electricity prices, which may make this model more viable. Any HaaS-style system would also need to be designed in such a way that consumers would still be able to switch energy provider. Mutual agreements between manufacturers and energy providers or a swap out are needed to enable ownership of the asset to be switched if the consumer wanted to change to an alternative energy provider.

*“I've looked at looked at heat as a service. But at the moment, it's very difficult to justify it based on the performance of the heat pumps...it's to do with the way that the electricity bills are made up and the way that gas bills are made up. There's a lot more levying on on electricity bills than there is on gas.” (energy researcher)*



## CHAPTER FIVE – CREATING A FAVOURABLE POLICY ENVIRONMENT

As we have seen in the previous chapters, there are clearly opportunities for the UK to expand its role in the supply chain. Scaling the UK’s heat pump supply chain could help to strengthen it against some of its vulnerabilities, bringing not only economic benefits, but security benefits too. However, the UK needs to act and act soon if it is to take advantage of the growing market. Failure to do so risks the UK missing out on potential economic benefits as well as being left behind in the global green race.

The government needs to invest in net zero. A 2022 report from IPPR argued that the UK needed to invest £30bn a year until 2030 in green industries, in order not to be left behind.<sup>85</sup> At the SMF, we have said that the government needs to spend at least £54bn over the next 10 years to remain competitive against the US and EU measures mentioned in Chapter One. Evidence gathered by the IEA has suggested that financial incentives to reduce the cost of heat pump installations are one of the key instruments in accelerating heat pump deployment. The current government seems less willing to invest in net zero and in heat pumps on the scale required. While the BUS has been extended, it has not received additional funding and in March 2023 Chancellor Jeremy Hunt said that the government had no intention of going “toe to toe” with the US on subsidies for manufacturing. Although additional funding and investment would be optimal, opportunities still exist for the UK. To take these opportunities, however, policymakers need to set the conditions that enable a joined-up scaling of the UK heat pump market and to de-risk its supply chain.

### **Recommendation One: Provide long-term policy certainty across the supply chain**

One of the resounding points from both our 2022 interviews and from our spring 2023 roundtable (and indeed from earlier reports) is the need for policy certainty. Without this, many see investing in heat pump technology and training as too much of a risk. Manufacturers will not commit their production lines until they are certain they can sell. Installers are reluctant to retrain if they cannot be assured they will get to put their new skills to use. Crucially, policy certainty provides the groundwork for other areas of the heat pump supply chain. Stakeholders commented that, without policy certainty, other steps to boost the supply chain are useless because they have no backing. The extension of the time period for grants such as the BUS, as well as an increase in the grant figure, provides some certainty but this alone is not enough.

*“long term financial incentives, clear long term market signals to invest across the supply chain. Once you start having that level of certainty, or that length of certainty, then suddenly it does become worthwhile for an SME to take one and apprentice because they can see their market growing” (renewable energy representative)*

*“without certainty, none of this is going to make the slightest bit of difference” (renewable energy representative)*



Firstly, government needs to think about the long term in spending and investment, moving beyond Treasury spending review cycles. Moving towards net zero and away from fossil fuels is a long-term project that needs long-term investment. One roundtable attendee referred to the longer-term budgets elsewhere within government, such as those for the Ministry of Defence. Given the importance of energy security and stable supply chains, budgets and investment for the Department for Energy Security and Net Zero should also have a longer remit.

*“It’s worth saying, while we do exist in these kind of treasury timelines, some other departments like the MoD do get much longer funding commitments and windows and envelopes for spending. So it’s not completely out the question”  
(energy researcher)*

Secondly, government needs to be clear on the future of heat pumps. With the phase-out of off-grid gas boilers delayed until 2035, government needs to provide certainty that the date for on-grid homes will now not move beyond 2035. One stakeholder expressed their concern that the current wording of an “ambition” to phase out fossil fuel boilers is too flexible and open to change; by contrast, legislating for it would create a definitive policy commitment. The government should also publish guidance on what it means for a home to be “too difficult” for a heat pump to be installed and update the guidance regularly to reflect technological developments.

Third, heat pumps should be named as a minimum requirement in the Future Homes Standard. The standard has formalised a ban on fossil fuel heating in new homes and states that homes instead will be fitted with low-carbon heating, but what falls into this category has not yet been specified. Naming heat pumps as the low-carbon heating technology would remove ambiguity around whether hydrogen boilers would be considered as low-carbon heating and provide a clear signal to industry.

*“there are a couple of key drivers that that would kick off this supply chain. One of them, obviously, is regulation, the most obvious is the future home standard ... if the future home standard is fit for purpose, and mandates against new gas grid connections ... you’ve got, you know, 150,000 odd [heat pumps] and 300,000, if we ever get anywhere near the government’s building targets. (renewable energy representative)*

Finally, the CHMM needs to be published and it needs to be clear about what it asks of manufacturers and what types of heat pumps are eligible to be included. For the Mechanism to be successful, it needs to be paired with an extensive information campaign for the public, both to improve understanding and awareness of heat pumps and to stimulate demand. While we would hope manufacturers will invest in installers to fit their heat pumps, as we will elaborate on in Recommendation Two, government also needs to actively work on developing the heat pump installer workforce so that there are sufficient installers to fit heat pumps, in response to expected heightened demand. The consultation proposed payments in lieu of missed targets, with further penalties for non-compliance. We would recommend that any financial sanctions levied on manufacturers, either as payments-in-lieu or for non-compliance, are reinvested into the move to clean heat such as through government grants, or alternatively used to pay for the training of heat pump installers.

*“Nobody really understands it [CHMM] and so we're not having a level of debate about this that we should be having” (heating industry representative)*

*“it's really important that it's not seen as a silver bullet. Clearly there is need for support to make sure it is possible for manufacturers to meet those targets. Otherwise, that's not fair. So making sure there's still onus on the government to increase the boiler upgrade scheme, do that kind of public awareness raising and working with installers. So it is much smoother. And it's not that the manufacturers are out there trying to plug these products. It needs a joined-up approach.” (energy researcher)*

*“we know that those sorts of market based mechanisms can work.” (energy academic)*

## **Recommendation Two: Consciously develop the future market structures**

### **Developing the low carbon workforce should be a priority**

There is an opportunity to move toward a new workforce structure within heat pump installations, away from the sole trader model that currently dominates. There is already an organic shift happening in this space, with the emergence both of an “end to end” model, as with Octopus, and of smaller businesses focusing on system design and heat pump installation. However, the absence of installers poses a serious risk to this opportunity and the scaling of the whole supply chain. As Nesta highlighted, there is very little leadership in this space, with no plan from government on how to scale the industry.

To capitalise on the opportunity presented, government needs to develop a proper industrial strategy and invest in training of heat pump installers. In March 2023 an additional £5m for heat training was announced, but we think the government needs to be more strategic when it comes to workforce expansion. We agree with Nesta’s recommendation that the UK government should appoint a body to oversee the expansion of the low-carbon heating industry and workforce. Liaising with industry, training providers and colleges is necessary to create an action plan that uses lessons from those on the ground and those with experience in recruitment and training on how best to attract people into the industry.

Simultaneously, the government needs to standardise training and skills development, to ensure consistency and quality of installations. Part of this should include greater vertical integration between different parts of the industry to provide more “linked-up training”, as well as horizontal integration across related industries. Collaboration should not just connect manufacturers to colleges but should be expanded to also include existing heat pump installation companies. A roundtable attendee spoke of the difficulty small businesses have in taking on apprentices. The absence of formal support for small businesses means that it can often be too expensive for a small business to take on an apprentice by themselves, but apprentices need “on the job” training.

### **Government should facilitate the development of a new market structure for heating**

We also see an opportunity for market structure change in relation to the consumer offer, through HaaS. Some trials for different types of HaaS are currently underway in the UK, including three trials with Energy Systems Catapult. Since 2020 Ofgem have received four enquiries about HaaS, although none have yet focused on heat pumps. There is clearly an interest in HaaS from a supply side in the UK, but it has not yet taken off. Adjusting this element of the supply chain will likely take significant work and will require buy-in from across industry. Government should explore the feasibility of the HaaS model in the UK, learning from other countries that have explored it as an option and considering how these lessons, as well as those from UK trials, can be applied to the UK market. Legal concerns around leasing should be addressed, as well as concerns around customer freedom to switch suppliers.

### **Recommendation Three: Ensure compatibility with secondary markets to maximise the potential for opportunities to succeed**

#### **Government needs to ensure that measures to improve energy efficiency actively support installation of low carbon heating systems**

Firstly, current energy efficiency schemes such as ECO 4 and ECO+ should plan to pivot upgrades towards electrification. The focus should be on making sure that the fabric of the property is warm for the consumer, but also that the insulation is sufficient for heat electrification and heat pump installations later down the line. Where improvements include replacing a non-condensing boiler, a heat pump rather than a combination boiler should be fitted. Relatedly, the £6 billion for energy efficiency measures from 2025–28 announced in the 2022 Autumn Statement should similarly focus on ensuring homes are adequately prepared for heat pumps.

Secondly, as recommended in the Net Zero Review, the current EPC system needs to evolve to reflect and support net zero ambitions. As it stands, EPCs will rarely/never recommend a heat pump due to outdated understandings of heat pump efficiency and the higher cost of electricity. The government is developing an updated EPC model and plans to consult on the new model later in 2023. Finally, with a view to heat pumps becoming the standard heating source in future, compatibility checks should be a necessary requirement at “trigger points” going forward, such as during home refurbishment, at point of house sale, during annual gas safety checks.

*“at the moment EPCs, as we know, never ever recommend heat pumps, which is a crazy state of affairs. Your main metric is discouraging people from going down the route [heat pumps] that you want them to go down” (energy academic)*

### **Policymakers need to improve the business case for heat pumps through energy price restructuring**

The current business case for heat pumps doesn't stack up for many consumers due to the higher cost of electricity compared to gas. Increases in wholesale gas prices over the past 18 months have also not made the case for switching to electrified heating, as the cost of electricity is linked to the price of gas. The first key to changing this is balancing the cost of electricity to households comparative to gas by moving levies either to gas or to general taxation. Given the current cost of living crisis, this would not only be politically difficult but may also be inadvisable at this stage due to potential effects on fuel poverty. In the longer term, decoupling gas and electricity prices is necessary. The government has already conducted a first consultation on reviewing the arrangements of the electricity market, with a second consultation expected later in 2023, and will continue to explore options for decoupling. As stated in our interim report on *Energy bill support*, however, the government should be cautious not to rush energy market reform before the consequences are better understood, and consultations to determine the best way forward can help to prevent poor policy decisions. However, the length of the procedure means that any change will come over the medium term.

*“you need to rebalance the taxation between gas and electricity ... it ought to be a progressive switching of that taxation, year on year. If that was a straight line migration, so everybody knew how that was going change then then people can make policy based on that” (heat pump manufacturer)*

### **Policy makers should support the creation of innovative financial products**

The cost of a heat pump remains a significant concern for many consumer and current private funding options are limited. While investigating the feasibility of HaaS, as suggested in Recommendation One, the government needs to explore the “asset leasing” model, and how it can best support businesses interested in providing this. Secondly, the government should work with the Green Finance Institute and banks to develop a pilot of property linked finance. A key part of this would involve addressing issues from past funding schemes and ensuring that homes that have used PLF do not come up against legal issues, as experienced in the Green Deal, when trying to sell the property.

*“the GFI are developing property linked finance ... rather than being like a second mortgage that's tied to the person it's a it's essentially a service charge attached to the home so it de-risks the investment.” (renewable energy representative)*

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