Green skills as an enabler of UK retrofit

Deep dive research report – Green Jobs Barometer
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pwc

Introduction and key messages

With at least 20 percent of the UK's carbon emissions coming from buildings,[1] retrofitting our buildings to make them more energy efficient is key to meeting Net Zero goals. Energy efficiency can also play a vital role in mitigating rising living costs and creating energy security.

The retrofitting of buildings has therefore become a strategic issue for the UK. The government's Heat and Buildings strategy sets out the immediate actions and long-term signals required to reduce emissions from buildings to near zero by 2050[2]. Around £200 billion of Investment will be required across public and private sectors by 2037[3].

The economic benefits are expected to be large. In addition to the financial savings from lower energy bills, there are direct social and environmental benefits – cleaner air, warmer homes, less fuel poverty - that could be worth more than £80bn[4]. In addition, the economic activity supported by this large-scale investment will create economic growth and jobs. Government analysis suggests that by 2030, the UK's building sector will be £6 billion larger[5].

However, there are several obstacles to accelerated retrofitting of buildings: For example, the scale and cost of the challenge – UK building stock is old and draughty– and the ability to attract the necessary private sector finance.

This report highlights an equally important challenge, and one that is potentially more disruptive: in short, **there are not enough people working in the retrofit sector**. Our analysis suggests between 10,000 and 66,000 new tradespeople will be needed each year as retrofit take up accelerates – , with heating engineers, glazers and insulation specialists the most in demand. [6]In addition to these trades, many more green jobs will be required both in the retrofit sector – retrofit coordinators, receptionists, marketing – and in its wider manufacturing and distribution supply chains.

However, since demand for labour in this sector has been limited until now, and has slowed markedly in the past decade as retrofit activity has decreased, people have not yet acquired the relevant skills. **With the potential for demand for retrofits to surge, a lack of skilled workers could be a key bottleneck to solving the cost of living crisis, and to delivering both energy security and Net Zero.**

Based on research and consultations with key UK stakeholders across the built and construction sectors, it's clear a **vicious cycle is holding retrofit back:**

- Projections point to a significant gap in the skills needed to improve housing energy efficiency → but in order to invest in upskilling, both the private sector and training bodies require clear market signals – but current demand for housing retrofit is low, and the future demand is uncertain at best, hampering such investment – so the skills gap will not be filled.

This cycle is amplified by the fact that:

- There are few recognised technical education pathways into the retrofit sector. Currently, most training is done on the job as quickly as possible – e.g. a plumber 'downs tools' for a week to learn to install a particular brand of heat pump.
- Like many blue-Collar jobs in Britain, working in the retrofit sector does not receive the same societal 'prestige' as white collar jobs.

Different actors have critical roles to play in breaking this cycle:

- **National Government –** Create the clear market signals needed to convert the targets in the Heat and Buildings Strategy into reality. This should include an energy efficiency target for all UK homes, creating longer-term funding pots, a simple but trusted standard for accreditation of suppliers, and a national campaign to encourage young people to take up a trade.
- **Local Government –** Help to match local retrofit demand with local supply by identifying the homes in greatest need of retrofit and acting as a source of information for homeowners about local suppliers and government schemes. Take a lead in retrofitting social housing
- **Construction and training sectors –** Create new technical education pathways for school leavers and adult-learning; invest in new training programmes; set aside time for workers to upskill in new retrofit technologies and processes.

There is limited time for a response. According to the climate change committee (CCC), the 'policy framework is not yet fully in place to drive the large programme of delivery required within this decade'.[7] Identifying and training the workforce that will be required to retrofit 29 million homes is one of the crucial missing components of this framework.

[1]And 25% from built environment https://www.ukgbc.org/climate-change-2/
[2]Heat and buildings strategy, HM government, October 2021.
[3]Net Zero strategy: Build back greener, BEIS, October 2021. These figures refer to the investments needed to achieve the level of emissions reductions in the heat and buildings sector indicated by the Net Zero delivery pathway to 2037.
[4]Accelerating Net Zero delivery: Supplementary report – PwC for UKRI, March 2022. Note that forthcoming analysis will revise these figures upwards based on new research into the economic impact of cold homes
[5]Heat and buildings strategy, HM government, October 2021. More details can be found on: here:https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/845654/energy-innovation-needs-assessment-building-fabric.pdf.
[6]PwC Net Zero Homes techno-economic model (unpublished). We model, on a property – by – property basis, 31 retrofit measures required to decarbonise each home to a different level of energy efficiency, grouped into 4 levels of retrofit, from shallow to deep. For each level, we estimate the cost and the labour required from seven different trades. These estimates are direct jobs only and do not include (a) other staff members working in retrofit companies, e.g. management/finance (b) the indirect or induced jobs these direct jobs will stimulate further down the supply chain.
[7]Climate change committee, 2022 progress report to parliament.

Section 1. Retrofit context: key for decarbonisation but low adoption

Benefits: from accelerated Net Zero to energy security

Improving the energy efficiency of the built environment would be a game-changer for the transition to Net Zero, with the UK having one of the least energy efficient housing stocks in western Europe – losing heat up to three three times faster than European neighbours[8]. 'Fabric first' is the approach where energy efficiency interventions, such as insulation improvements, are taken as a first step, before the installation of low carbon heat technologies such as heat pumps. Fabric first is a 'no regrets' strategy, because it reduces overall heat need, whether that heat comes from a gas boiler or low carbon source.[9]

In the UK, buildings are the second largest source of UK emissions (89 MtCO2e, 20%) after transport (101 MtCO2e, 23%)[10].Residential buildings, as opposed to commercial, generate four fifths of this by burning fossil fuels to provide heating and hot water in homes. Improving energy efficiency in homes via fabric retrofits can therefore lead to a significant cut in the UK's total greenhouse gas emissions, particularly if one also adds the reduction in emissions of residential electricity use – which are not included in the above number (these are normally attributed to the power sector).[11]

Home Retrofit in the UK

Homes in the UK[12]
29m

Homes with poor EPC rating (EPC D and below)[13]
3 out of 5

Building emissions reduction target[14]
47-62% reduction from 1990 levels by 2035

Average annual jobs supported (2023-2030)[15]
45,000

Investment required
~£200bn

Average number of years taken to payback retrofit costs
15

Low-carbon home retrofits can involve the following steps[17]:

1. Insulation of lofts, floors and walls
2. Draught proofing of floors, windows and doors
3. Double or triple window glazing
4. Low-carbon heating - heat pumps, hydrogen/electric boilers, district heating systems
5. Highly energy-efficient appliances and energy-saving controls
6. Microgeneration (predominantly solar PV) and solar thermal
7. Ventilation and shading to protect against excess summer heat

[8]UK homes losing heat up to three times faster than European neighbours, tado, February 2020.
[9]The 'fabric first' approach might not be the best solution for all houses, especially given the complexity and expense of deep retrofits. However, improving energy efficiency from housing would reduce the total grid demand, lowering the emissions in the medium term, while electricity is not yet fully decarbonised.
[10]Progress in reducing emissions: 2022 report to parliament, The climate change committee, June 2022.
[11]Final UK greenhouse gas emissions national statistics: 1990-2020, BEIS, June 2022.
[12]30m is a rounded figure. CCC indicates that there are 28.6m homes, https://www.theccc.org.uk/wp-content/uploads/2022/03/CCC-Independent-Assessment-The-UKs-Heat-and-Buildings-Strategy.pdf
[13]England and Wales EPC - department for levelling up, housing and communities – Energy performance certificate data on open data communities, Scotland: https://www.gov.scot/policies/energy-efficiency/energy-efficiency-in-homes /, Northern Ireland: https://www.nihe.gov.uk/Documents/Research/HCS-2016-Main-Reports/ HCS-Main – report – 2016.aspx
[14]Climate Change Committee: https://www.theccc.org.uk/publication/sixth-carbon-budget/
[15]PwC analysis, see also Section 2 of this report.
[16]Net Zero strategy: Build back greener, BEIS, October 2021.
[17]UK housing: Fit for the future?, the committee on climate change, February 2019.

Improving housing energy efficiency is even more important today, when the UK is facing a steep rise in the cost of living due to rapidly increasing energy prices. Around 6.5 million households in the UK are either in or at risk of fuel poverty as of beginning of 2022, a figure that might be increasing as the energy crisis has accelerated throughout the year[18], in Scotland, for instance, the average proportion of fuel-poor houses is 24%, and can reach 40% in the northernmost parts. Poorer places in England suffer higher numbers of fuel poverty, which leads to hardship – and the current energy crisis could lead the number of households in fuel poverty to increase to a quarter of all UK households.

The inflation in the cost of energy took the centre-stage in PwC's September 2022 UK Economic outlook (UKEO), which linked short-term UK economic growth to energy supply scenarios. The UKEO reported that in June, electricity, gas and fuels accounted for more than 50% of headline inflation in the UK, mainly reflecting the sharp increases in oil and gas prices. As the ongoing cost of living crisis weighs down on consumer sentiment and economic growth, better energy efficiency in homes could alleviate some of the inflationary pressures and make the UK economy more resilient to future energy shocks. PwC analysis shows that deep retrofits[19] and adoption of energy-efficient appliances would help reduce household energy bills by £1,250 / year on average, even before we take into account the recent jump in energy prices[20].

The technologies needed for energy efficiency and electrification – the two main drivers of decarbonisation of the built environment – are already available on the market, including improved building envelopes[21], heat pumps, appliances, and energy efficient building design (see Box X). The key challenge in the sector is one of incentives for households and businesses to invest in retrofitting efforts, as we explain below, which then also holds back the investments in reskilling that are needed to respond to the potential increase in retrofitting demand.

Technologies for retrofitting

IEA's clean energy technology guide illustrates that 53% of the technologies in the Buildings sector are market-ready, meaning that solutions are commercially available, but some might need improvement to stay competitive. In fact, the buildings sector has the largest intersection between the impact of a technology on Net Zero and its market availability, making it an essential component required to reach Net Zero goals in the short-term, by 2030.

Most impactful and commercially-available technologies, IEA

Sector	Proportion of market-available technologies	Proportion of very-high Impact technologies
Buildings	53%	20%
Transport	39%	15%
Industry	36%	9%
Energy Transformation	32%	6%
CO2 infrastructure	30%	20%

Source: IEA, PwC analysis.

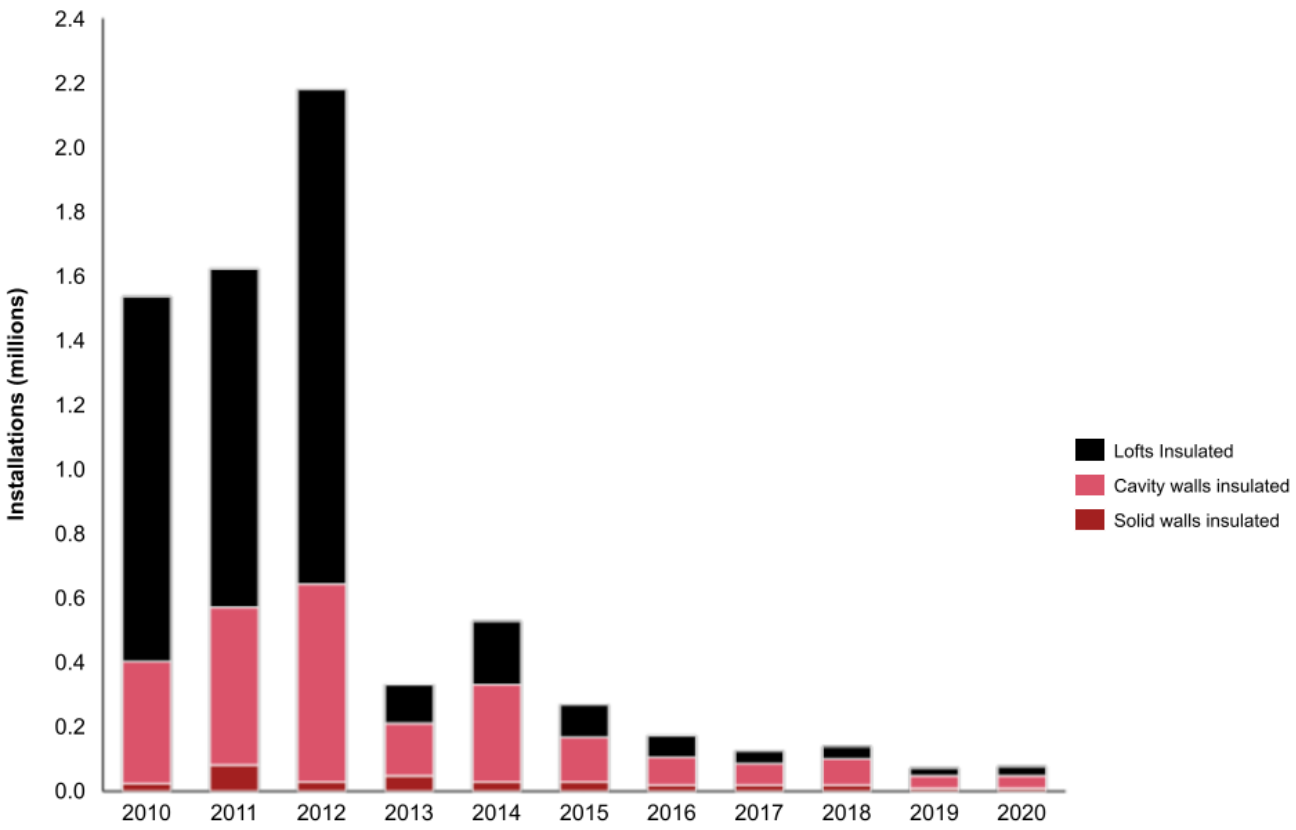
[18]What is fuel poverty?, NEA, February 2022. The number of houses below EPC C is approximately 15m, of which approximately 1.6m are social and 54% of these are in fuel poverty.
[19] 'Shallow' retrofit typically involves simple measures such as floor and lof insulation, while deep retrofit also involves more pervasive measures such as insulating solid walls, triple glazing, and replacing gas boilers with heat pumps
[20]The average annual energy cost is £647 for EPC A-C vs £2,317 for EPC F&G. Therefore, getting the housing stock into the A-C band has a significant impact on fuel poverty therefore)
[21]'Envelope' is a technical term referring to the physical barrier between the exterior and interior environments.

The challenge: lack of incentives to housing retrofit

Privately-owned homes play an important role in retrofitting efforts – homes emit the largest amount of greenhouse gases compared to other buildings. The UK has around 30 million homes, the majority of which are heated by gas boilers, while the bulk of the rest use electricity or oil. Around three-fifths of homes are rated below EPC C[22]. As of 2019, homes represented 77% of direct buildings' greenhouse gases, with a smaller proportion from commercial buildings (14%) and public buildings (9%)[23].

There is no doubt that retrofitting homes would deliver a public good in the form of cleaner air, greater energy independence as well as lower energy bills. Yet, housing retrofit is not progressing at the pace needed to meet Net Zero goals – and home insulation rates have actually decreased significantly in the last decade (see Figure 1).

Figure 1: By 2020, home insulation rates have decreased to only a fraction of 2012 levels.



Source: BEIS (2022) household energy efficiency statistics, BEIS (2021) national energy efficiency data – framework (NEED), PwC analysis.

[22]Progress in reducing emissions: 2022 report to parliament, The climate change committee, June 2022.
[23]Breakdown of UK GHG emissions by source and greenhouse gas, national atmospheric emissions inventory, 2022.

Retrofit can certainly occupy a higher priority place in the government policy agenda. Local authorities do not have sufficient resources to fund decarbonisation efforts[24] and the recent committee on climate change (CCC) reports that the central government substantially cut back its support for energy efficiency after 2012, resulting in stagnation of energy efficiency upgrades[25]. Yet, the reality is that regulations, funding and other policies[26] are not enticing owner – occupied households (those that typically are able to pay) to undertake energy efficiency improvements. Even though the government has proposed mechanisms for increasing heat pump uptake, including regulations (e.g. via an obligation on boiler manufacturers to sell a rising number of heat pumps) and grants to encourage homeowners to install low-carbon heating systems[27], the UK still has a very poor track record for the installation of heat pumps.

The European heat pump association (EHPA) reports that only 1.48 heat pumps were installed per 1,000 households in the UK across 2021 – far below the 15.3 instals per 1,000 households that the CCC said is required to reach the 2050 Net Zero goal[28]. Furthermore, the level of activity has been declining in the UK: in 2012, 1.6m lofts were insulated, but by 2020, this had fallen to 32,000[29]. This is despite the fact that two thirds of the UK's 28 million homes remain below the recommended energy efficiency (EPC C).

Mobilising retrofits for 30 million households and making it an attractive option for all of them is the main challenge. The technology is already mature, and households (and wider society) would see a clear benefit in terms of energy bill reduction, but the lack of financial incentives, understanding and knowledge about retrofitting homes is what is holding back the wider rollout. A key reason for the lack of private incentive to invest is a misalignment between the expected social benefits (outlined above) and the costs that will mainly be borne individually by private homes:

- **Retrofits have large upfront costs**. The government estimates that approximately £200bn[30] will be required to retrofit homes in order to stay on the Net Zero pathway. The vast majority of this funding is expected to be covered by the private sector or homeowners. PwC's modelling shows that even shallow, 'fabric first', retrofits cost the homeowners over £6,000[31] while deeper retrofits with heat pumps cost over £50,000 for the average house.
- **Financial returns are slow and uncertain**. Notwithstanding recent high energy costs, the payback period for an average 'shallow retrofit' is around 10-15 years, and for a deep retrofit may be a number of decades[32]. Furthermore, research evidence is inconclusive about whether spending on energy efficiency improvements really translates into higher house prices or rents as effectively as other house renovations (e.g. a new bathroom) might.
- **There is not a strong narrative for retrofitting**. Perceptions also prevent homeowners from undertaking deep retrofits. People perceive energy delivery measures, such as solar panel installations, as an easier and more affordable route than deep retrofit measures that would significantly improve housing energy efficiency (which is not necessarily the case as we see below)[33].

Policy actions, as further described below, can help overcome these challenges. But even if the demand existed, there is an additional factor holding retrofitting back, which could become an even bigger obstacle over time for all types of buildings: the lack of skills. We examine this in the next section of our report.

[24]ibid
[25]Analysis: Cutting the 'green crap' has added £2.5bn to UK energy bills, Carbon Brief, January 2022. Carbon Brief explains that, in 2013, the government's answer to rising energy costs was to significantly reduce the energy-efficiency subsidies, 'effectively banning onshore wind in England and scrapping the zero-carbon homes standard.'
[26]For instance, there have been policies to ban of boilers in new builds from 2025- and a potential ban from 2035 on buying new boilers. Also, there are new increases on EPC level for commercial landlords (https://www.nelsonslaw.co.uk/epc-b-2030/).
[27]The boiler upgrade scheme (BUS) also provides grants to encourage homeowners in England and Wales to install low-carbon heating systems, which, on average, covers 20% and 40% of the air source heat pump and ground source heat pump installation costs respectively. Source: Boiler Upgrade Scheme (BUS) monthly statistics England and Wales, BEIS, July 2022, PwC analysis.
[28]UK's slow heat pump efforts will take 600 years to meet 2050 target', new scientist, 12 July 2021.
[29]Independent assessment: The UK's heat and buildings strategy, committee for climate change, 2021.
[30]Net Zero Strategy: Build back greener, BEIS, October 2021.
[31]Considering the 2023-2050 timeline.
[32]Considering the energy costs before October 2022 energy cap increases.
[33]Ibid (H&B strategy). Plenty of studies show that such investments in energy efficiency do lead to gains in the value of properties (e.g. https://solarenergyuk.org/wp-content/uploads/2021/10/The-Value-of-Solar-Property-report_SEUK.pdf). Yet, the evidence for retrofit in specific is more limited.
[34]For commercial buildings. Government policy (e.g. EPC mandates) and investor ESG trends mean that the commercial sector has different market and policy signals to decarbonise.

Section 2: The skills challenge for retrofit take off

Despite the low levels of retrofits and heat pump installations, the UK's construction sector is already overwhelmed with orders. Case studies and qualitative evidence suggests that there are not enough qualified specialists and general tradespeople who can deliver the 500,000 retrofits and 600,000 heat pump installations required each year until 2025 and 2035 respectively to meet Net Zero goals. The UK does not have 'anywhere near enough capacity in its supply chains to install the number of heat pumps that the UK needs'.[35]

And, looking ahead, retrofit activity is only expected to increase. In addition to growing Net Zero ambitions across government and industry, insulations are becoming more viable in economic terms. Even with the government's unprecedented energy price guarantee, the average household energy bill in 2022 will be twice what it was in 2021. This means that loft insulation that might have paid for itself in energy savings over 2 years would now be paid back after just a year, which now makes it more cost effective for private homes to take action.

With the expected acceleration in demand, evidence suggests that developing the necessary skills for the scale of the retrofit ambitions in the UK will require unprecedented levels of coordination and policy incentives[36]. This means that even if the funding were available tomorrow to get all houses above EPC D, there would not be the workforce to deliver it.

The labour shortages driving these skills gaps have not necessarily to do with the complexity of training and reskilling needed. Many retrofit activities require little or no additional specialist training – so people in general construction and tradesperson occupations could be repurposed for these roles. Those that do require specialist skills (such as heat pump installer) can be addressed through training that is delivered as upskilling to existing, well established professional accreditations – for instance, a gas safe engineer has highly transferable skills for the installation of heat pumps.

There are other retrofit roles which are increasingly demanded but where there are few people trained.The roles of: retrofit advisor, retrofit assessor, retrofit evaluator, among others, are all defined roles recommended by the PAS2035 standards to ensure the work of retrofit installers meet the required standards needed to avoid of poorly executed works, which are costly to rectify and fuel a lack of trust in the public.

One of the greatest barriers to labour force engagement with such upskilling is encouraging workers (most are SMEs) to stop work, and therefore earnings potential, for a period of training. Showing these workers the cost-benefit of upskilling is a challenge when signals about the possible future demand for this work has been lacking in the economy (and where the government has a role to play). This creates a vicious cycle where a lack of engagement with training means the training delivered is potentially not of the highest standard (low demand for training inhibits funding for training to be updated), which then dissuades engagement further. Another challenge in taking time out of work for training purposes is that there has been ample work available in the buildings industry in recent years without the need to be a skilled retrofitter. This has also kept many trainers out of roles as educators as it is more lucrative to work in the trade.

The size of the challenge

Estimates of the demand for retrofit jobs vary significantly[37]: Based on engagement with industry, the government estimates that delivery of its Heat and Buildings Strategy will support 240,000 green skilled jobs by 2035, while the construction leadership council estimates that the UK will need 500,000 new professionals and trades to tackle this challenge.

In order to gauge the magnitude of this challenge, we have modelled the implied demand for retrofit jobs using two distinct methodologies (see box for methodology).

Under both methods, we assume that the pace of retrofit picks up from 2023, peaking in 2029 before tapering off between 2035 and 2050, by which stage all homes requiring retrofit will have been treated. However, we model this using 4 different levels of retrofit, from shallow to deep.

[35]Taking stock of the UK government's heat and buildings strategy, The Climate Change Committee, March 2022.
[36]'Taking stock of the UK government's heat and buildings strategy", The Climate Change Committee, 9 March 2022.
[37]And, as a fragmented sector, data is often not compiled centrally, making it difficult to estimate the exact skills gap and to track the progress adequately.

1. Trades jobs analysis

Each level of retrofit requires different types of specialists and an increasing number of days of work required to install various measures. The direct number of trades jobs we estimate to be required to complete these retrofits are shown below in table 1.

Table 1: Average annual trades and other jobs required (2023-2030) in direct retrofit activities, of which.[38]

	General tradesperson	Electrician	Insulation specialist	Heating engineer / plumber	Glazer	Retrofit PMO	**Total trades jobs**	**Other direct jobs[39]**	**TOTAL direct jobs**
Shallow	0	0	12,200	1,900	0	1,400	**15,500**	16,400	**31,900**
Medium+HP	11,000	0	13,900	16,000	17,000	5,800	**63,700**	103,000	**166,700**
Deep	6,600	7,000	13,900	37,700	17,000	1,200	**83,400**	117,800	**201,200**
Deep + appliances	8,800	8,500	13,900	37,800	17,000	8,600	**94,600**	110,300	**204,900**

2. Wider economic employment effects

Our estimates for the jobs that would be supported by retrofit investments across the wider economy, including direct, indirect and induced jobs, are found in Table 2. Throughout the remainder of the 2020s, additional UK investment in retrofit is, on average, £4bn per year in the 'Shallow retrofit' scenario and £35bn in the Deep+appliances' scenario. If this investment did not displace investment and employment in other sectors, and did not change the underlying structure of the UK economy, it would support 583,600 total (direct, indirect and induced) jobs - of which 94,600 are direct jobs by tradespeople and 110,300 are additional direct jobs by support functions such as administration. This would add 0.2-1.4% to today's UK employment rate of 75.5%[40]. However, over a 30 year period, changes to the structure of the economy, technology and prices are unpredictable and, as a result, such numbers should always be used with caution[41].

[38]Note that the number of jobs varies each year depending on how long it takes for the market to get to scale. In the long run there will be lower numbers of jobs supported as most retrofit measures are only done once (insulation) or replaced every 15-20 years (glazing, heat pumps).
[39]Figures for the six trades jobs are calculated using our trades jobs methodology set out in bullets 3 and 4 in the box. We then use the input-output method discussed in bullet 5 to calculate the direct, indirect and induced jobs in the wider economy. This column represents (all direct jobs) – (trades jobs] and represents the many people involved in retrofit companies who are not physically installing measures – e.g. finance, designers and management.
[40]Office for national statistics (ONS), employment in the UK: October 2022.
[42]Given the scale of investment envisaged, changes are unpredictable but inevitable: an increase in retrofit demand might lower the price of heat pumps, and/or increase the wages of installers, which might in turn lead to new technologies to be substituted for heat pumps, or different installation methods. Economies of scale might evolve and/or bottlenecks may develop.

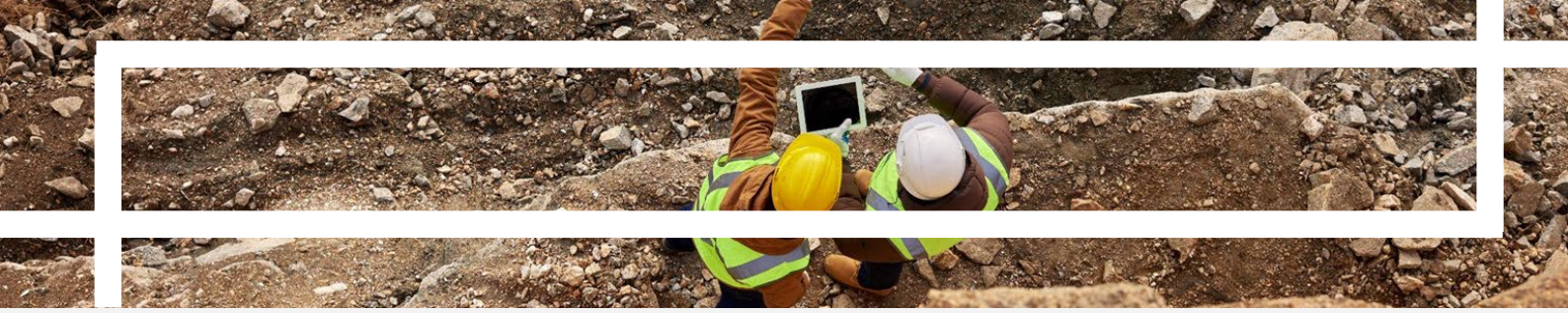


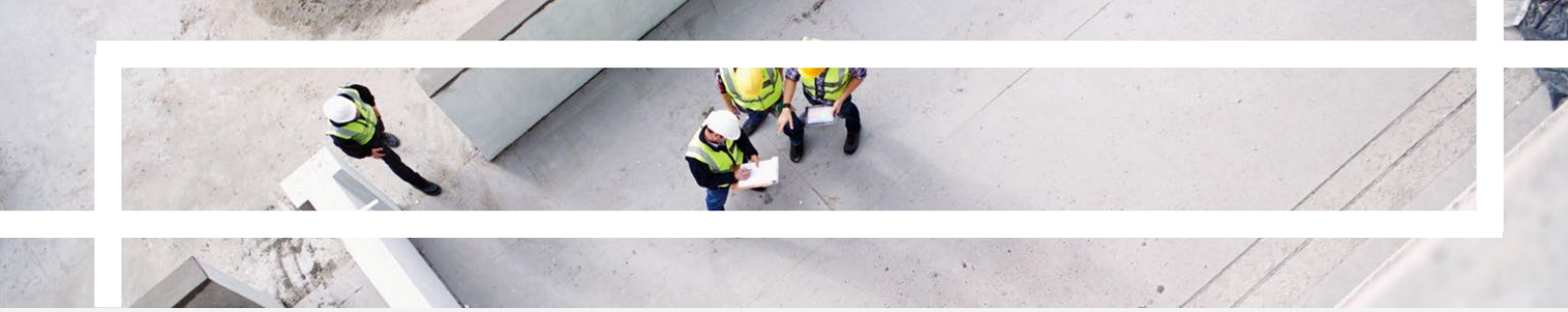
Table 2: Average annual jobs supported in the wider economy via retrofit investments (2023-2030)[42] of which [43]

	Manufacturing	Installation	Transportation and storage	Research and scientific activities	Wholesale and retail trade	Energy sector	Other	**Total**
Shallow	20,200	13,700	4,800	4,500	20,900	-3,100	9,900	**70,900**
Medium+ HP	117,900	141,800	23,600	29,100	111,900	900	55,300	**480,500**
Deep	147,000	145,400	31,400	35,800	144,000	-400	70,300	**573,500**
Deep + appliances	149,400	149,300	31,900	36,300	146,200	-900	71,400	**583,600**

PwC retrofit jobs model – Methodology

1. We first created a model of the UK's housing stock, based on EPC and survey data, to give us an idea of which homes need which retrofit measures[44].
2. We then modelled the deployment of different retrofit measures depending on property need and decarbonisation ambition. We grouped 31 individual measures into four scenarios, of increasing ambition:
   - Shallow: A "fabric first" retrofit involving several of the most cost-effective insulation interventions such as cavity wall, loft and floor insulation, as well as low-energy lighting.
   - Medium: A much more extensive retrofit, with all of the above plus solid wall insulation, triple glazing and a heat pump.
   - Deep: All of the above as well as a significant solar PV array and adaptation measures (external shading and MVHR) to prevent summer overheating.
   - Deep + appliances: All of the above with white goods (fridges, washing machines, ovens, TVs) also being replaced with the most efficient version on the market.
3. We created a database of the cost and number of hours of time required from each of six types of trades jobs for each type of measure in each type of home – e.g. for a typical detached home, it takes 2 general builders less than a day to fill in cavity walls, and costs around £1,200. We also consider 'downtime' which includes travel between jobs.
4. This granular detail can then be scaled up to estimate the total direct number of trades jobs that would be supported under each – or any other - retrofit scenario, either at a local, city, or UK-wide scale.
5. Similarly, the cost data allows us to estimate the total cost of each retrofit scenario. These costs are separated into economic sectors, and input-output analysis is used to estimate how this investment would lead to increased jobs further down the supply chain, for example: the builder would buy cavity wall-filler and plaster from a building supply shop; the builder and the shop owner would employ one other person each; all four would spend their wages on groceries, etc.

[42] Note that the number of jobs varies each year depending on how long it takes for the market to get to scale. In the long run there will be lower numbers of jobs supported as most retrofit measures are only done once (insulation) or replaced every 15-20 years (glazing, heat pumps).
[43] These jobs are inclusive of those in the table above, not supplementary. They represent the direct, indirect and induced effect on UK employment.
[44] The methodology of this PwC analysis can be found in this UKRI report https://www.ukri.org/publications/accelerating-net-zero-delivery/



In 2020, there were an estimated 1,800 heat pump installers, compared to 130,000 fossil fuel boiler installers. This leaves a significant gap in heat pump installation capacity, provided that over 16,000 heat pump installers will be required on average each year. Research from BEIS suggests that around 80% (or 105,000) of the total fossil fuel boiler installers are either already skilled in heat pump installation or open to reskilling, provided the relevant reskilling programmes have capacity [46]. Additionally, the Low Carbon and Renewable Energy Economy (LCREE) data suggests that, in 2020, there were 35,800 specialists in the construction sector who could install energy efficient products, including the delivery of insulation and glazing work. There were further 2,900 specialists in the solar PV installation sector and 6,700 specialists in the renewable energy installation, including heat pumps and other types of renewable energy measures, such as geothermal heating. However, the number of jobs in the energy efficient product installation and solar PV installation have decreased by 7% and 11% respectively since 2014, while renewable energy installation jobs have not grown at all [47].

This shows a worrying downward trend, especially taking into account that LCREE data is likely to overestimate the number available of specialists. A review of the retrofit pilot programmes report a significant shortage of retrofit coordinators, insulation and heat pump installers, and a lack of interest from generalist tradespeople [48]. The number of *available* specialists is also likely to be lower than the number of trained specialists, because trained employees can take their skills elsewhere making it hard to capture the full benefits of training [49].

For the retrofit industry specifically, the challenge may be even greater. SMEs and sole-traders are a lifeblood of the construction industry, and they require stronger incentives to invest in training as their opportunity cost for taking time out of paid work is greater. Government funding has increased since the launch of the Net Zero and Heat and Buildings Strategies. Yet, low demand from the private sector, coupled with poor visibility of the future works landscape and a challenging perception issue from previous failed schemes, has made it difficult to convince SMEs that training is worth the investment.

The construction sector specifically cites that The green homes grant, due to a combination of red tape, lack of labour and effective marketing, achieved only a small fraction of its target and left many workers with depleted order books.

“The green homes grant delivered a lot of intermediary measures but did not deliver on the training for retrofit assessment or installation of heat pumps.”

The rise in home improvements since the pandemic has accentuated an already stark skills supply issue within the construction sector and made training an even less attractive proposition in the current climate. Whilst some training providers have attempted to combat some of these barriers for SME’s to train by offering free and flexible training which fits around their usual workload, continued government funding and regulation remains key for this to be sustainable [50].

Implications for skills policy

In short, evidence shows a significant skills gap in order to address the need to improve housing energy efficiency, which hinders retrofit rollout. In order to invest in upskilling, the private sector requires clear market signals. While current demand for housing retrofit is low, and the future demand is uncertain at best, when demand increases, the low workforce capacity means that additional skilled workers will be needed quickly. Given the lead times for entering into relevant retrofit occupations, in order to avert a critical workforce supply bottleneck, training needs to start now to ensure the industry has the necessary capacity to respond when demand does increase. Because of the strategic role retrofit has in the UK’s transition to Net Zero, any delay in such capacity building could prove perilous for the Government’s decarbonisation timeline.

[45] Electrification of Heat, Beama, October 2021
[46] BEIS, Social research with installers of heating systems in off gas grid areas of England and Wales, May 2021.
[47] Though LCREE Survey is currently the most reliable source of official information on retrofit activity, there are significant data gaps, such as in estimating the number of retrofit coordinators, and it likely overestimates the total number of specialists that are available for specific retrofit jobs.
[48] Net Zero and Construction: Perspective and pathways, CITB
[49] Energy Innovation Needs Assessment: Sub-theme report: Building Fabric, Commissioned by BEIS, October 2019
[50] Greening Construction: A complex challenge for jobs, skills, and training, Edge Foundation, March 2022

Section 3: Overcoming skills gaps

The private sector and Government need to work together to support initiatives for the development of the skills needed for retrofitting - and wider net zero ambitions. There are policy actions that can help boost upskilling and strengthen the pool of workers. Yet, these efforts will not work in isolation without looking at demand – and actions to stimulate retrofit activity.

The lack of support to stimulate demand for housing retrofit means there is little incentive for stakeholders in the construction trades to invest in training in technical skills associated with emerging green technologies or general sustainability knowledge. Funding, clearer vision and policies, enabling regulation, and job quality are all key in attracting talent to the construction sector and
incentivising upskilling.

Basic incentives to encourage 'demand' for retrofitting create the basis for further policies and action, including for upskilling, and are therefore a necessary condition for investing in skills; these can then be followed in tandem by upskilling initiatives which align to the expected employment of those efforts.

In short, preparing the UK workforce for our retrofit ambitions requires actions in three main areas

- Demand incentives
- Upskilling
- Job Quality

Demand incentives: necessary condition for retrofit acceleration

According to the Climate Change Committee, there are "significant gaps"[51] in the government's heat and buildings strategy that will hamper the roll-out of housing retrofit. Two-thirds of homes in the UK are owner-occupied and the majority of those are not fuel-poor, but there are no large-scale interventions currently targeting this segment of the population – either through incentives or regulation.[52] For example, while landlords, commercial buildings and new builds have target dates for certain minimum energy efficiency standards, no such target exists for owner-occupiers; As current policy stands, there is no date at which you would not be able to sell a draughty, gas-heated home. There is also little in the way of positive incentives – almost all funding is directed towards either poorer households or social housing.

Government can increase demand via other market signals, for example, mortgage lenders are aware that a voluntary target to improve the energy efficiency of their customers' properties may later become mandatory. However, this channel has difficult implications for household finances which have only increased with recent rises in mortgage rates [53]. It is also not easily enforceable – government cannot force mortgage companies to pay for their customers' retrofits.

The uptake of electric, low-carbon heating systems, such as heat pumps, is also hindered by the imbalance between electricity and gas prices: on average, UK electricity is priced at between 3 and 5 times more expensive per unit and a sizeable proportion of this gap is due to the fact that green 'policy costs' (taxes used to subsidise renewable energy, nuclear and other investments) are levied almost exclusively on electricity, and not on the more carbon intensive fuel, gas. This gap means that in many cases, as well as being more expensive to **buy**, heat pumps are also more expensive to **run** than gas boilers. This issue is most acute for large, non-residential buildings, where energy bills are large and a lot of insulation is also needed. In the Strategy, the government committed to "rebalancing of policy costs from electricity bills to gas bills this decade". Given recent energy price spikes this policy is not likely to be implemented soon, but Government should not delay consulting on what the right long-term strategy is for funding the renewable energy investment we need.

Uptake will also benefit from reducing the complexity of energy efficiency schemes. In order to minimise homeowner risk or hassle, home retrofitting funding schemes could be paid to the installer directly. For instance, the ECO scheme obligates energy suppliers to work with installers to introduce certain efficiency measures into homes, such as loft or wall insulation, or heating measures. Complexity also needs to be reduced for enterprises – simply shifting the burden of untangling this complexity from the homeowner to the construction sector might stifle the upskilling progress. Effective schemes need to ensure that contractors do not bear an excessive administrative burden.

[51] Climate Change Committee (2022) Independent assessment: The UK's heat and building strategy

[52] The boiler upgrade scheme and GHFA both target this segment, but these incentives are only likely to bring forward the demand; even with higher energy prices, it is possible that further regularly intervention could be required linked to either ownership transfer, mortgage system or property taxes.

[53] Progress in reducing emissions: 2022 Report to Parliament, The Climate Change Committee, June 2022

Upskilling: funding, regulation and incentives for an adequate workforce

The most important factors when undertaking decarbonisation retraining or upskilling are external funding to cover some or all of the cost of training and receiving an accredited qualification at the end of the course.

Training costs are generally seen as a bigger barrier for small businesses. With the majority of the construction sector being composed of SMEs and self-employed contractors, the funding issue is highly acute and needs to be addressed effectively. Lost revenue is also seen as an important consequence of attending training. Provision of training online would reduce both the training costs and foregone revenue. However, even partial external funding is necessary for incentivising businesses to undertake decarbonisation training.

"Individuals will struggle to afford to retrain without market visibility"

If left to market forces, training courses can be developed, but they will remain empty until there is demand for the retrofitting skills. Once the demand increases, the lead times in upskilling are likely to slow down the decarbonisation efforts. In the short-term, the regulation of occupations and licence to practise in the UK could ensure that green skills are incorporated into vocational training. As the current system is limited in its ability to look forward and take action to deliver training, requiring accredited qualifications might be a viable short-term solution in undertaking decarbonisation retraining and upskilling.

Apprenticeship levy as a government incentive

The apprenticeship levy is generally paid by larger companies, with over £3m / year in payroll payments. 0.5% of the payroll payments are put in separate accounts and topped up by 10% by the Government. These funds are intended to be used for training apprentices, and the Apprenticeship Levy facility allows for designing bespoke courses, which can be tailored to training for retrofit skills. The funds that are not spent on training apprentices expire after two years. A proportion of this funding is instead directed to the Department for Education's budget to fund apprenticeships in small businesses that do not pay the levy.

The construction sector has a low uptake of the Apprenticeship Levy funding, with large employers struggling to spend their levy pot (since 2019, more than £3.3 billion has returned to the Treasury under the Government's use-it-or-lose-it apprenticeship levy rules) and non-Apprenticeship Levy-paying businesses (typically SME's) struggling to secure necessary funding. Non-Apprenticeship Levy-paying employers have no direct recourse to access apprenticeship levy funds however they can be the indirect beneficiaries through a number of routes: i) the Apprenticeship Levy Transfer allows SME's access of funds from an Apprenticeship Levy-paying employer they have an existing relationship with i.e. in their supply chains; ii) via the Apprenticeship levy pledge service, SME's are allowed to apply for unspent funds pledged by Levy-paying businesses; and iii) via apprenticeship funding direct from the Government.

Whilst there are indirect sources of Levy funding for SME's, to avail of the levy, a small business has to partake in the same amount of administrative burden as a large business. Businesses that are not already using the funding provided by the Apprenticeship Levy face steeper initial time-cost, which deters them from engaging with it. Up to 25% of the levy payments from large businesses can be gifted to the supply chain - a policy that should, in theory, enhance the use of the funds. Not all businesses are aware of this possibility, and 25% of the total levy is not enough to cover the training costs at the scale that is needed. Smaller businesses are also more sensitive to the amount of time apprentices spend in class-based training. Until recently, the use of Apprenticeship Levy funds required apprentices to spend 20% of their time in off-the-job training, which might be seen as lost revenue for construction firms. Promisingly, this issue has been recently addressed by the department for education and the treasury to lower the off-the-job training burden by lowering the class-based requirements. Whilst it will be important to track its impact going forward, the move represents a significant lowering of one perceived barrier to apprenticeship uptake [52].

Job quality: the key to attract qualified specialists

The UK's construction workforce has contracted since 2019, and the demand for skilled workers is currently high. The Construction Industry Training Board (CITB) has identified the combination of the COVID-19 pandemic and EU exit as key factors in this contraction. CITB research suggests that up to 90% of the buildings sector workforce would be willing to retrain and the future demand will be largely met by retraining and existing skills. However,the sector workforce will need to grow to meet demand for energy efficiency retrofits, heat pump installations and heat networks.

The quality of work plays an important role in attracting new talent to the construction sector. It has long faced challenges in attracting the people it needs and the competition with other sectors for skills is getting more intense. Skills shortages are getting worse and employers are facing pressures for existing skills and the need to develop new skills.

ONS research suggests that 65% of workers in the construction sector are considered to be in quality work. A higher percentage of quality work than men in all industries. Most marked differences were in "construction" , where 83% of female employees had quality work compared with 61% of male employees.

PwC's Green Jobs Barometer analysis further suggests that the construction sector consistently ranks below average in the quality of work indicators compared to other sectors. Workers in construction are less likely to have a permanent employment contract, more likely to work long hours. Salaries are roughly average compared to other sectors, possibly reflecting the prominence of self-employment in the construction sector.

Negative perceptions surrounding culture and behaviours about the construction sector persist. Less than a fifth of respondents outside of the construction industry believe that it is an attractive career, presenting another challenge to attract qualified specialists to this sector.

The construction industry faces significant challenges that need to be addressed urgently in order to improve the quality of work and attract skilled workers. Mental health challenges have been especially prominent and statistics highlight the urgent need for steps to reduce the stigma surrounding mental health and improve support to workers [54].

Quality of jobs indicator	Statistic
Feel that their job uses the best of my skills and abilities	68%
Satisfied with hours worked	66%
Find their job fulfilling	65%
Rarely or never work longer than 48 hour weeks	40%
Satisfied with their employment contract	84%
Majority fall within this salary range	£20,000 – £29,999 (around national living wage)

[54] Apprentices who started prior to 1st August 2022 are required to train for a minimum of 20% of their working hours. However, for full-time apprentices starting on or after 1st August 2022, the Department for Education has amended the off-the-job training policy to remove the link to the apprentice's working hours. The new minimum off-the-job training requirement for a full-time apprentice is 20% of a 30 hour week (even if their working week exceeds 30 hours), equating to an average of 6 hours of off-the-job training per week. (see: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1109625/2223_Employer_Rules_Version_2_Final.pdf pp17-29)

Conclusions and other implications for policy

The government's retrofit targets are ambitious and largely supported by the independent climate change committee (CCC). But the CCC also notes that delivery against those targets is 'significantly off track', with a lack of clear policy, delivery and funding commitments. Home-owners and the private sector will be required to bridge these funding gaps to deliver on the government's Net Zero Strategy. Government alone cannot install every heat pump - but Government can create the market signals - clear policies and meaningful funds - that the private sector needs to invest in new skills to deliver on the retrofit challenge. There are important roles for local government and others too:

National government should create the clear market signals needed for the private sector to respond, including:

- **Energy efficiency targets** that cover all building emissions, notably a target for owner-occupied homes which is currently absent
- A reiteration that, as per the Net Zero Strategy, **heat pumps will play the major role in home decarbonisation**, regardless of any hydrogen decision.
- **Long-term funding pots** that focus government money in large scale roll-out of the most value- for-money, 'no regrets' interventions - predominantly home insulation.
- Work with industry and local government to support a **trusted accreditation system** for retrofit installers that does not create unnecessary barriers to entry, but does ensure quality and build customer trust
- Amend the legislative blockers of retrofit finance: for instance (1) to allow **retrofit debts to be linked to the property**, rather than the individual, which will incentivise home improvements, and (2) to enable **the creation of the stable revenue streams** needed to pay off these debts over a long-time horizon - in other countries, energy bills, social rents or local taxes are used to collect the revenues generated by energy bill savings, but UK regulation prohibits most of these options [55]
- Launch a consultation on **shifting most policy costs away from electricity**
- Launch a **citizen awareness campaign to encourage energy savings** at meaningful levels while protecting the vulnerable: if every UK home set their thermostat to 19 degrees ("19's plenty") - a level which is not associated with any negative health effects - total buildings energy demand would be reduced by 8%, saving an average of £250 per household in 2023[56]
- Learn from countries such as Germany which have combined domestic energy price caps with **price incentives** that discourage high energy use
- Launch a **national campaign to encourage** young people to take up a trade
- Introduce multi-year funding allocations for Further Education as proposed in the recent consultation and further support to ensure FE can play an active role in local retrofit upskilling

Local Government should take advantage of its extensive local knowledge, community trust and key role in housing:

- Help to **match local retrofit demand with local supply** by identifying the homes in greatest need of retrofit from the perspectives of both emissions reduction and fuel poverty reduction
- Act as a **source of information for homeowners** about local accredited suppliers and government schemes, working with Net Zero Hubs
- **Take the lead in retrofitting social housing**, working with Net Zero Hubs to create sound business cases that can attract large-scale government and private-sector investment
- Consider how the **abatement of local housing emissions can be accredited as carbon credits** in order to incentivise local investors to invest in, and decarbonise their communities

The construction and training sectors should work together to:

- Create **new technical education pathways** for school leavers and adult-learners and invest in new training programmes
- **Set aside time for workers** to upskill in new retrofit technologies and processes
- Work with national and local government on a campaign to encourage young people and adults in others trades, as well as existing tradespeople to **retrain in green retrofit technologies**
- Support a national government campaign encouraging trades career

[55] Climate Change Committee, 2022 Progress Report to Parliament
[56] Green Finance Institute (GFI), Retrofitting social housing: a model for the UK, Oct 2022
[57] PwC modelling using Standard Variable Tariffs for gas and electricity as per the October 2022 Energy Price Guarantee and BEIS projections of heating oil prices for 2023. If, as expected, the price cap rises in winter 2023, the £ savings will be notably higher.
[58] Reforms to Further Education Funding and Accountability, updated August 2022

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