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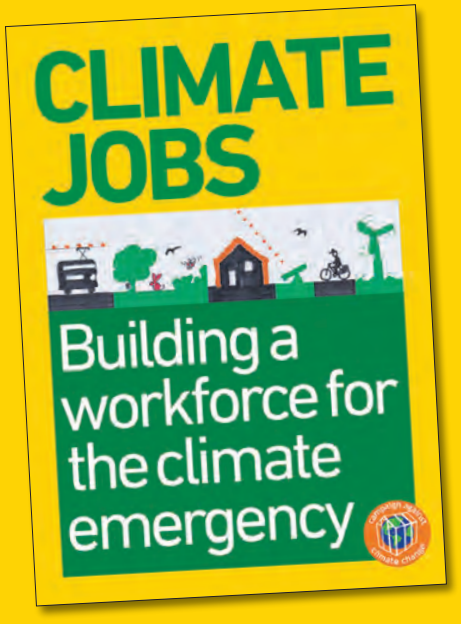


Order the forthcoming pamphlet www.cacctu.org.uk/climatejobs or by emailing info@campaigncc.org

Chapter 3:

Warm homes, healthy workplaces: climate jobs in buildings

This chapter is an extract from the forthcoming pamphlet Climate Jobs: Building a workforce for the Climate Emergency.

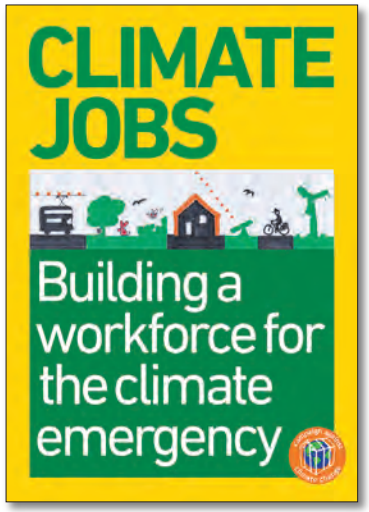
In this chapter, released in advance of the full pamphlet, we examine how we can cut the emissions from our homes and other buildings, which contribute nearly quarter of UK domestic emissions, and in the process create millions of jobs as well as warm homes and healthy workplaces.

In the forthcoming report we provide a detailed and in-depth update of the Million Climate Jobs report (2014), demonstrating that there are many >>>

>>> more than a million good, well paid, skilled jobs that could be created if we get serious and urgently tackle the climate emergency, as the science demands.

But to do this requires us to break from the failed reliance on the market and instead to invest in a huge expansion of public sector jobs across all sectors from transport, energy and food to homes, education and more, which are essential to tackling the climate crisis.

At the heart of this, we argue, needs to be a National Climate Service which can organise, plan, train workers and deliver the jobs so urgently needed. The changes needed are ones which will improve our lives, ensuring among other things we have warm homes, a fully integrated public transport system and most importantly a safe climate and ecology now and in the future.



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Each chapter is accompanied by a Technical Companion which provides references, modelling and more detailed explanation expanding on some of the issues covered in the pamphlet.

Warm homes, healthy workplaces: climate jobs in buildings

This chapter is about jobs in retrofitting (upgrading) homes and other buildings to reduce their energy use and change the type of energy they use, and also building new ones that use less energy. This will significantly cut carbon emissions, as well as tackling the scourge of fuel poverty and the many physical and mental health problems caused by cold and damp homes and unhealthy work environments. This work has never been more urgent as we face an escalating climate emergency. This sits alongside a huge and ongoing jobs crisis, of low pay, precarious employment, often poor working conditions and long hours – now made worse by thousands of COVID-related job losses.

A mass retrofitting programme will need a large, skilled workforce in every part of the country, mostly additional to the numbers currently employed in the building trades. We argue that the majority of climate jobs – that is, jobs that directly help reduce carbon emissions – need to be public sector jobs. A National Climate Service (NCS), like the National Health Service, will need to be established to ensure the work needed to tackle the climate crisis can be done at the scale and pace needed, using public funds to create well paid, skilled and unionised public sector jobs.

A National Climate Service would ensure that workers in high emissions sectors were retrained for new technologies or for climate jobs in other sectors, alongside other unemployed or precariously employed workers and new entrants to the labour market. In the case of buildings retrofit, the focus of this chapter, the challenge for the National Climate Service will be to recruit enough workers to a sector which needs to grow very rapidly, whilst ensuring they are all equipped with the necessary level of training to do the job properly. This chapter sets out what we see as an ambitious yet realistic approach to this vital work.

> **"Heating our homes currently uses between 300 and 370 TW hours per year. We can cut this by around half within the next 10 years, and by even more in the years following."**

These workers will draught-proof and insulate homes and other buildings so that they use far less energy and are more comfortable and healthier to live in. This must include adequate ventilation to ensure good indoor air quality and help prevent aerosol transmission of viruses like COVID-19. They must also ensure buildings can cope with the heatwaves, heavy rain and high winds that will become more common due to the climate change already happening.

Where appropriate they will also install local renewable heat and energy sources in buildings and on roofs. Together with renewable electricity from the grid, these will, over time, replace gas boilers and other fossil fuel heating for most buildings.

The goal is to make most buildings all-electric, but it will be a difficult challenge to meet the energy demand for buildings, for transport and for industry, all from renewable electricity. Fortunately, though, we can drastically reduce the amount of energy needed in our buildings.

This work, the types of jobs and training needed and how this could be carried out is our starting point. Later in the chapter we will look at the work needed to electrify our homes and buildings. Throughout we examine the impact on the urgent need to reduce emissions and on the quality of our home and workplaces.

Homes

In 2019 (ie the last year before the COVID-19 pandemic), energy used in homes – including electricity generated in power stations – accounted for 21% of the UK's greenhouse gas emissions, or 95.3 Mt CO2e. [1] And almost two-thirds of this is caused by burning fuel directly in the home, mostly gas for heating and hot water.

Energy efficient electrical appliances, and those which use less water (eg for showers and washing machines), can dramatically reduce energy use. More savings can be made by insulating pipes, recovering heat from waste water, and making use of solar heat [2] (*see section below on Electrification and Renewable Energy on site*). But by far the biggest savings come from slashing the amount of energy we need for heating. Heating our homes currently uses between 300 and 370 TW hours per year. We can cut this by around half within the next 10 years, and by even more in the years following. [3]

To do this we need to draught-proof and thoroughly insulate the buildings and replace inefficient boilers with new heat sources. In the next few paragraphs, we outline the main aspects of retrofitting which could cut energy use, reduce CO2 emissions and create jobs that will play a key role in tackling the climate emergency as well as improving quality of life for all.

Clockwise from top: external wall insulation detail (LHC) wood fibre insulation installation (Alex Jelly/openecoho mes.org) and an external wall insulated home in Langlee, Scottish Borders (Changeworks).

Start with a survey and a plan

The first step should be to send in well-trained and certified National Climate Service energy assessors to determine what work can be done on each dwelling. [4]

Each individual house needs careful assessment and planning before refurbishment. Any retrofit work – whether done all at once or in stages – needs to take into account the whole house and make sure the work done in one area doesn't lead to new problems. For example, when sealing homes to avoid heat loss, problems with condensation, or with overheating in summer, must also be avoided.

In many areas, the work can be done efficiently on a street-by-street basis. A team of National Climate Service building workers can put up scaffolding along a row of houses, go in as a team and do all the necessary jobs in one go. The work can be phased so that the worst stock, and the localities where fuel poverty is a serious problem, can be prioritised.

Roofs

In houses, insulation can usually be added easily to loft spaces, which are particularly vulnerable to losing heat. Many houses already have some loft insulation, but at least eight million [5] have much less than is needed.

Climate change means roofs in particular come under pressure as heat increases and rainfall gets more intense, so a retrofit is an opportunity to prepare for the future in every way.

Windows

Windows lose a lot of heat, both directly through the glass and through the gaps around the frames. There are still about two million homes with single glazing, and many older buildings have draughty window frames. Solutions include plugging air gaps, draught-stripping windows and installing triple-glazed windows or adding "secondary glazing".



From left to right: Diathonite insulating limehemp plaster (Ecological Building Systems); insulation keeps the heat indoors, people who insulate their loft notice the difference in their comfort and in their fuel bills; solar PV can be incorporated into a home in the form of PV roof tiles.

Walls

Many houses built since the 1930s have cavity walls, some of which have been filled with insulation. However, many such installations have failed because gaps in the insulation have created a cold bridge, allowing parts of the wall to cool and causing condensation, resulting in mould and damp. In such cases, the insulation must be removed.

New insulation will usually need to be applied inside or outside to provide the level of insulation needed. In most cases, breathable materials should be used, that keep warmth in but let water vapour find its way out instead of getting trapped in the wall where it can feed mould growth.

Applying insulation outside usually works better and can allow the walls inside to absorb heat and help to keep temperatures stable in winter and summer. Applying it inside can preserve the outside appearance of the house, though there will be a small reduction in room size.

> **"For this to work at the necessary scale and speed, it must be – like the NHS – free at the point of delivery."**

In either case, insulation needs to be installed with great care. The tragedy of Grenfell reminds us of the importance of thorough training, inspection and enforcement of standards, as well as of the need to use the best and safest materials. This is a further reason why we advocate doing this as a public service with directly employed labour rather than leaving it to cost-cutting private contractors and unaccountable outsourcing chains.

A note on insulating materials

Currently, the main types of insulation used are plastic foams (made from oil) and mineral wool. Both are responsible for heavy CO2 emissions during manufacture, and the foam products especially emit other dangerous pollutants and are extremely flammable. Plastic, oil-based products were at the heart of the Grenfell tragedy.

There are alternatives that are non-toxic, more fire-resistant than plastics, and capable of allowing water vapour to "breathe" through – important when lining older buildings. Materials such as hemp and wood-fibre can be grown as crops or recycled, providing more jobs in the supply chain, and capturing and locking up carbon for the lifetime of their use.

Whilst starting with the best and safest of the materials we have now, we need to ensure that we build up those supply chains rapidly alongside the roll-out of the retrofit programme. (*We discuss this subject in more detail in the Technical Companion*.) 5

Floors

Timber "suspended" floors in older houses can be upgraded by including an insulating layer within their structure. For concrete floors, insulation can be added on top if the rise in floor level is acceptable. Otherwise, the floor must be removed and replaced with an insulated timber or "green concrete" floor. In flats (above ground floor), heat loss through the floor is unlikely to be a problem.

Ventilation

In sealing our homes against heat loss, it is vital to consider ventilation – both to prevent damp developing and to ensure healthy air quality (especially important for control of contagious diseases like COVID-19).

Correct ventilation firstly means installing windows that can be opened. For some homes, though, high quality fan systems can be installed, which can also be made to recover the heat from stale air as it is expelled.

Cooling homes

As the climate changes, overheating in summer becomes more of an issue. Insulating homes and making them more airtight can lead to real problems if we don't have effective ways of keeping them cool.

Sunshades, shutters or screens may be needed to keep sun out on the hottest days, and other forms of seasonal cooling could be installed, such as ventilation chimneys (removing the warmest air) and "active cooling" – moving the heat from inside to outside the building – powered by renewable energy.

How do we get the job done?

For this to work at the necessary scale and speed, it must be – like the NHS – free at the point of delivery. The current piecemeal approach relying on a hotchpotch of grant funding and financial incentives for homeowners is both discriminatory and immensely inefficient.

The failure of the Green Homes Grant shows this clearly. Complicated, and managed by a private US company that delayed or failed to pay out to thousands of householders and installers, less than 5% of the grants were made before the government pocketed the remaining cash and scrapped the scheme entirely.

To make a mass retrofit programme work, planning needs to be done in a transparent and accountable way. Local councils, as partners of a National Climate Service, are best placed to coordinate this as they are democratically elected, have a direct relationship with local residents, and already know a lot about the local housing stock through their existing responsibilities.

To build the necessary trained workforce, a huge expansion of high-quality training will be essential, requiring partnerships between councils and local FE colleges.

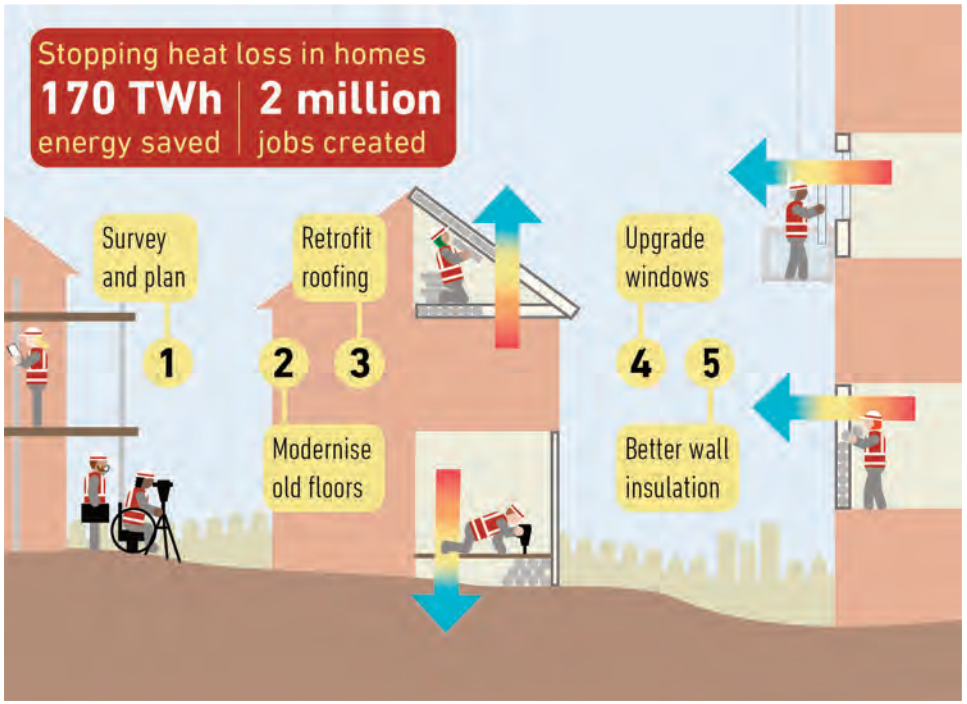


Illustration: David Sewell

Good training courses and apprenticeships crucially depend on the availability of suitable work experience on high-quality projects, both for new trainees and for upskilling existing tradespeople. And courses can only recruit if potential trainees know there is a good secure job at the end.

Where councils still own housing stock, they can, with the right funding, start large-scale schemes on these homes quickly, which in turn supports the development of local supply chains for materials and components, generating further high-quality local employment. Housing associations can play a similar role, in collaboration with councils.

For privately owned homes and in areas of mixed tenures, local authorities can still identify the work that needs doing on each property and engage with homeowners, tenants, landlords and community groups to enable an efficient street-by-street approach to the retrofit works. For this to work, it must be accompanied by rigorous statutory standards for private rentals to ensure uptake in this sector.

At the same time, pioneering work in retrofit is already being done by community interest businesses, cooperatives, third sector organisations, housing co-ops and community groups seeking to reduce their own energy consumption. These would retain their independence but can be supported where appropriate to scale up, provide high-quality unionised employment, offer good apprenticeships and participate in training opportunities.

Standards

There are a variety of approaches to standards in low emissions construction and retrofitting. Passivhaus, for example, has a standard of 15 kWh per m2 per year for heating in new homes and 25 kWh per m2 per year (the "EnerPHit" standard) for retrofit. This compares with an average of 140 kWh/m2/year for existing UK homes. [6] (*See Technical Companion for more detail on standards*.)

We will take this as our gold standard for NCS retrofits, achieving an average reduction of more than 85% of the energy used for heating. But we know we won't achieve this for all homes, and in practice we need to aim for the best outcome possible for each home. In addition, we need to consider what approach will bring the biggest emissions savings as quickly as possible, whilst opening the way to even further reductions over time.

How many jobs could be created?

We suggest that to do the work, we will need to build a workforce of around two million direct jobs *in homes retrofit alone* by 2030. Recruiting and training such a large workforce will be a challenge, but what we can achieve will increase year by year. We have set out a detailed plan for gearing up in the Technical Companion.

Apart from the energy assessors, retrofit designers and building project managers, and the carpenters, plumbers, electricians and other building workers needed, we will need administrators to make these projects work. They will need to plan the programmes, liaise with residents and ensure that homes are ready for work when the builders arrive, that the energy efficiency of the home is monitored after completion and that snags are dealt with and learned from.

"To do the work, we will need to build a workforce of around two million direct jobs in homes retrofit alone by 2030."

The strategy

To strip back an old house or flat and weatherproof and refurbish it to the highest possible standard of energy efficiency might take four skilled workers six months. [7] Even if we already had a large enough trained workforce, it would take more than 20 years to bring all UK homes to that standard.

But some things – like loft insulation, draught stripping, new windows – can be done much more quickly and make a big difference to energy losses. Tackling these simpler measures first – beginning with the worst housing – will also mean rapid reductions in fuel poverty.

So we propose a twin-track approach for a National Climate Service. For the majority of homes, we prioritise the simpler measures that can be done relatively quickly. This does not mean a one size fits all approach – every home will be assessed to determine what will be of most benefit, whilst also identifying what will need to be done later.

Meanwhile we start on the "deep retrofit" of other homes, including those where damp and lack of maintenance has caused damage. The teams doing this work will also be gaining valuable

experience. All retrofits will need to be followed up by monitoring the energy efficiency of the building while it is in use, so that if the savings are less than expected, the reasons can be identified, rectified and learned from.

In terms of energy savings, this approach could see:

- 27 million homes improved to better than Energy Performance Certificate (EPC) C standard, with the energy required for heating reduced by at least 50% (more for the worst stock).
- Two million homes improved to higher "EnerPHit" or equivalent standards, where the energy required for heating is slashed to less than 20% of typical levels.
- Once this is done, the (now experienced) workforce goes on to further upgrade the remaining homes to the same higher standard, over perhaps a further 20 years.

Picture: Sean Vernell

Public buildings and businesses

We turn now to non-domestic buildings – office buildings, hospitals, shops, restaurants, warehouses, schools and many more. These buildings differ a great deal from one another in the ways they use energy. The use of some buildings may also change in the future due to changes in work patterns and public health requirements. Non-domestic buildings (excluding factories) are estimated to contribute between 15% and 27% of greenhouse gas emissions in the UK. [8]

Offices

For offices, overheating is often a major problem. People and IT equipment generate an enormous amount of heat, and lots of glass can add to this problem in sunny weather. As a result, many buildings are air conditioned, using huge amounts of electricity. Air-conditioning installed or used wrongly could also increase risks of transmitting COVID-19 and other infections. But the same buildings can leak a lot of heat and feel cold in the winter.

Even with low energy light fittings, around 15% of energy in commercial buildings is still used for lighting, sometimes during the day when poorly designed windows have to be shaded to reduce glare.

Computers have become more efficient but servers (in offices and in cloud warehouses) are using more energy than ever before. [9]

One case study in Germany reports that energy use in an office building was reduced dramatically, from 600 to 100 kWh/m2/year. [10] This was done by installing "2+1" (triple-glazed) windows with built-in blinds to reduce glare and allow better use of natural light, external wall insulation, and a better air conditioning system with heat recovery. The new heating system has storage tanks which can be night cooled in the summer to help cooling overall.

Not all retrofits will have such dramatic results, but we think it is possible to reduce existing office energy use by more than 50% overall, to an average of 100 kWh/m2/year. [11]

Local renewables can then help provide the remaining energy. The large roof spaces of many public and commercial buildings provide scope for large solar panel arrays, and may also be able to supply surplus energy to the grid.

Schools and colleges

Retrofitting school and college buildings is just the kind of large-scale project that can help support training and boost local supply chains, enabling the retrofit sector to expand more rapidly and create even more jobs. The shoddy buildings and vast sums of public money sucked into corporate pockets under PFI schemes clearly demonstrate the advantages of a National Climate Service employing direct labour for retrofitting schools and other public buildings.

Targeting schools also has the advantage of creating a healthier environment for learning [12] and helping students learn about energy efficiency. National Climate Service energy assessors can work with school staff and students to cut energy use in schools. They can then identify needed improvements to the building fabric (*see also note* [13]).

> **"Retrofitting school and college buildings is just the kind of large-scale project that can help support training and boost local supply chains."**

Stabilising temperatures and avoiding overheating is particularly important. Sunshading for windows, ventilation systems and "thermal mass" or night cooling systems can all help with this. Good ventilation is of course vital for both learning and infection control.

Electrification and renewable energy on site

We've described how we can cut the amount of energy buildings use. Now we look at how we can supply the remaining energy, using electricity where possible. The more we can generate on site, the less demand we place on the grid, leaving more electricity for other uses. (*Please see the Technical Companion for more detail.*)

Heating our homes: heat pumps and other options

For some homes, heat pumps can provide sufficient heating using the low-level warmth in the ground or air. But they will not be suitable for every home and should only be installed after a thorough assessment of the building to ensure they can produce enough heat, and with with low electricity demand. Most often, work on the energy efficiency of the building fabric will be needed first.

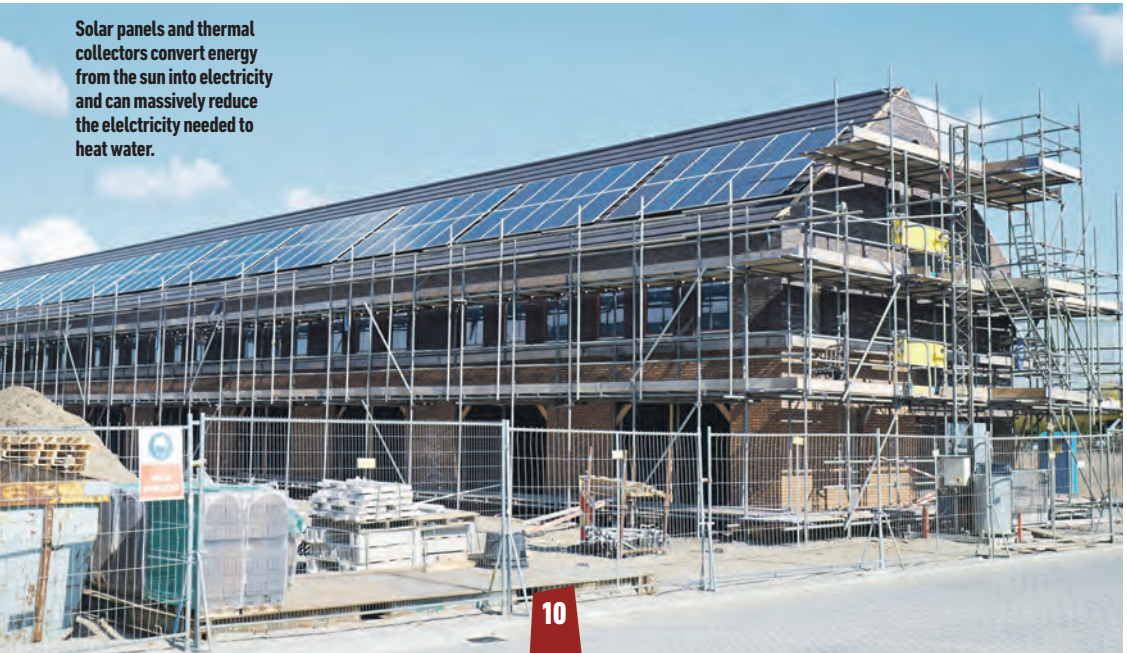
To work properly, heat pumps need to be carefully installed and the heat needs to be delivered by underfloor heating or extra-large radiators. Ground source heat pumps are most efficient but need at least some garden space for the coils to be buried in. In areas of denser housing, a group or terrace of houses or a block of flats can be served by a communal system.

"Air-source" heat pumps can also work well for some homes.

District heating

In district heating (and cooling) networks the efficiency of sharing heat and energy across a local area means savings in energy per home, provided the area is compact and the pipework well lagged.

In Southampton, "Geothermal" energy - heat collected from a mile below the earth – provides heat and electricity for public buildings and over 1,000 homes. [14] A similar scheme is being planned in Bristol using an old mine shaft and warmth from sewer pipes. These schemes can be near-zero carbon.



Solar panels and thermal collectors convert energy from the sun into electricity and can massively reduce the elelctricity needed to heat water.

Solar panels

Mounted on or built into roofs, and sometimes walls, these convert energy from the sun into electricity. To work efficiently they need to face south, south-east or south-west. They need transformers to convert the electricity to a usable voltage, and either an arrangement with the grid or a method of storing energy when it isn't needed (*for more on solar panels see chapter on Energy*).

Hot water

Solar thermal collectors mounted on roofs can massively reduce the amount of electricity needed to provide hot water in buildings. A solar collector uses the sun's rays to heat a fluid which is then pumped to a heat exchanger inside a water tank, where the heat is transferred into the water. Over the course of a year it will meet about 50% to 60% of a typical home's hot water needs.

A note on hydrogen

We do not support current industry proposals for a large-scale conversion of domestic gas supplies to hydrogen. However, this is a complex topic and we refer readers to the chapter on energy in this pamphlet for a more detailed discussion.

New buildings

At least 80% of existing homes will still be in use in 2050, so retrofitting them is a high priority. For existing housing stock, renovation should be preferred to demolition and replacement, which generally has a much higher emissions cost and frequently results in the loss of affordable homes and displacement of working-class communities.

"We also need to build at least 235,000 new affordable homes a year, most of which should be owned and built by local authorities."

There is also a good deal of scope for retrofitting empty buildings for social housing, as well as schemes to enable councils to take over and retrofit empty homes. Compulsory Purchase Orders have a significant role to play in making the best use of existing housing stock.

However, to solve the shortage of affordable housing – we also need to build at least 235,000 new affordable homes a year, most of which should be council homes, owned and built by local authorities and let at genuine council rent. (*See note* [15] *and Section B in the Technical Companion for more detailed discussion*.)

It is vital we regulate to ensure that these new homes and other buildings are built to near-zero carbon energy standards. As with existing buildings, the key thing is ensuring the highest insulation standards for the building fabric. Merely lowering emissions by supplying more renewably generated energy is not an adequate solution. [16]

It is far easier to cut emissions in new buildings. We can use materials with lower "embodied" carbon – emissions caused by the production and

transportation of materials. Locally produced materials can create jobs as well as minimising transport emissions.

Again, the ideal model would be local authority direct labour organisations, drawing on local supply chains with good standards of employment. The skills and training needed will be similar to those needed for low emissions retrofit. So it makes sense for at least some of the newbuild jobs to be integrated into a National Climate Service, including those concerned with planning, assessment and monitoring of performance. The overall number of jobs in construction will of course be greater, reflecting the higher standards required.

The workforce needed to retrofit our homes and buildings

Jobs

(*Section B of the Technical Companion sets out in full the data we have used and how we have calculated these estimates*.)

We estimate that over the next 10 years the retrofit programme will create the following jobs:

- 2,000,000 workers retrofitting homes
- 200,000 workers retrofitting other buildings
- 20,000 building energy assessors
- 20,000 surveyors or architects to become retrofit designers and project managers
- 20,000 support staff to help plan and administer the work
- 40,000 workers providing on-site renewable energy

That's a total of 2,300,000 workers over 10 years.

Of this number, we estimate just over 300,000 are already working on building refurbishment of some sort.

So the number of additional jobs created by the buildings retrofit programme we estimate to be **2 million**.

In addition, there will be approximately **1.5 million** new jobs in the supply chain, providing materials and equipment, and approximately **200,000** extra jobs building new homes.

There will also be jobs in construction training and education and additional building inspectors, which are not included here.

Not all these jobs can be created at once, so we have set out in the *Technical Companion* how the numbers can be grown over a 10-year period.

After that, this skilled and experienced workforce will continue until all buildings have been brought to the highest achievable standard of energy efficiency and make use of on-site renewable energy where possible.

Emissions cuts

Along with the switch to renewables in the grid, this will reduce emissions from buildings by around **95%**.