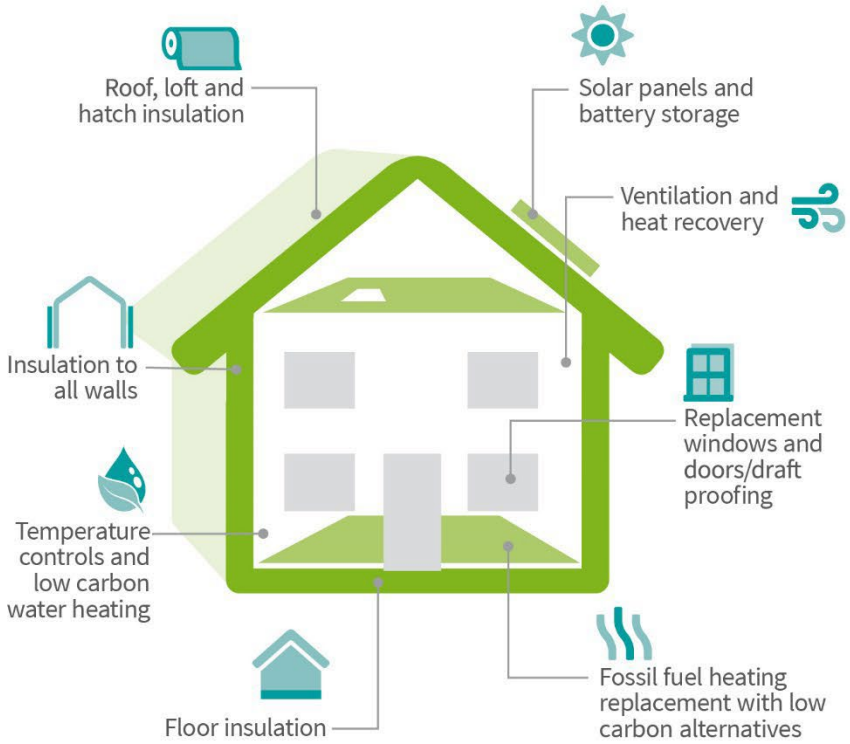
Draft strategy

Cornwall Housing Decarbonisation Strategy



July 2024 | Rev G

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CORNWALL COUNCIL
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Contents

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Our commitment

Cornwall is rapidly becoming known as a centre for excellence in clean growth and is at the forefront of tackling climate change, facing head-on the huge challenges which lie ahead, whilst embracing our exciting and unique opportunities. Cornwall is striving to lead the country's clean energy revolution.

In 2019, Cornwall Council declared a Climate Emergency and the development of this Housing Decarbonisation Strategy forms part of the ongoing response of Cornwall Council to this emergency. To achieve our ambitions, virtually all emissions arising from heating, cooling and energy use in our homes will need to be eliminated. In 2021, 21% of the total emissions in the county came from our homes.

The Council's overarching mission "To work together for a carbon neutral Cornwall where everyone can start well, live well and age well" provides the focus and the commitment to achieve our net zero ambitions, alongside tackling the inequalities that exist in our society, so that everyone can live a good life in Cornwall.

Our homes are at the very core of enabling everyone to live a good life, and they are a priority in preventing ill-health and building personal resilience. Working to reduce harmful emissions from our housing stock can drive improvements to energy efficiency, tackle fuel poverty, and in turn contribute to improving levels of decency across all tenures, including reducing the incidence of damp and mould. Adopting a holistic approach will improve access to safe, warm and secure homes across all tenures.

The CloS Good Growth Investment Plan 2022 highlights the challenges Cornwall faces in relation to its housing stock in terms of age, quality and thermal efficiency but a push to accelerate improvements in our housing stock will drive increased investment in our green economy and create new skills and employment opportunities for our residents.

According to data from MCS (Microgeneration Certification Scheme), UK's quality mark for small-scale renewable energy, Cornwall has nearly surpassed 38,000 MCS certified renewable energy installations – more than any other local authority in the UK.

More than 15% of households in Cornwall have an MCS certified renewable energy installation, including solar panels, heat pumps and battery storage.

Cornwall has installed more than 1,800 renewable installations in 2024 so far.

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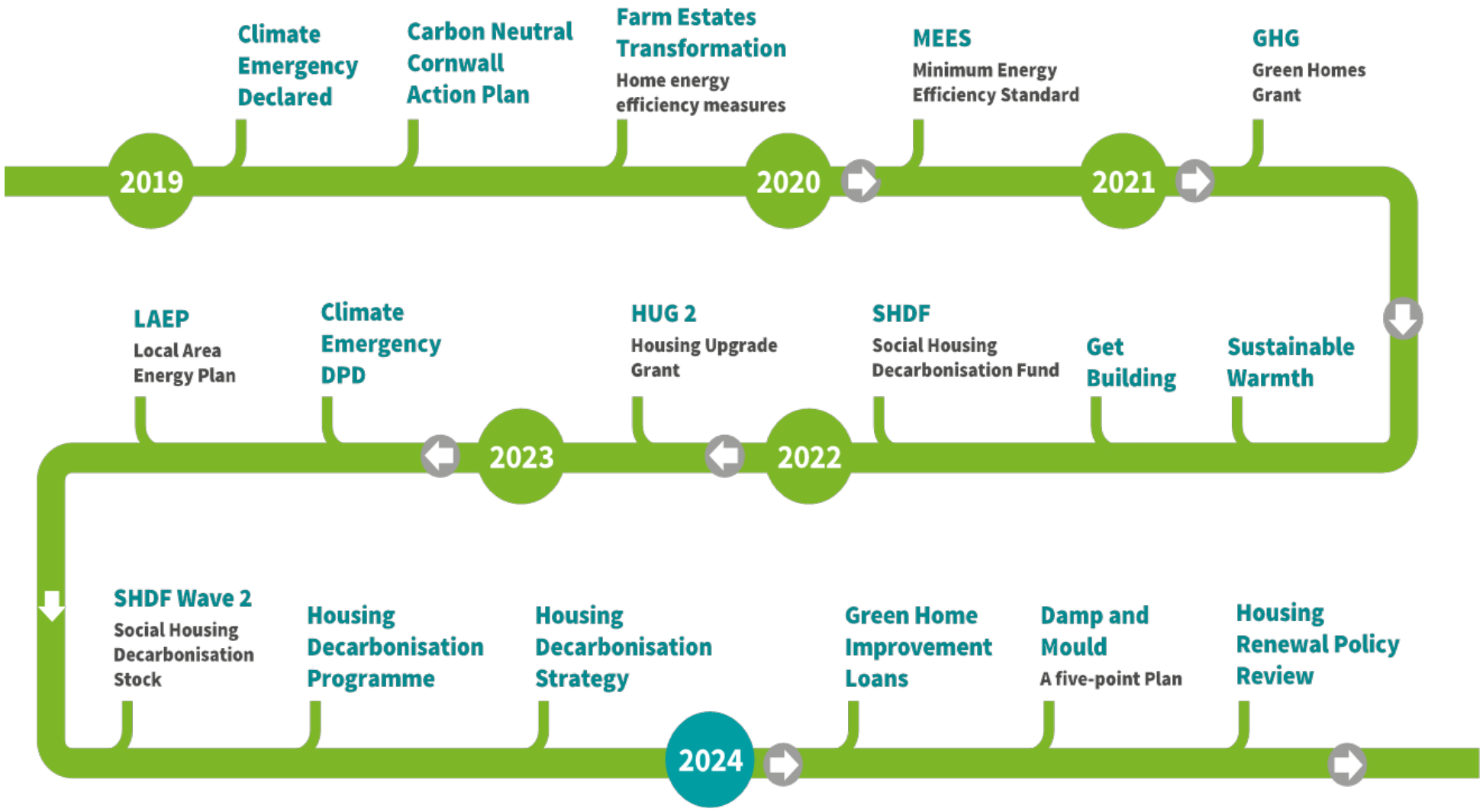
Our journey so far

TIMELINE



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Decarbonisation of homes in Cornwall has already begun

Partnerships are our greatest strength

Cornwall Council – one and all • onen hag oll

citizens advice Cornwall

ovo energy

Winter Wellbeing

Cornwall Housing

Community Energy Plus

Inclusion Cornwall

Ocean Housing

Coastline housing

..... and many others

1000 homes

£15M of Investment

41 homes in Falmouth – refer to ‘case studies’ for further details

1.0

Introduction

We want our homes to be:

- Kinder to our planet
- Warmer
- Healthier
- Affordable to heat

The background, scope and context for the Housing Decarbonisation Strategy for Cornwall.

This document should be read in conjunction with the Appendices Report which expands on aspects of this main report.

The appendices give additional context on how and why the strategy has been developed and offers greater detail on some of the technologies and measures discussed in the main document.

Introduction

The purpose of this strategy is to consider the practical measures required to reduce emissions from housing in Cornwall and outline key strategic actions the Council can take to accelerate decarbonisation, while reducing energy costs and making homes more healthy places to live.

With around 290,000 existing homes in Cornwall split between different tenures, the scale of the challenge is significant. With a sizeable proportion of homes built prior to insulation and low carbon heating being fitted as standard, the need for retrofit measures to the Cornish housing stock is significant.

Current building standards and the adoption of Cornwall's Climate Emergency DPD sets net zero standards for new build homes within the county and therefore it is the existing stock which this strategy will concentrate on. The condition or the levels of decency within our stock must also be a consideration.

76% of our housing emissions are attributed to heating our homes and our hot water provision and while emissions from fossil fuels are increasing, we need to balance emission reduction with running costs. With fuel poverty and deprivation running at an all-time high across Cornwall, decarbonisation cannot come at any cost.

We feel we have the right balance in Cornwall and have worked hard to establish and maintain our partnerships over time to enable a holistic approach to improvements and hope to build on these principles within this strategy.

Cornwall is already leading the way - 5.6% of Cornish homes are already using heat pumps, compared to 0.9% nationally, with deployment rates increasing.

Cornwall has a much older housing stock than most parts of the country, with 31% of properties built before 1930.

96% of future emissions from housing in Cornwall will come from the existing housing stock that has already been built.

49% of Cornwall's homes are heated by mains gas, far less than the 74% across England and Wales. Fossil fuels such as oil and LPG are used in 20% of homes with the balance (32%) provided mostly through forms of direct electrical heating.

51% of roofs in Cornish homes need more insulation compared to 38% nationally.

43,500 homes (16%) are at least partially single glazed, with 15,500 (6%) fully single glazed. 90,000 (33%) homes have older double or single glazing with a further 72,000 (26%) having double glazing of an unknown age.

The cost to move to low carbon heating is estimated to be £2.4-3.1 bn as a minimum first step (£3-10k per property). £8.4 - 9.1bn should be invested for all homes to be well insulated with (£26-29k per property) by 2050.

Around 14% of households in Cornwall live in fuel poverty, according the Government's most recent reports. Fuel poverty is a significant driver of health inequalities.

25% of all dwellings are estimated to be in severe disrepair.

12,000 homes are estimated to suffer with damp and mould.

Housing is a determining factor for health, education and employment.

Housing tenure is split with 13% social rent, 20% private rent or rent free and 67% owned outright or with a mortgage or loan.

Baseline

Evidence base: building on previous studies

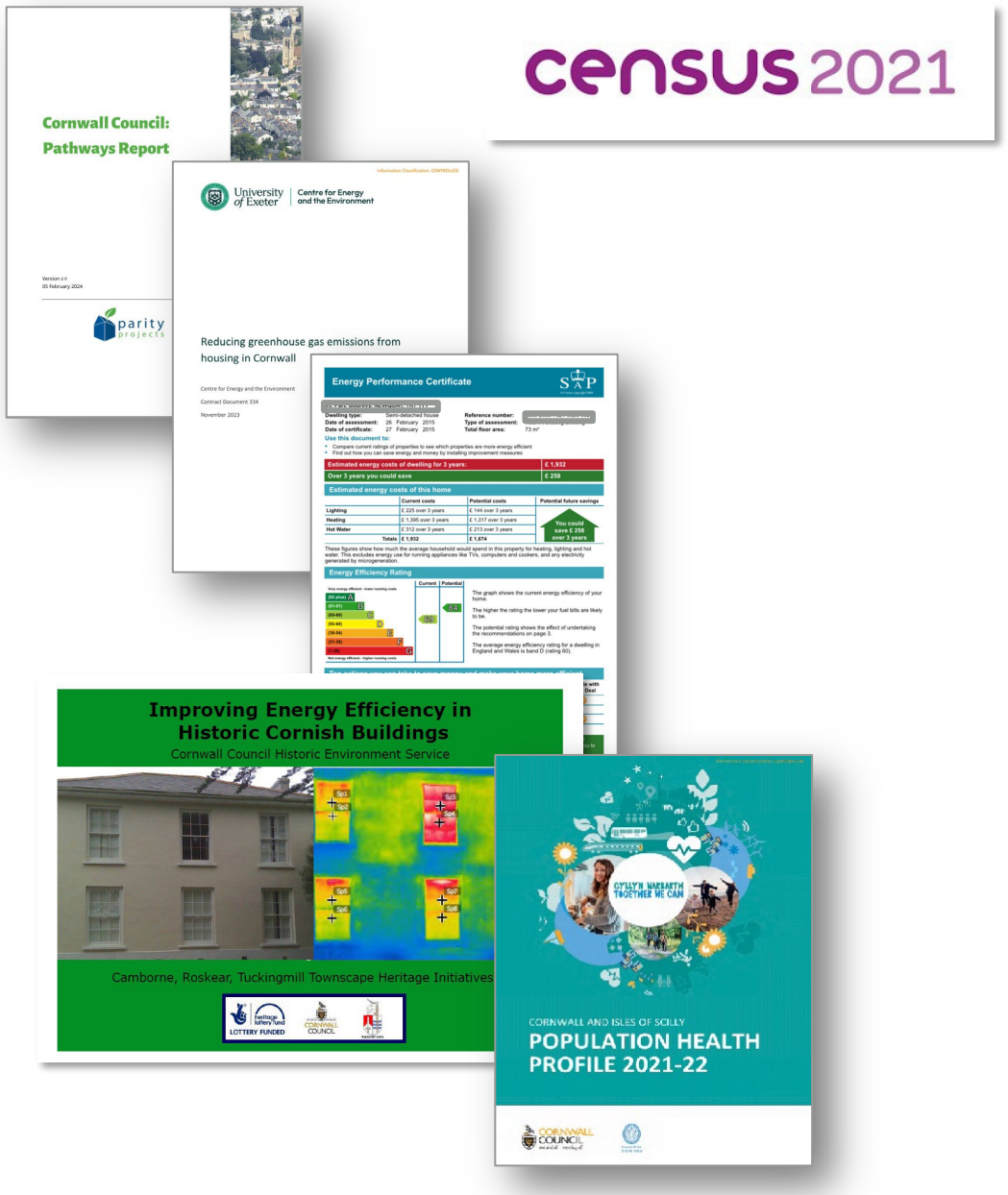
The University of Exeter were commissioned to explore ways to reduce greenhouse gas emissions from existing housing, which represents around 21% of emissions in Cornwall. Their report presents a high-level approach to reducing emissions and quantifies expected emission reductions against the UK's legal carbon budgets.

Parity Projects were also commissioned to model the baseline characteristics for Cornwall's housing stock as well as results of investment scenarios designed to achieve EPC C and to aim for more comprehensive retrofit scenarios. Key insights, from these reports, key datasets and our own analysis used to prepare this strategy are illustrated to the right.

EPC data has also been used as a baseline for this report and the modelling within it. An Energy Performance Certificate (EPC) contains information about a property's energy use and typical energy costs with recommendations about how to improve energy efficiency. The data can be downloaded in bulk format and although we believe this information has limitations in planning for decarbonisation it does contain valuable insights into our building characteristics at an address level.

The population health profiles for Cornwall were also considered to ensure we understood the correlation between housing and health and the links to home retrofit.

Tenure is also a key consideration for acceleration with different opportunities and challenges present. The Private Rented Sector (PRS) in particular faces some key challenges and barriers leading to inequalities for private tenants and the pathways to reducing emissions.



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Global, national and local context

Global carbon budgets

A carbon budget is the total amount of carbon dioxide that can be released into the atmosphere before a specific degree of global warming is expected to occur. Use of carbon budgets is vital to ensure that cumulative emissions remain within required limits. The Intergovernmental Panel on Climate Change (IPCC) have estimated global carbon budgets required to limit warming to well below 2˚C while pursuing efforts to limit warming to 1.5˚C above pre-industrial levels, in line with the Paris Agreement.

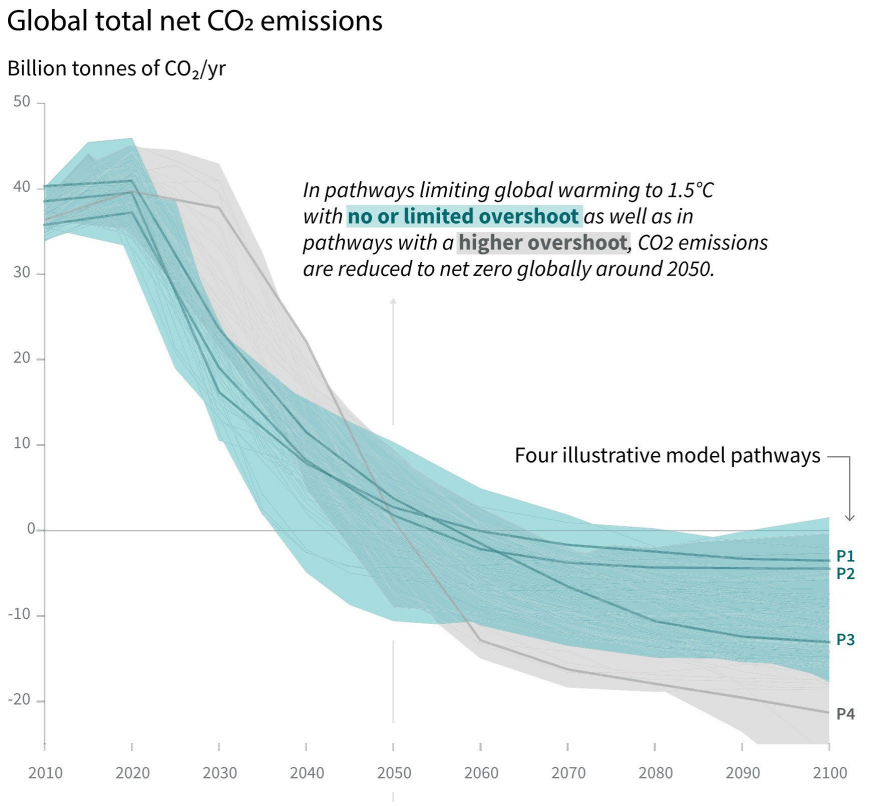
Implications for emission reductions

The latest evidence on carbon budgets from Lamboll et al indicated a remaining global budget of 250 $GtCO_2$ at the start of 2023 for a 50% chance of limiting warming to 1.5˚C. If global emission rates continue at the present rate, the carbon budget will be consumed by the end of 2028. For the carbon budget to last until 2050, it is likely that emission reductions of at least 58% need to occur by 2030.

National and local context

Translating international carbon budgets into national and regional budgets introduces complexities around emissions accounting, which are explained in more detail in Appendix 1. In summary, the UK's national carbon budgets do not appear to be sufficiently ambitious to align with a global 1.5˚C emission reduction pathway.

Local policy is more ambitious than the IPCC pathways, with Cornwall Council declaring a climate emergency in 2019 and aiming for carbon neutrality by 2030. However, given the lack of progress made to date in decarbonising housing, and the limited time remaining until 2030, this would now be very difficult to deliver. This strategy therefore proposes adopting a target based on the IPCC's carbon budgets, which indicate that emissions should reduce around 58% below 2010 levels by 2030.



The IPCC modelled four emission reduction pathways in their report on impacts of 1.5˚C of global warming. Only one of these, P1, appears practical given current limitations in negative emission technologies. The P1 pathway required a 58% reduction in emissions from 2010 to 2030, however due to lack of progress in reducing emissions since this report was published, an even greater emission reduction by 2030 is now required. © IPCC

How to address the key challenges

The Housing Decarbonisation Strategy for Cornwall will only be able to succeed if we are able to meet a number of key challenges. This report is structured to respond to these concerns, aiming to avoid costly mistakes or increased living costs by continually evaluating results.

Technical

Every home presents a different set of issues. The possible solutions can be confusing, and the relative benefits and risks are generally not well understood by the general public. This document seeks to clarify the key technologies and how they go together, presenting decarbonisation approaches for different buildings, recommending simple metrics and appropriate targets that align with scheduled home maintenance work.

Costs and funding

A full retrofit is not always affordable in a single phase, this strategy gives clear recommendations for prioritisation of retrofit steps and expected costs for an example of a simple home. Measures for reduction in energy costs are described, funding streams identified, and social value indicated.

Supply chain

Training and upskilling is needed to deliver the number of low carbon retrofits required, and a good quality assurance process must ensure that installations work effectively. Clarifying and supporting the case for investment is a key part of the challenge and example delivery models show how these can be managed. Developments in the electricity grid will also need to be aligned.

Raising awareness

Ensuring accurate information is available and tackling myths, making sure the policy landscape supports the retrofit measures that need to be undertaken, and making the retrofit journey manageable.

2.0 Technical

- Heating, building fabric and solar PV explained
- Minimising risk with whole house retrofit planning
- Decarbonisation approaches for different homes
- A clear approach to metrics and appropriate targets

3.0 Costs and funding

- Example costs for a simple home
- Energy costs for residents and how to increase affordability
- Funding streams that are currently available
- Social value – …

5.0 Raising awareness

- Ensuring people know how to decarbonise their homes
- Understanding public opinion and tacking misinformation
- Ensuring policy encourages and doesn't inhibit retrofit
- Make the journey as easy as possible for people

4.0 Supply chain

- The importance of training and upskilling
- Quality assurance processes
- Creating a supportive environment for investment
- Example delivery models
- Grid investment

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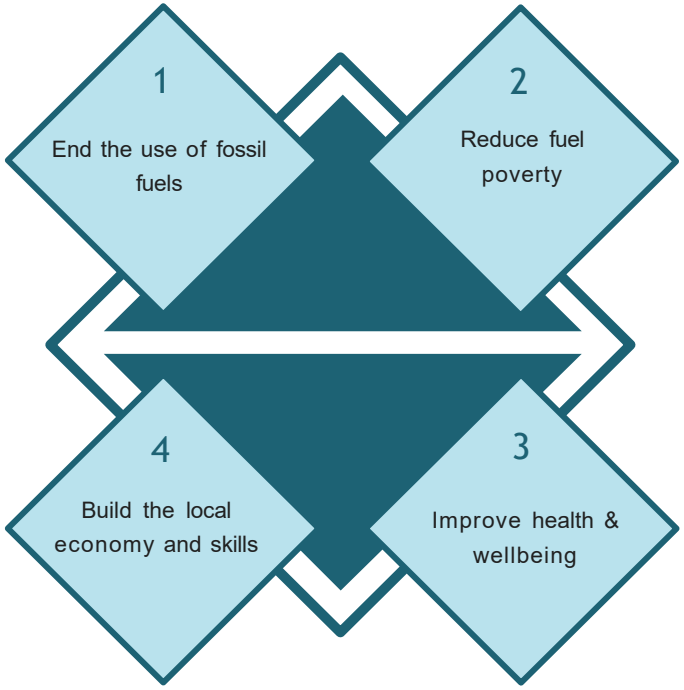
Priorities

Cornwall's housing decarbonisation strategy has been developed to meet the key objective of decarbonisation. The strategy should enable Cornwall to make a proportional contribution toward reducing emissions within a 1.5˚C carbon budget. In practice this means aiming for a 58% reduction in emissions below 2010 levels by 2030. The strategy's approach to decarbonisation also aims to deliver co-benefits to Cornwall.



Four strategy principles

1. End the use of fossil fuels – the strategy should aim to replace oil and gas heating in at least 55% of homes by 2030. Decarbonising heat is the most significant change that can be made to rapidly reduce carbon emissions. Much of this can be achieved by replacing end of life boilers with heat pumps in heat pump ready homes.

2. Reduce fuel poverty – the amount of energy used in homes should be reduced where there are cost-effective opportunities, to reduce residents' energy bills as far as is practical. There should be a specific focus on those in, or at risk of being in, fuel poverty, to ensure that decarbonisation also delivers savings on residents' energy bills. Renewable energy generation and energy tariffs also play a role in addressing fuel poverty. Care must be taken to ensure that decarbonisation measures do not increase or worsen fuel poverty.

3. Improve health & wellbeing – homes should become healthier and more comfortable places to live as they decarbonise. Our homes are at the core of physical and mental wellbeing and should be places for people to thrive. Improving housing quality through retrofit plays an important part in tackling health inequalities. Retrofitting must also be responsible, and not create unintended consequences which may impact health.

4. Build the local economy and skills – create jobs and a stable marketplace and support training in the county to upskill the workforce to deliver the decarbonisation objectives. Better skilled installers will deliver more effective decarbonisation and reduce the risk of poor outcomes. A greater number of qualified installers will support the market to limit cost increases caused by supply chain constraints.

Optimised retrofit principles

Optimising retrofit for a whole stock approach

In this strategy we consider all housing across the county. Most new builds should not require fabric retrofit but may need a low carbon heating system. However, we must consider all homes, many of which have not been built to net zero standards. The key principles of optimised retrofit to achieve a cost and carbon optimal approach are outlined in this strategy, and focus on achieving the fastest emissions reductions possible, while remaining affordable and ensuring value for money.

For most homes, this will mean:

- ❑ Prioritising replacement of carbon-based heating systems (generally with heat pumps).
- ❑ Reduce heat loss by targeted fabric retrofit, where cost effective (easy wins) or replacement is necessary anyway. Plus, airtightness & heat recovery for ventilation and wastewater.
- ❑ Installing renewable energy, and/or ensuring residents have access to cheap electricity.

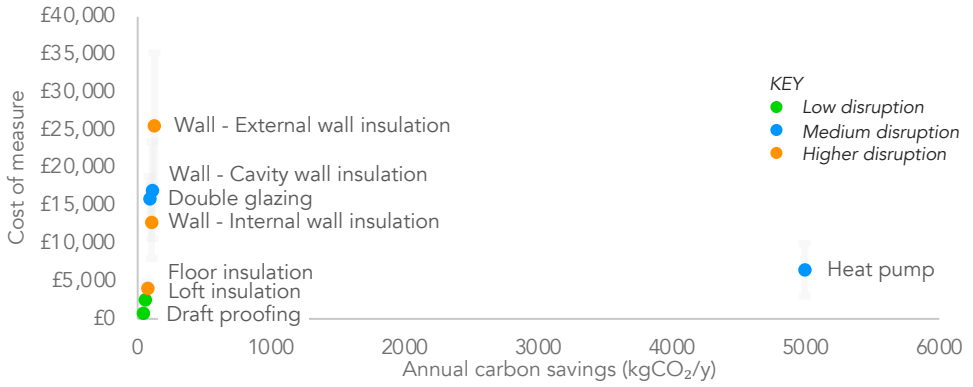
The cost of these measures can vary significantly, as can the carbon and cost savings they provide. Sequencing these measures in the correct order will save money on upfront costs, routine maintenance, achieve better value for money and enable emissions to be cut faster than the traditional fabric first approach.

Insulating homes can save energy, make homes healthier and more comfortable, but work to fully insulate homes is not always cost effective, it can be very disruptive and often creates a barrier to the transition to a low carbon heating system, when it is not essential in many homes. Some insulation measures, such as draught proofing, loft and cavity wall insulation tend to have lower costs and offer excellent value for money. Other measures, especially solid wall insulation, are often more expensive and do not always justify their cost.

P28 shows the breakdown of the housing stock in Cornwall in relation to this approach and the works required to each home before a transition is possible.

While insulation plays an important role in reducing heat demand, heat pump efficiency can be largely driven by a well-designed heating system, with correctly-sized heat emitters which enable a lower flow temperatures. Electricity to gas price ratios are shifting and have fallen in recent years, balancing further the running costs on the transition to low carbon. In 2016 Government committed to rebalancing the electricity to gas ratio through the Climate Change Levy (CCL) which continues to rebalance the costs on an annual basis.

We do acknowledge that one size will not fit all when it comes to retrofit and individual bespoke plans will be required on a property-by-property basis to identify the best pathway for each house and each occupant. Affordability will vary between our residents as will the impacts of the condition of our homes and the cost-of-living crisis. Adopting a holistic approach will improve access to safe, warm and secure homes across all tenures. P47/48 showcases the comprehensive work the Council and its partners are already doing to ensure no one is left behind and our work to decarbonise is always focused on identifying those in greatest need and providing the right support. The overarching ambition is for every home in Cornwall to able to transition to a low carbon heating system with sufficient insulation to make it affordable to heat to a healthy standard.



Installing a heat pump in the first step of a retrofit delivers large reductions in emissions, making subsequent emission reductions from fabric improvements relatively small. Upgrading the fabric over time is still important to improve health and comfort, reduce operating costs, and mitigate demand on the electricity grid.

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An inclusive strategy: creating the right balance

A balanced strategy must consider all our homes and all residents and for many a fully fabric first approach is not always achievable or affordable. In many homes the insulation levels are already sufficient to enable a transition to low carbon heating and this should be supported where possible. However for others improvements to the fabric may well be the best approach or what a resident want to focus on first as in some cases some measures like better doors and windows will make homes more liveable.

The modelling on P29 shows that there are approximately 57,000 properties in Cornwall which are ready to make the transition with no fabric upgrades required. The reason being, while many house builders have installed low carbon heating systems and solar panels in recent years, this hasn't been a requirement until the implementation of Cornwall's Climate DPD policies in 2023. Policy SEC1 now requires that all new homes are built to a mandatory net zero build standard, where energy generation is balanced with energy use. Cornwall Council took this important step to go beyond the standard policies for new build to minimise creating "the retrofit of the future"

In contrast insulation requirements have been well established by Building Regulations providing for high levels of insulation and thermal efficiency since the late 1990's. This presents an opportunity to decarbonise quickly in properties built over the last 30 years where insulation and condition are likely to be good, and an adequate electrical supply is available. These homes are classed as heat pump ready and can quickly transition at a reasonable cost. Combined with excellent design, installation, energy generation capacity and optimised tariff advice these properties could see running costs drop below those of a gas or oil boiler.

Our stock also contains a proportion of properties which require basic improvements to insulation and ventilation, where fitting solar panels often also make sense as early interventions alongside low carbon heating. Additional measures to further reduce the heat loss of the building can be done as parts of the building are naturally upgraded and replaced .

So, while it is important to tackle our older hard-to-treat properties it is as equally as important to consider our quick wins and focus some attention on these. These homes could equally be occupied by households in fuel poverty who could benefit from retrofit measures and tariff advice. An inclusive strategy for all house types and occupiers is essential to drive our ambitions.

The case studies developed alongside the strategy showcase a wide range of homes and residents with different solutions deployed but all with the same aims to reduce emissions and running costs.

Clockwise from top left: MVHR in a 1990s bungalow, air to air heat pump in a 1950s semi-detached bungalow, PV on a 1990s house, new windows in a Victorian cottage.

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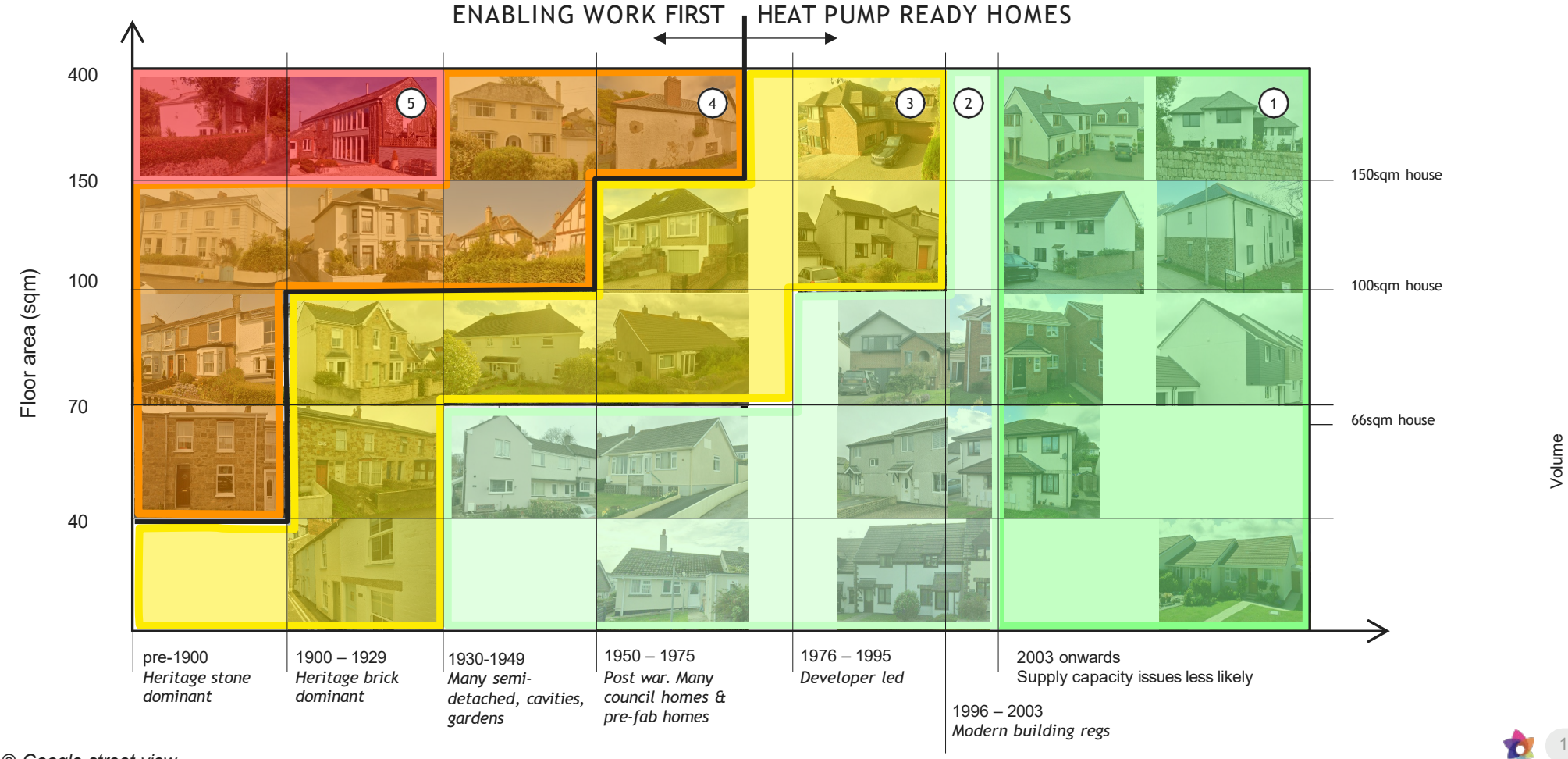
Different homes need different decarbonisation approaches

Assessing how easily a heat pump could be installed in Cornish homes

It is possible to assess the likely standard of insulation to walls and floors of homes based on when they were built. Significant changes to construction occurred around 1930, when cavity wall construction was used more consistently, and in 1996 which is when modern building regulations were introduced, with better fabric requirements.

The second key indicator for which homes could have a heat pump fitted quickly is the internal floor area, which is recorded in the EPC data. Smaller homes will generally need less heat so are more likely to be able to have a heat pump on a standard electrical supply. We have also observed that smaller and newer homes usually have simpler shapes, especially simpler roof shapes, which will also help to make them more energy efficient.

The diagrams below show example properties of different ages and sizes. The properties to the left are the oldest and properties at the bottom are the smallest.



Images © Google street view

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The evidence

A growing evidence base

An increasing number of studies support this approach to decarbonisation, including DESNZ's Cost-Optimal Domestic Electrification study, Nesta's report on Insulation Impact, a Buildings & Cities paper on the 'Fabric First' approach, a Passivhaus Trust paper on staged retrofit, and recent articles by CIBSE and others.

The Energy Systems Catapult Electrification of Heat Project, involved around 740 heat pumps installed in a representative and broad range of house types. The project demonstrated that decarbonised electricity offers very low or even zero-carbon heating for homes, without necessarily carrying out extensive deep retrofit work, evidencing that it is technically possible to install heat pumps in the vast majority of house types in the UK with no threat to comfort or running costs. Its findings also establish that heat pumps typically have a Seasonal Coefficient of Performance (SCoP) of 2.9.

In these studies, cost calculations generally use the standard energy tariff set by the Energy Regulator for Great Britain's price cap in their calculations. Further cost reductions are possible using a combination of on-site solar generation and the new breed of energy tariffs designed specifically for heat pumps.

The Regulatory Assistance Project (RAP) also regularly analyses the running costs of heat pumps versus gas boilers and explains that heat pumps have similar running costs to a gas boiler, even though electricity is more expensive than gas, because they produce heat at a more efficient rate. On average heat pumps turn one unit of electricity into 2.5 to 5 units of heat, meaning they use about three to five times less energy compared with gas boilers (For further details on potential running cost savings see p35).

Several reports over the past few years have considered the optimal approach to decarbonising buildings, and concluded that heat decarbonisation should generally be prioritised, with other measures introduced more gradually over time.

Other heat decarbonisation led strategies

The approach of this Housing Decarbonisation Strategy, to prioritise low carbon heating systems rather than a simple 'fabric first' principle, is in line with other organisations in the construction industry. But acknowledges that this will not always be the best course of action, so each building and its inhabitants must be considered so that no one is left behind.

AECB Step-by-step retrofit

The Association for Environment Conscious Building's (AECB's) CarbonLite Step-by-Step Retrofit programme has now endorsed this approach, with decarbonisation of heating in the first phase – Step 1 - of retrofit work.

The AECB describes the Step 1 retrofit standard as a 'heat pump retrofit' standard as it has been designed for a lighter fabric retrofit, effective ventilation and a heat pump.

The Passivhaus Trust paper – 'The right time for heat pumps'

Passivhaus and EnerPHit (the Passivhaus retrofit standard) are fabric led standards. The Passivhaus Trust has issued a guidance paper (April 2024) recommending a similar strategy to the AECB, starting with a plan for the whole process but introducing the heat pump at an early step, with minimal fabric improvements needed initially for many homes.

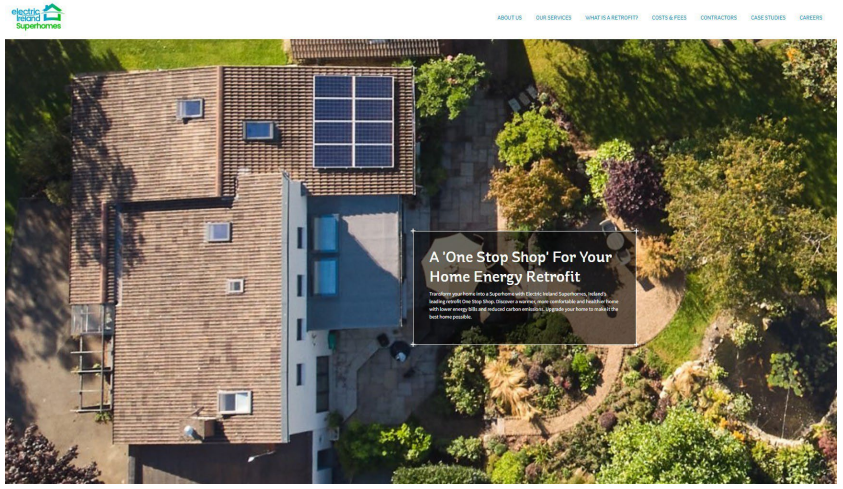
Superhomes one stop shop

Electric Ireland Superhomes was established in 2021 with the aim of dramatically upscaling home retrofit and supporting Ireland's climate action targets through a commitment to delivering over 30,000 home retrofits by 2030.

They offer a set menu of services including heat pump+, whole house retrofit, and retrofit for groups of multiple properties. Their service includes design, advice and support to access funding, and recommended installers. The heat pump+ service for newer homes involves the installation of a heat pump heating system, combined with basic insulation measures and solar PV.

Headline certification criteria - *updated Sept 2023*			
Criteria	**Carbonlite Retrofit** Step-by-step	**Carbonlite Retrofit**	**Carbonlite New Build**
Delivered space heating and cooling (kWh/m2/a)	report result	≤ 50 kWh/m².a (≤ 100 kWh/m².a with certifier-approved exemption)	≤ 40 kWh/m².a
EITHER Primary Energy (PE, varies) **OR** Renewable (PER) (kWh/m2/anum)	report result report result	report result report result	≤ 85 kWh/m².a ≤ 75 kWh/m².a
Ensure ventilation	Continuous MEV or MVHR must be installed : follow PAS 2035 Annexe C or as required by Part F of the Building Regulations.		
Airtightness (q50)	≤5.0 m³/m².h	≤2.0 m³/m².h	≤ 1.5 m³/m².h
Thermal Bridges	N/A. If some additional & significant fabric measures are being replaced or installed, certifiers will advise whether full Retrofit Standard requirements are applicable.	Assumed to be less than 0.01 W/mK, else accounted for in PHPP or for retrofits a default heat loss factor may be used.	Assumed to be less than 0.01 W/mK, else accounted for in PHPP
Surface Condensation (fRsi) assessed		fRsi to meet criteria in PHPP, or 0.75 (as Building Regulations/ PAS2035), or local standards - whichever is more onerous.	fRsi to meet criteria in PHPP, or 0.75 (as Building Regulations/ PAS2035), or local standards - whichever is more onerous.
Heating System	Change existing fossil fuel (or direct electric) heating system to a heat pump.	Existing heating systems may be retained, but a practical plan to allow for future low carbon heating supply must be in place.	Install a non fossil fuel system or connect to a low carbon district heating network.
Thermal Comfort	PHPP modelled overheating risk, <10% Acceptable (Guidance: <5% Good practice or <3% Best practice)		
Running cost comparison	Must be same/lower running costs than base case **	-	-
Where a heat pump is installed			
Certifiers must liaise with the building owner and the MCS heating system designer in order to ensure that:			
Maximum flow temperature for the designed and installed heating system (space heating only)	no greater than 50°C ; Best Practice - heating system is designed and installed for flow temp <45°C		
Energy Model using PHPP, showing:			
	A. Pre-retrofit Baseline *B. Step 1 achieved* *C. Retrofit scenario showing how Full Retrofit could be achieved (≤ 50 - 100 kWh/m2.a)*	*Retrofit Standard achieved (≤ 50kWh/m².a or ≤100 kWh/m².a with certifier approved exemption)*	*Building Standard achieved*

The AECB have updated their retrofit certification criteria to include a 'step by step' option. Step 1 is the minimum required for certification, based on installing a heat pump with specific system characteristics.



The Superhomes website offers homeowners and landlords in Ireland a simple route to retrofit and heat decarbonisation. https://electricirelandsuperhomes.ie/

2.0

Technical

Target Outcomes
Improved levels of insulation
Good ventilation
Well-designed low carbon heating systems
Renewable energy generation

The technical challenges and solutions associated with low carbon heating, electrical supply capacities, building fabric, and solar photovoltaics.

This section should be read in conjunction with Appendices 2.1 to 2.7

Technical context for Cornwall

Decarbonisation and retrofit of homes is a complex challenge everywhere in the UK, but there are also some specific local challenges, including:

Climate

Although most parts of the county are relatively mild, wind driven rain can present a risk when insulating existing homes, especially the walls. Particular care and expertise is needed to avoid damp.

Radon

Radon is a radioactive gas that occurs naturally in some areas including Cornwall. Improving airtightness of homes is a key part of improving energy efficiency, but this must be done in conjunction with improved ventilation and with particular regard to ensuring radon doesn't accumulate indoors.

Mundic and system builds

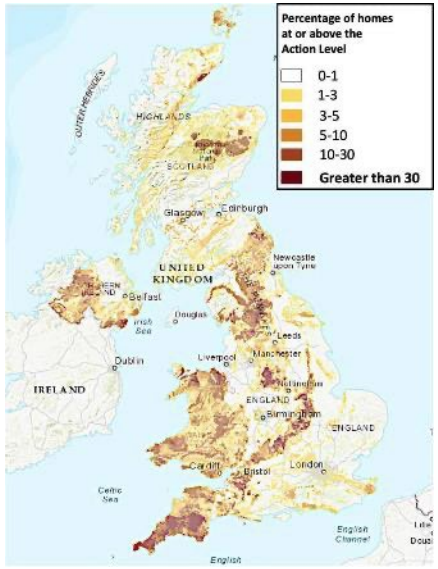
Over the years, different ideas have been put forward to solve Cornwall's perennial housing shortage. These have included novel construction materials and methods intended to make housing cheaper to build. Many of these methods relied on a shorter building life as a means to reduce costs, using less durable, lower cost materials such as reinforced concreted and mundic. Retrofit of these homes can be particularly challenging and potentially costly, so they need a specific strategy to ensure the most cost-effective approach.

Heritage and traditionally built homes

Cornwall has an older overall housing stock than the rest of the UK. These older properties and communities need to be protected while ensuring the residents are able to make the changes needed to improve the energy efficiency of their homes. Retrofitting should be carried out sensitively to ensure character is retained.

Cornwall's particular risks

Relatively old housing stock
(image source: Prime Location)



Radon
(image source: UKHSA)

Mundic
(image source: rics.org)

Driving rain (image source:
Ivan_L from Freerange Stock)

Low carbon heating

Most domestic emissions are from heating

Heating with oil or gas boilers is responsible for most carbon emissions from homes. The phase-out of fossil fuels for heating is therefore the single most important measure to decarbonise homes.

Heat pumps are expected to be the main technical solution

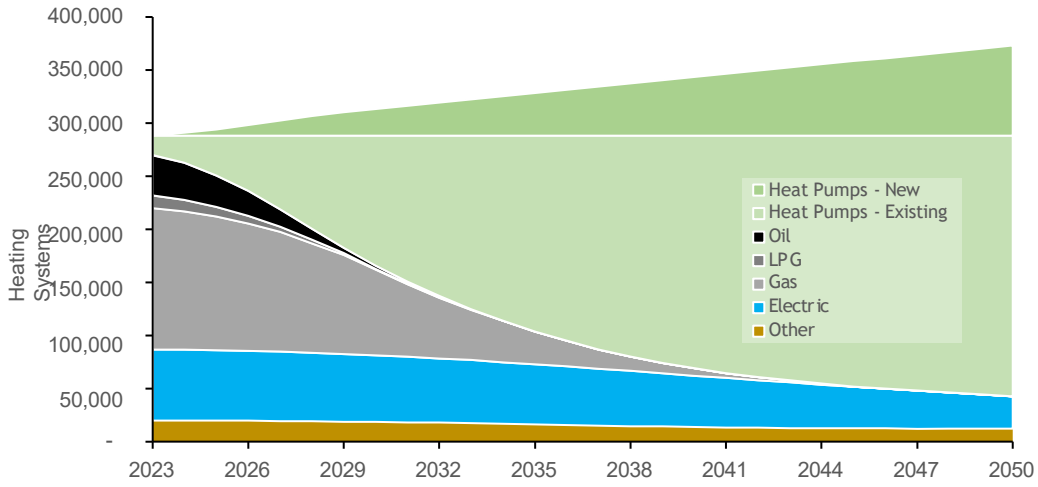
The carbon emissions per kilowatt hour of electricity in 2023 were 30% lower than gas and over 50% lower than oil. By 2030 they will be 75% lower than gas and 83% lower than oil, and by 2050 close to 100%. This means the main pathway for decarbonising homes is to replace fossil fuel heating systems with electric heating systems.

As the direct use of electricity for heating is generally expensive, the majority of electrification is expected to occur via air or ground source heat pumps. These come in different configurations, but all types typically use 60-80% less electricity than direct electric heating, resulting in emission reductions of 80-90% relative to fossil fuels, and competitive operating costs. The technology is also commercially available, mature, and scalable.

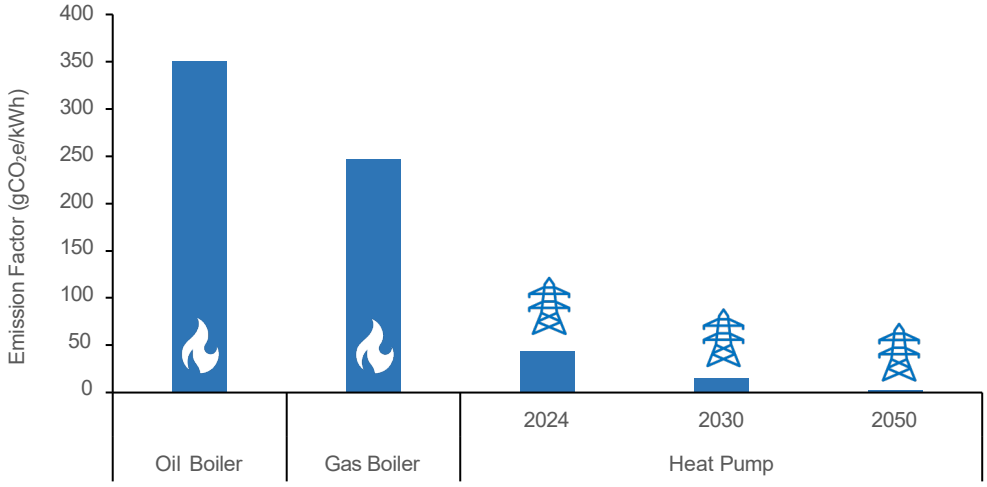
Other heating technologies,fuels & future innovations

- Electric storage heaters may be suitable in some homes.
- Geothermal heating may be suitable for some homes, however costs are not yet known. Trials are in progress so its potential is expected to become clearer over time.
- Woody biomass, liquid biofuels such as Hydrotreated Vegetable Oil, and biogas are not expected to be scalable and do not significantly improve combustion related air quality issues.
- Hydrogen has issues with cost, efficiency, scalability, carbon dioxide emissions, air quality, and safety. Sufficient quantities of genuinely low carbon hydrogen are highly unlikely to be available.
- Energy from Waste is not considered a low carbon energy source.

For further information see Appendix 2.1 Heat Sources



Number of heating systems in Cornwall by system type required to deliver 58% emissions reduction by 2030. Replacement of fossil fuel heating with various forms of heat pump forms the core strategy to reduce emissions.



Carbon emission factor comparison per unit of heat energy delivered by fossil fuel boilers versus air or ground source heat pumps. Emissions from heat pumps will fall even lower as the grid decarbonizes, and also where on-site solar generation is present.

Myths about heat pumps

Understanding what is possible

As with many unfamiliar technologies, it is normal for myths to circulate. Heat pumps are no different, and because of their sensitivity to poor design and installation practices there are, unfortunately, case studies of systems that are not performing as well as they should be. Given the importance of heat pumps to Cornwall's decarbonisation strategy, some of the more common myths have been summarised below:

1. Heat pumps are not suitable for most dwellings (FALSE)
   The Energy Systems Catapult led Electrification of Heat project was able to successfully install heat pumps in a wide variety of building types across the UK. Our analysis of Cornwall's housing stock indicates that the majority of homes should be suitable.
2. Heat pumps 'don't work' in poorly insulated buildings (FALSE)
   Heat pumps can efficiently move heat into any building, regardless of how well insulated it is. In poorly insulated buildings a larger heat pump will be required, together with larger heat emitters to ensure it can operate efficiently.
3. Heat pumps cost £10k+ to install (PARTIALLY FALSE)
   The cheapest type of heat pump is usually an air-air unit, more generally known as mini-split air conditioners. These often cost less to install than a gas or oil boiler.
4. Heat pumps are more expensive to run than oil or gas boiler(sFALSE)
   Properly installed heat pumps offer similar running costs to oil or gas boilers, based on Q1 2024 price cap rates for fixed tariffs. Combining heat pumps with time of use electricity tariffs can reduce costs by 40-50% compared to a boiler, while the addition of solar photovoltaics can take bills down to zero, and beyond.
5. Heat pumps don't work when it's cold (FALSE)
   Heat pumps are the most common heating system in some of the coldest countries in Europe.

Trelissick House in Cornwall is a grade II listed mansion that was built in 1755 and is representative of what many people would consider a building that is 'impossible' to heat via heat pumps. It was fitted with 165kW of locally built ground source heat pumps from Kensa in 2022 as part of the National Trust's mission to become net zero by 2030. (Image source: National Trust)

Where poorly performing heat pump installations are identified, these systems should be checked for deficiencies in their design, installation or operation as the first intervention, these being the 3 critical considerations to achieve optimal outcomes. If deficiencies are identified outside of these 3 checks, then feedback loops with installers, manufacturers and accreditation bodies need be utilised to ensure lessons are learned and enacted for following installations.

In some cases a heat pump may not be the appropriate measure and this strategy reflects the need to consider each property and its inhabitants when finding energy efficient and emission reducing solutions.

The importance of electrical supply capacity

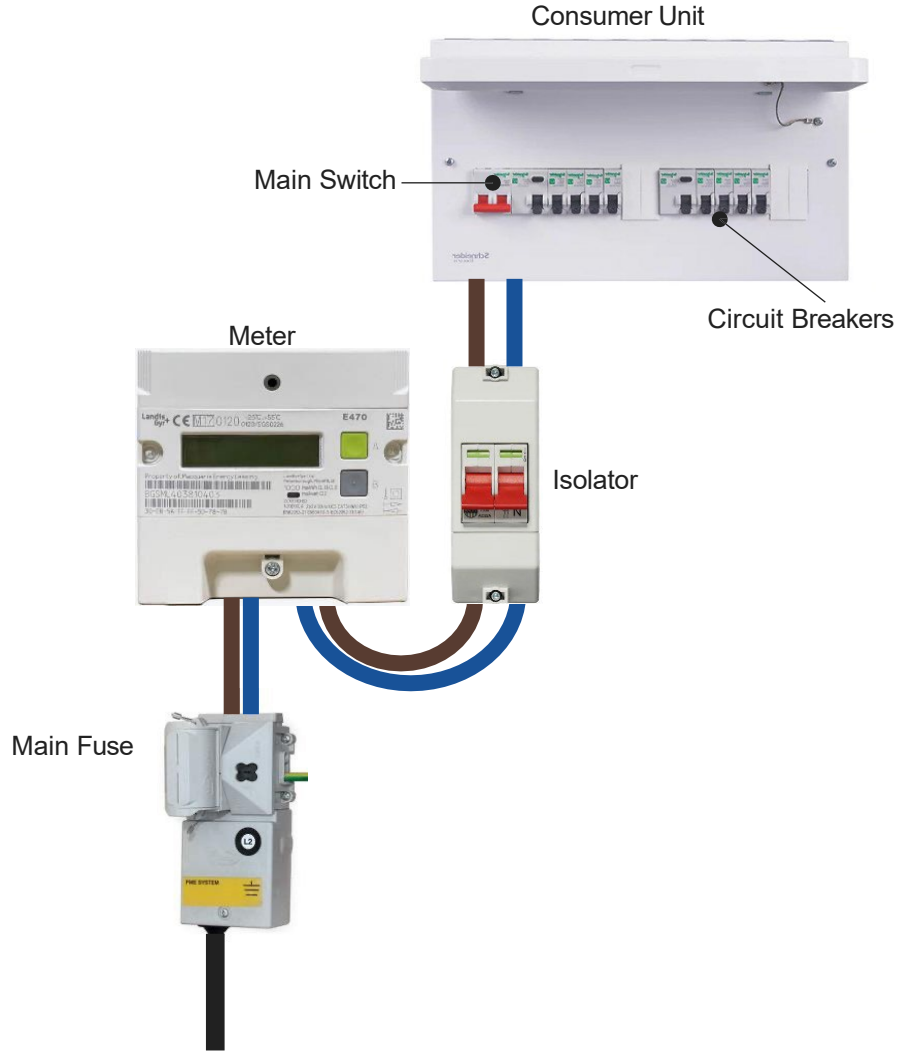
Understanding domestic electrical supplies

Homes must have sufficient electrical supply capacity to meet the power demands of a heat pump. In many cases for smaller and newer homes the supply will already be sufficient, however for older homes the existing supply capacity may need to be upgraded. In the case of larger homes, fabric efficiency measures may also be required for a heat pump's power demand to remain within the available single phase supply capacity. The adjacent diagram shows the main components in a typical modern single phase domestic electrical supply, starting from the incoming electricity supply cables through to the consumer unit, which distributes the electricity to individual circuits within a home.

Who owns what?

The table below summarises who usually owns the main components in a domestic electrical supply. This is important to understand as various parties may need to be involved in upgrading different parts of the electricity supply, some of which may involve lead times of several months.

Distribution Network Operator	Electricity Supplier or Property Owner	Property Owner
Electricity supply cables	Meter	Isolator to consumer unit cables
Main fuse		Consumer unit (including main switch and circuit breakers)
Main fuse to meter cables		
Meter to isolator cables		
Isolator		



Various components of domestic electricity supplies may introduce constraints on heat pump capacity. In some cases these components will need to be identified and upgraded, ideally prior to failure of an existing fossil fuel heating system to allow for emergency replacement with a heat pump. (Image sources from top to bottom: Schneider, Landis+Gyr, Wylex, Lucy Electric)

Fabric and ventilation efficiency – insulation and windows

Good quality building fabric and ventilation is important from an environmental and human perspective. Housing quality is a concern in Cornwall, with many homes in need of repair. Heat pumps will be the most impactful measure in terms of carbon, but improvements to the building fabric will also help to alleviate comfort issues and fuel poverty in situations where residents are currently 'zoning' their heating. In a 'deep retrofit' scenario, some residents will be able to use very little heating. This page introduces fabric measures, and the next page describes airtightness and ventilation measures. Later in the report we describe how these might be prioritised and fit into the decarbonisation pathways.

Heat loss through the building fabric

(see Appendix 2.4 for more detail)

Insulation added to the building fabric prevents heat being lost through walls, floors and roofs. Insulation is best when applied to the outside of a structure, as existing fabric remains warm and protected, however several strategies are possible. The image to the top right shows an example of loft insulation installed in two layers, leaving adequate space for ventilation at the eaves, and wood fibreboard installed on the inside of a solid brick wall.

Windows and doors tend to have a higher thermal conductivity than walls, and upgrading these to high quality double or triple glazing can reduce heating demand and improve thermal comfort. The images to the right show a single glazed window in poor condition compared to a new vacuum double glazed unit and a triple glazed sash window.

Earthwool loft insulation (image source: www.the-salutation.co.uk)

Wood fibre insulation (image source: Prewett bizley Architects)

Windows: poor single glazed, new vacuum double glazed (image source: Prewett bizley Architects), triple glazed casement (image source: www.weare21degrees.co.uk)

Fabric and ventilation efficiency – Ventilation and airtightness

Heat loss through air movement

(See appendix 2.5 for more information)

Reducing heat loss through air movement is achieved by stopping accidental air leakages and adding the right amount of ventilation in a controlled way while recovering the heat from the expelled air where possible.

Airtightness measures help to reduce infiltration (unwanted ventilation), which improves comfort levels and energy use. Filling visible gaps and using well fitted windows and doors, gives a reasonable improvement in airtightness. This can be taken further by using specialist air tightness tapes, windows with better quality seals, and stripping back finishes to the basic structure and repairing and taping junctions. For example, joist ends as shown in the images to the top right. Removing chimneys will also help to improve the airtightness of the external envelope.

Ventilation needs to be provided mechanically in a building with low air leakage. This is important for resident health, especially given the high levels of radon in some parts of Cornwall. It is possible to recover a high proportion of the heat using mechanical ventilation with heat recovery systems (MVHR) and these can be commissioned to ensure a positive pressure in areas of high radon.

The image to the bottom right shows a ceiling mounted MVHR concealed in a kitchen bulkhead in a flat. With careful planning, these can be integrated into living spaces in an unobtrusive and practical way. Ideally the external supply and exhaust ducts should be close to an external wall or roof, to minimise the duct lengths. This helps to increase the overall system efficiency of the heat recovery and mean less heat is lost to the outside.

Stripping back to the structure (Image source: Eightpans) and applying airtightness tape to joist ends (Image source: Ecomerchant) will deliver best practice levels of airtightness.

An MVHR system recovers heat from the air leaving the building and transfers it to the fresh air entering the building. This exchange heat happens without the two air streams mixing.

Information Classification: PUBLIC

Fabric and ventilation efficiency – Strategies **to avoid overheating**

An increasing health issue

Mitigation of the risk of overheating in homes is becoming a more significant concern as climate change is affecting summer temperatures and dangerous heatwaves become more common. In new homes there is now a Building Regulations requirement to assess and take steps to avoid overheating, but in existing homes there is no obligation to do so as part of a refurbishment or retrofit (except to meet PAS2035 standard). It is generally the case that retrofit doesn't increase the risk of overheating, but in homes that already overheat, there is an opportunity to consider potential measures to reduce the risk as part of a retrofit project.

The Good Homes Alliance have created an assessment tool for existing homes to identify key contributors to overheating risks at early stages of retrofit projects.

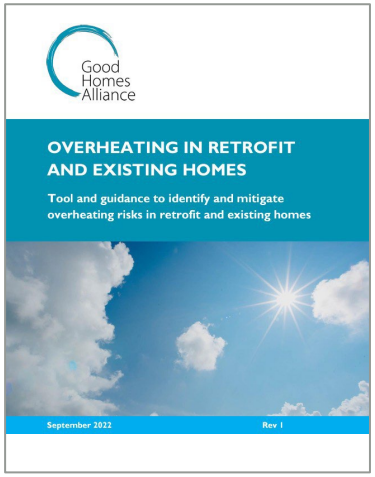
Mitigation strategies

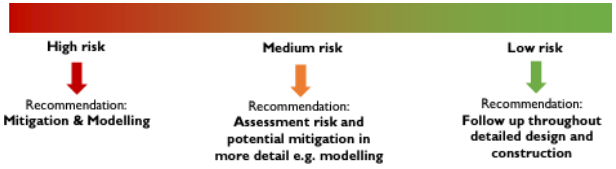
South and west elevations are likely to be at most risk of extensive solar gain. East facing windows would also experience similar issues especially as midday sun approaches.

Mechanical cooling should not be relied on as the primary mitigation for overheating as those least able to cope with physical effects of overheating – the very young, very old and those with restricted movement – are also those least likely to be able to afford the energy costs of cooling.

Introducing shading, such as awnings or shutters, and ensuring effective ventilation as well as insulation, particularly to roofs, are the primary strategies. (Note that air-to-air heat pumps can usually operate in reverse as cooling as a secondary strategy where these are used for heating.)

See appendix 2.5 Managing Risk for more infomation





The good homes alliance tool for assessing the risk of overheating can be used to determine the broad category that homes fall into, and the accompanying guidance provides information on the best approaches to reduce the risks. The guidance also sets out how to carry out a more detailed assessment of the risk as the design is developed.

Mitigation strategy		
Shading	External shutters (image source: Contrasol)	
	Internal blinds/curtains (image source: English blinds)	
Passive ventilation	Fully openable windows (image source: Velfac)	
	Ceiling fans (image source: RS Components)	
Active ventilation	MVHR with summer bypass	
	MVHR with 1.5 kW cooling coil (image source: Zehnder)	
	Full cooling	

Potential mitigation strategies to reduce the risk of overheating in homes.

Solar photovoltaics

The vital role of solar photovoltaics

Nationally, the Climate Change Committee's Balanced Net Zero Pathway indicates solar capacity needs to increase from around 17GW at present to 85GW by 2050. This is a similar amount to the National Grid's most plausible net zero aligned Future Energy Scenarios. This represents the addition of around 114 million 600 W commercial panels or around 170 million 400 W residential panels.

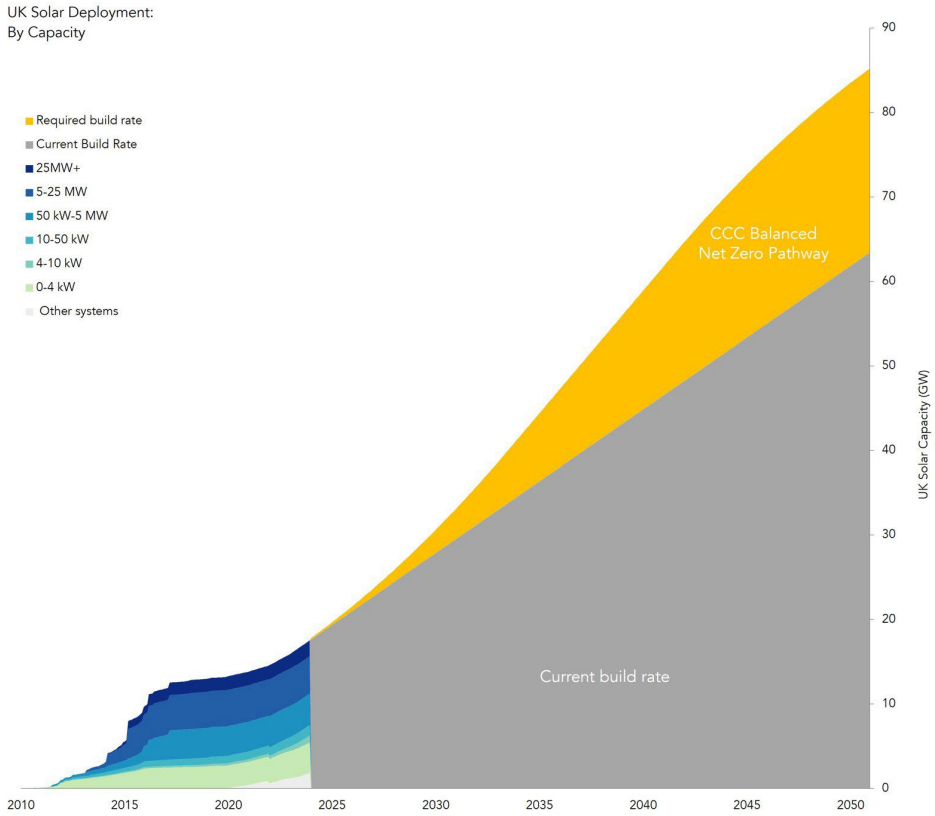
Where should solar be installed?

Around a quarter to a third of solar capacity installed in the UK is thought to be located on buildings, with the remainder being utility scale ground mount systems on green or brownfield sites. In the future, it will be important to continue to install solar panels on buildings to maximise benefits to occupants and reduce pressure on greenfield sites. Installing solar systems on 30 – 50% of homes in Cornwall would represent a reasonable contribution toward the UK's overall targets for solar deployment. If this proportion were to be achieved across the country it would result in around 45% of UK solar being generated from systems mounted on homes.

Benefits of building mounted solar

The levelised cost of electricity produced by domestic solar systems is typically around 7-10p/kWh. This is 60-75% less than current price cap rates and demonstrates how installing solar panels can be a very effective way to provide significant long-term reductions in energy cost for occupants, particularly as heat and transport electrify.

While utility scale ground mount solar can provide even cheaper electricity, this is usually sold to electricity suppliers at lower wholesale prices, unless it is part of a microgrid that can sell energy to homeowners at retail prices. The retail cost of solar electricity provided by microgrids is usually less than the retail cost of grid electricity, but higher than the cost of owning your own solar system.



The UK's solar build rate has increased significantly in the past few years, but still needs to accelerate more to be on track for the quantity required in the Climate Change Committee's Balanced Net Zero Pathway. Much of this can be installed on existing buildings to reduce electricity bills and pressure on greenfield sites. Based on solar deployment data from DESNZ and Solar Power Portal.

What about solar water heating?

Solar water heating can be an effective solution in some situations, however, whilst it can contribute to a household's hot water energy use in some situations, using a solar PV array and/or a heat pump is usually a simpler and more cost-effective solution. Solar hot water has a relatively small application so finding installers and operatives able to maintain the systems may be more challenging than for mainstream systems.

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Whole House Retrofit Planning

What is a whole house retrofit?

A whole house retrofit is a comprehensive plan for home improvements. This does not mean that everything has to be done at the same time, but improvements should be made in a way which is compatible with the end goal, and that does not compromise the health of the residents or the building.

Key issues such as air quality, damp, overheating, mould growth and ventilation are easier to manage when retrofit is delivered as part of a structured plan instead of through a series of ad hoc interventions.

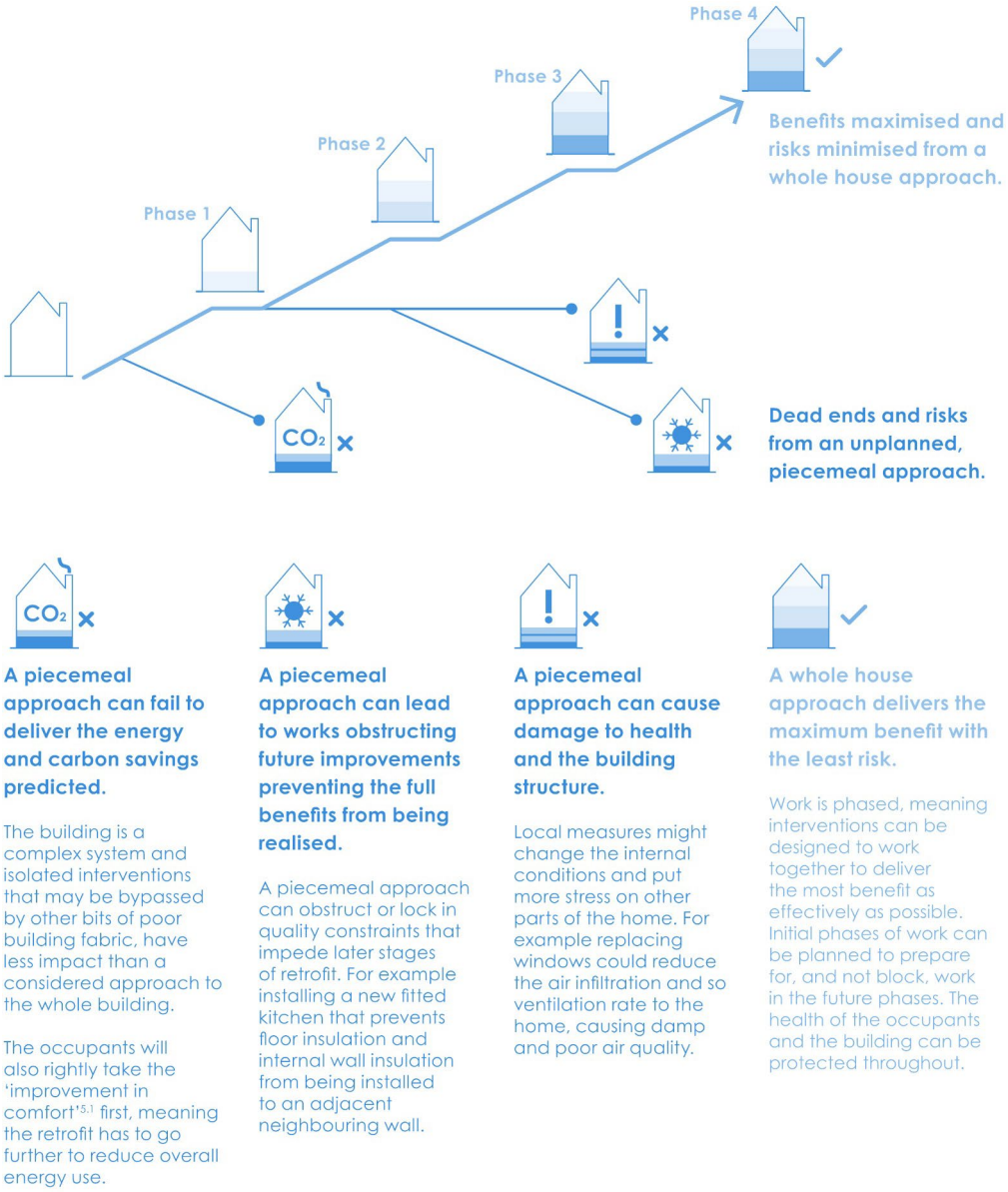
What are the main considerations?

It is now commonly agreed that retrofit should be done in a holistic manner which addresses the following key objectives:

- Addressing existing building defects.
- Providing a low carbon heating and hot water system.
- Providing a continuous insulating layer where possible and developing a clear approach to interfaces, edges and junctions.
- Having a clear winter and summer ventilation approach.

How far do we go with energy efficiency?

A consensus is now emerging that whole house plans at scale should seek to immediately deliver electrification of heat, while aiming for modest reductions in space heat demand over time, with fabric and ventilation upgrades carried out at appropriate points in the building's lifecycle. The following pages explore recommended metrics for measuring progress in decarbonisation, and performance targets for a decarbonised housing stock.



Advantages of a whole house approach to retrofit, versus a piecemeal approach. Source: LETI's Climate Emergency Retrofit Guide.

How this translates into the recommended approach to housing decarbonisation

Decarbonising existing housing is a complex challenge because every home is different. This complexity can be daunting and a barrier to action. The flow diagram on the right proposes a process to overcome this barrier. It shows the pathway that homes need to follow.

Electricity supply

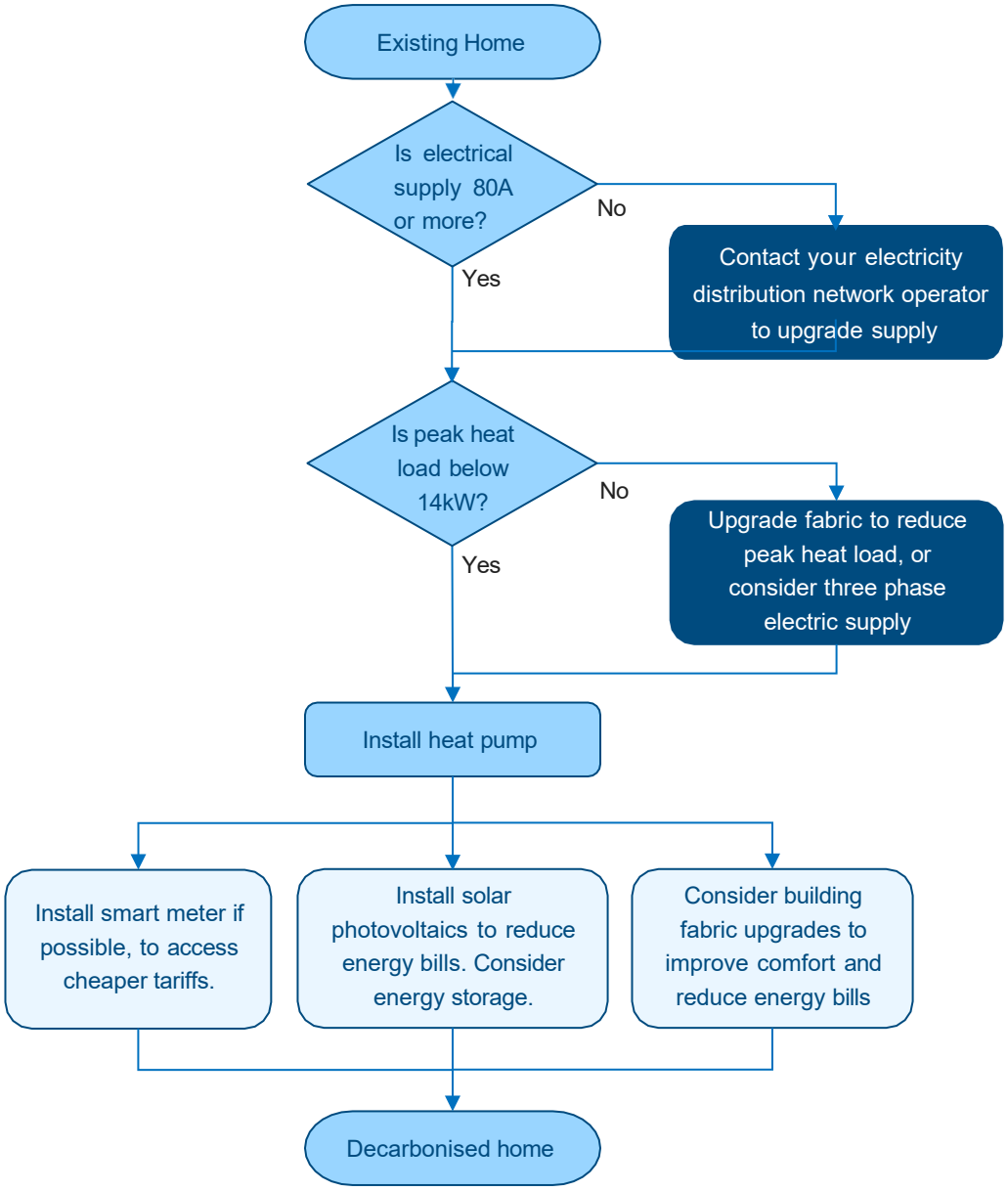
Some homes have a low enough heat demand to be able to have a heat pump on a standard single phase electrical supply (minimum 80Amp), and some currently do not. The first step for every home is to check that there is an adequate electrical supply for a heat pump to be installed. Where required, National Grid Electricity Distribution are able to provide upgrades to a minimum 80A single phase supply free of charge, but the resources to do the work are limited and it therefore will take time.

Does the fabric need to be upgraded now?

Based on a maximum single phase electrical supply capacity of 80A, the highest corresponding heat output from a standard heat pump is around 14kW. This sets a practical limit on the peak heat load for most ordinary homes, beyond which fabric upgrades or a three phase electrical supply will be necessary.

High level decarbonisation strategy for each home.

Once a heat pump has been installed to decarbonise the heating system, remaining work can be carried out in stages that work with the building's lifecycle and budget for additional measures. The specific measures that can be carried out will depend on the building and how it is occupied by the residents, but all are important aspects of delivering affordable net zero homes.



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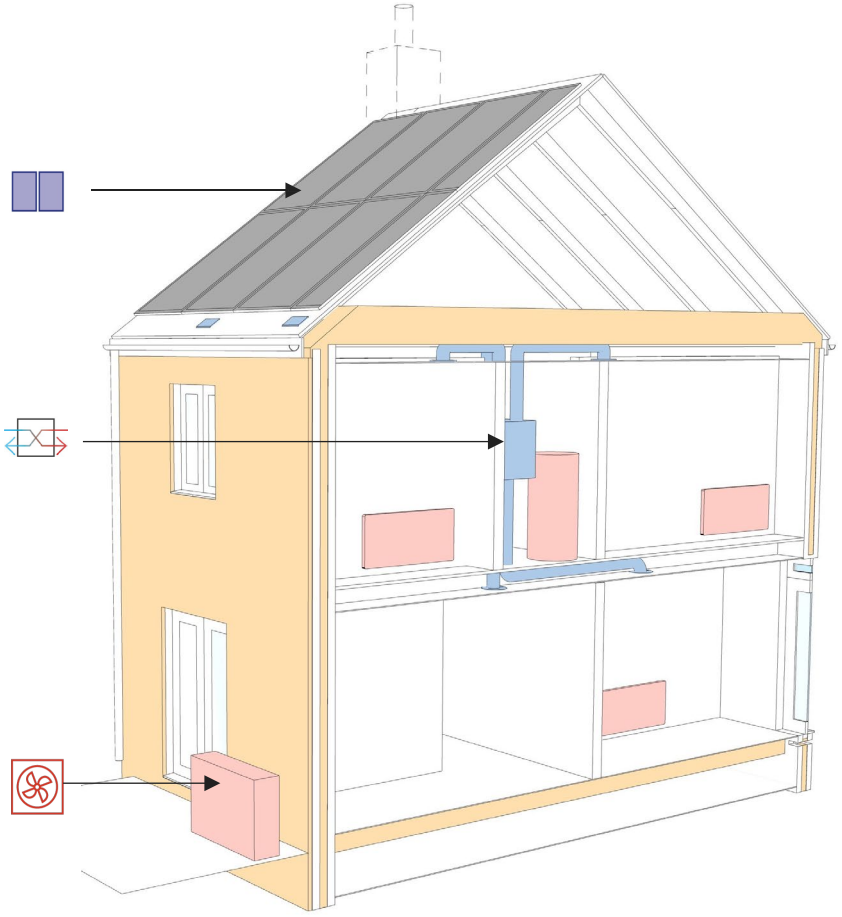
Example decarbonisation strategy for a simple home in three steps

Each home will have a bespoke process for decarbonisation. This is an example process, which is anticipated to be relevant in principle for a high proportion of homes. See appendices for details on individual measures. Any 'easy win' measures should be brought forward to an earlier step if opportunities arise, or if particular needs are identified.



Step 1 - low carbon heat and 'easy wins'

Air source heat pump installed at the earliest possible stage.

Hot water tank (heat pump or electric)

Maintain existing radiators and pipework or increase radiator size if needed.

Electricity supply capacity Use the process described later to determine whether it is necessary to upgrade the heating supply

Solar photovoltaic panels (early if possible)

Top up loft insulation or insulate rafters if required. Ensure adequate ventilation below rafters and continuity with cavity wall insulation.

Step 2 - high impact fabric measures

New / replacement cavity wall insulation where appropriate

Windows and doors, good quality double or triple glazed, installed in centre of insulation line. Upgrade ventilation together.

Draught proof around junction with floor, windows and doors. Consider junctions at corners, roof and ground.

Ventilation – MVHR will need to be located close to external façade, and ducted through wall or roof.

Step 3 - more complex fabric measures

Remove chimney to void risk of roof leakage and improve airtightness of external envelope

External wall insulation on all façades. Consider junctions at corners, roof and ground.

Insulate under raised timber floors and above or below concrete floors.

Proposed approach to decarbonise homes in Cornwall (at stock level)

This approach focuses on a strategy of decarbonising heating systems as quickly as possible and suggests the order in which measures should be implemented for homes with five different starting points, shown in the diagram

Heat pump readiness and decarbonisation approaches

Heat pump readiness of a home can be identified by a combination of its fabric efficiency, its volume (as an indication of heating load), heating emitter size and electrical supply capacity. The level of heat pump readiness has been used to derive five types of home, which can be be simplified into two categories: *Heat pump ready* and *Enabling work first*. The table to the right shows these different approaches in order of how easy it would be to install a heat pump as a first step, and indicates any building fabric, heating emitter and electrical supply upgrades required.

Heat pump ready homes

Heat pump ready homes have the potential to install a heat pump straight away or very soon. Some minor fabric or heat emitter modifications could be necessary alongside the heat pump installation, or to make the system more efficient. Electricity supply capacity should be checked and National Grid's process to apply for an upgraded supply followed to resolve any issues. Post 2000 homes are unlikely to need an upgrade and can usually connect and then notify the electricity provider.

Enabling work first homes

Enabling work first homes require some intervention before a heat pump should be installed. This could include changes to the building fabric and/or heat emitters. Upgrades to the heat emitters may have the potential to reduce the extent of initial fabric works required. Electricity supply capacity should be checked and National Grid's process to apply for an upgraded supply followed to resolve any issues. A three-phase supply may be necessary where heating load cannot be reduced below 14kW.

			Upgrades required before heat pump		
			Building fabric	Heat emitters	Electrical supply
Heat pump ready homes	1	Heat pump ready	*None*	*To optimise only*	*None*
	2	Heat pump ready with electricity supply upgrade	*None*	*To optimise only*	*Potential Upgrades*
	3	Heat pump ready with minor fabric, electricity supply, and heat emitter upgrades	*Minor upgrades*	*Potential upgrades*	*Potential Upgrades*
Enabling works first home	4	Moderate fabric modifications required	*Moderate upgrades*	*Potential upgrades*	*Potential upgrades*
	5	Major fabric modifications required	*Major upgrades*	*Upgrade*	*Potential upgrades*

This table summarises the five different types of home based on heat pump readiness, starting from the most heat pump ready to the least.

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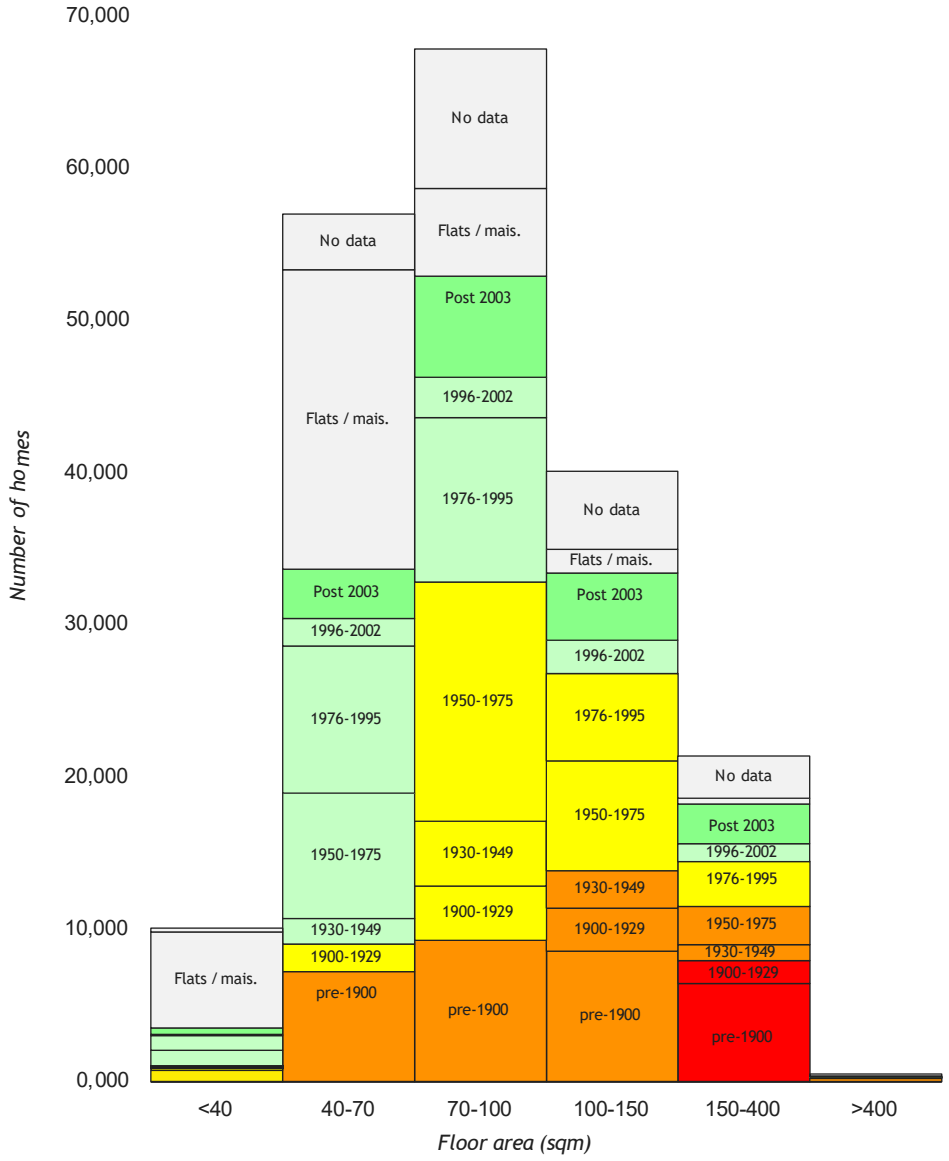
Proportions of homes in Cornwall

The chart to the right shows the proportions of homes anticipated to fall into each of the five categories of heat pump readiness. This is estimated from the EPC data, based on the age and size of properties, and is representative of two thirds of Cornwall housing.

It should be noted that age and size are good indicators of heat pump readiness, but other factors will impact on heating load. For example, an older home which is well orientated, with sensible window proportions, smaller rooms and reasonable shading conditions, may have a lower heating load compared with a more modern, open plan home with poor orientation and large window proportions on a very shaded site.

Our modelling used a range of possible values for key fabric parameters to enable us to understand the likelihood of homes within different size and age bands requiring work before a heat pump could be installed. More detail on the process to derive this is given in the appendices.

	Heat pump ready homes		
1	Heat pump ready	17,358	(12%)
2	Heat pump ready with electricity supply upgrade	40,487	(28%)
3	Heat pump ready with minor fabric, electricity supply, and heat emitter upgrades	42,212	(30%)
	Enabling works first homes		
4	Moderate fabric modifications required	33,981	(24%)
5	Major fabric modifications required	8,235	(6%)
--	No data	22,727	
--	Flats and maisonettes	33,707	



The chart above gives a visual representation of the likely proportions of heat pump ready homes using the floor area and age distribution as an indicator of heating load, and the table to the left gives numbers of these homes from the EPC data (representing two thirds of Cornwall homes).

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Proposed housing decarbonisation metrics

Use of appropriate metrics is necessary to monitor progress in decarbonising Cornwall's housing stock, both at the level of individual homes as they proceed along their retrofit journeys, and also at the stock level.

The problem with EPC Energy Efficiency Ratings (EPC EERs)

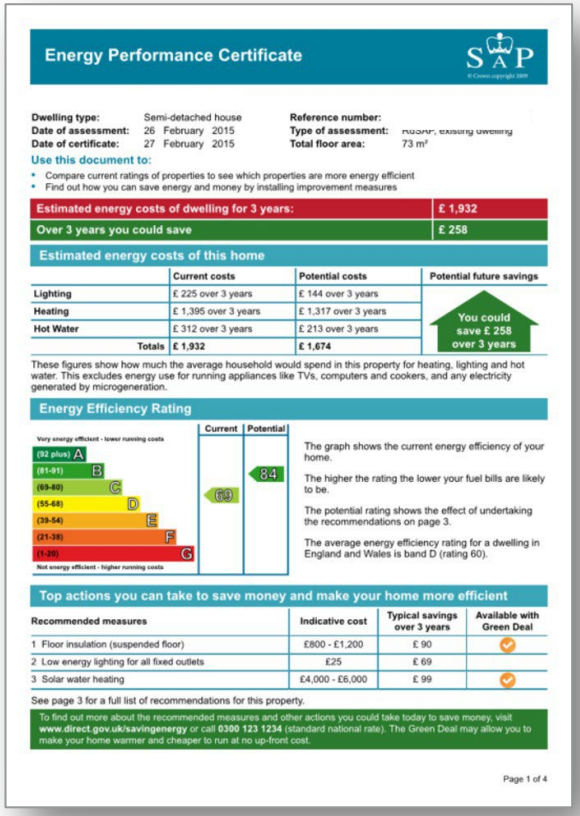
The 'A to G' Energy Efficiency Rating (EER) provided on EPCs is often considered to be the de facto metric for scoring the 'efficiency' of homes. This is currently unsuitable to measure progress toward decarbonisation though, as it is actually an energy cost rating, rather than a true energy efficiency rating. The methodology currently used to calculate EPC ratings is also outdated and does not provide reliable energy performance estimates. This could change in the future.

Recommended metrics for housing decarbonisation strategy

A simple set of metrics are recommended. These include the same metrics that are already used by Cornwall Council for the SEC 1 new build homes policy, which have also been used by various industry groups seeking to define appropriate levels of performance for retrofit. In addition, we recommend use of a metric specifically focused on ending fossil fuel heating, resulting in four metrics to use in strategic planning, some of which are measurable at the meter:

1. Fossil fuel heating (yes/no)
2. Total energy use (kWh/m^2/yr)
3. Space heating demand (kWh/m^2/yr)
4. Renewable energy generation (kWh/m^2/yr)

These metrics are generally suitable for energy modelling of large numbers of buildings, energy modelling of retrofit plans for specific architypes, or for analysis of metered energy use data.



Energy Performance Certificate

SAP

Dwelling type: Semi-detached house
Date of assessment: 26 February 2015
Date of certificate: 27 February 2015
Reference number:
Type of assessment: RdSAP, existing dwelling
Total floor area: 73 m²

Use this document to:

- Compare current ratings of properties to see which properties are more energy efficient
- Find out how you can save energy and money by installing improvement measures

Estimated energy costs of dwelling for 3 years:	£ 1,932
Over 3 years you could save	£ 258

Estimated energy costs of this home

	Current costs	Potential costs	Potential future savings
Lighting	£ 225 over 3 years	£ 144 over 3 years	You could save £ 258 over 3 years
Heating	£ 1,395 over 3 years	£ 1,317 over 3 years	
Hot Water	£ 312 over 3 years	£ 213 over 3 years	
Totals	£ 1,932	£ 1,674	

These figures show how much the average household would spend in this property for heating, lighting and hot water. This excludes energy use for running appliances like TVs, computers and cookers, and any electricity generated by microgeneration.

Energy Efficiency Rating

	Current	Potential
(92 plus) A		
(81-91) B		84
(69-80) C		
(55-68) D	63	
(39-54) E		
(21-38) F		
(1-20) G		

The graph shows the current energy efficiency of your home.

The higher the rating the lower your fuel bills are likely to be.

The potential rating shows the effect of undertaking the recommendations on page 3.

The average energy efficiency rating for a dwelling in England and Wales is band D (rating 60).

Top actions you can take to save money and make your home more efficient

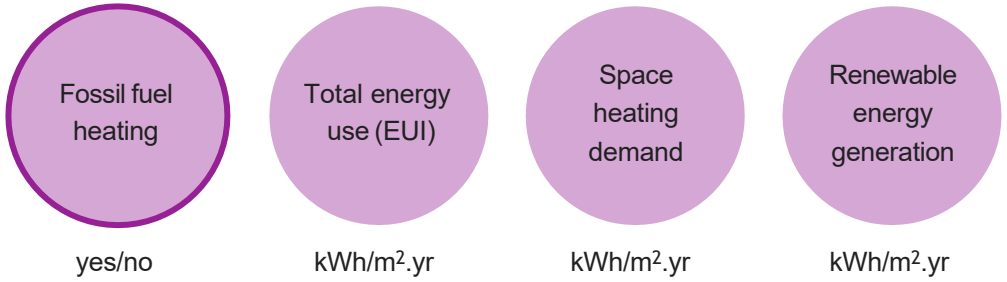
Recommended measures	Indicative cost	Typical savings over 3 years	Available with Green Deal
1 Floor insulation (suspended floor)	£800 - £1,200	£ 90	✓
2 Low energy lighting for all fixed outlets	£25	£ 69	
3 Solar water heating	£4,000 - £6,000	£ 99	✓

See page 3 for a full list of recommendations for this property.

To find out more about the recommended measures and other actions you could take today to save money, visit www.direct.gov.uk/savingenergy or call 0300 123 1234 (standard national rate). The Green Deal may allow you to make your home warmer and cheaper to run at no up-front cost.

Page 1 of 4

The Energy Efficiency Rating letter on EPC's is based on the cost of energy required to provide space heating, water heating, pumps and fans, and lighting, less any savings from solar generation. As high carbon fuels can result in low operating costs and good EPC scores, it is not a suitable indicator for housing decarbonisation.



Recommended metrics for Cornwall's housing decarbonisation strategy

Information Classification: PUBLIC

Proposed targets

End fossil fuel heating

To deliver emission reductions in line with a 1.5˚C carbon budget, emissions reductions of at least 58% need to be achieved by 2030 across all sectors. Translating this into a specific target for housing is complex (refer to Appendix 1), but our scenario modelling indicates that a challenging target of around 55% of fossil fuel heating systems need to be replaced by 2030, and close to 100% by 2050.

Total energy use

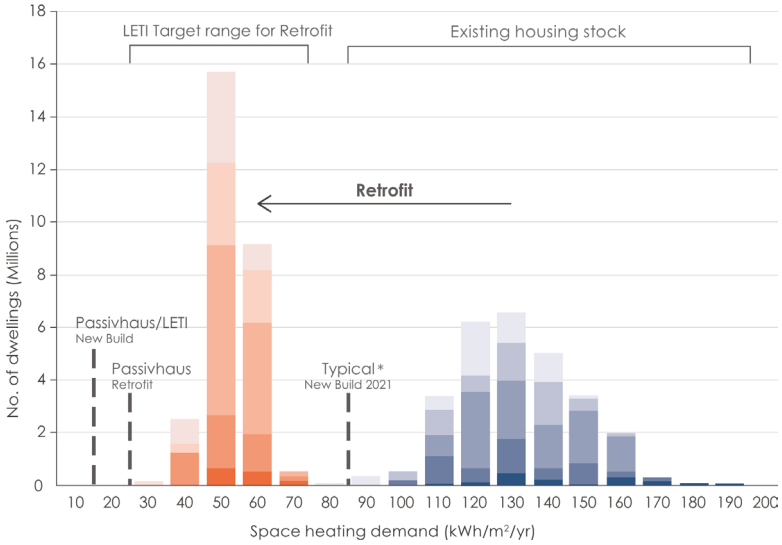
A target of 50 kWh/m^2/year has been recommended by LETI in their Climate Emergency Retrofit Guide, with a relaxed target of 60 kWh/m^2/year for harder to treat buildings – a value also recommended by RIBA. At a strategic level it is recommended that these targets are adopted for Cornwall.

Space heating demand

A target range of 40-70 kWh/m^2/year, depending on dwelling type, has been recommended by LETI. Given the numerous co-benefits, it is recommended that the LETI range is adopted as a long-term target for Cornwall, with exceptions for hard-to-treat homes. The University of Exeter's work outlines most of the measures required, however the timing of these measures should be relaxed in cases where this can enable faster decarbonisation of heat.

Renewable energy generation

National guidance from industry groups is simply to 'maximise renewables'. In practice, most renewable energy systems will be designed to make best use of available space, which is more practical than imposing per-dwelling targets. Installing PV on 30-50% of houses in Cornwall would represent a fair contribution toward the 70-85GW of solar capacity that is required by 2050. The upper end of this range prioritises rooftop systems to reduce pressure on greenfield sites.



Recommended space heating demand targets pre (blue) and post (red) retrofit, developed by LETI based on stock modelling of UK dwellings. It is proposed that these be considered long-term targets for phased retrofit.

3.0

Costs and funding

Target Outcomes
Create a supportive investment environment for housing decarbonisation & retrofit, while driving down upfront costs, maximising funding opportunities and ensuring affordability

The costs of an example decarbonisation project and also the wider funding environment for retrofit work.

This section should be read in conjunction with Appendix 3

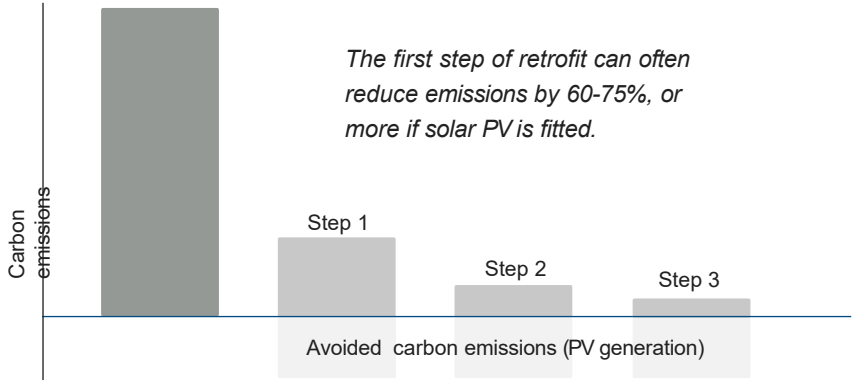
How much will it cost to decarbonise homes?

Cost of retrofit measures

It can be challenging to accurately assess retrofit costs. They depend on the home's characteristics, state of repair and on which works are required. It also depends on whether the 'energy' retrofit measures will be delivered on their own or whether they will be combined with other renovation and modernisation works. An indicative guide for all the measures required for a medium to deep whole house retrofit is shown in the table to the right, for a small, heat pump ready, home.

The first step of retrofit is often affordable

- Step 1 involves installation of a heat pump and hot water tank, basic insulation measures such as loft insulation and draught proofing. Install solar PV early if possible, to reduce energy costs.
- Step 2 involves further improvements to the building's fabric such as new windows, which could be planned to coincide with the end of life of the existing windows. A mechanical ventilation system with heat recovery is installed when any significant airtightness improvements are made, to improve indoor air quality.
- Step 3 involves a final package of improvements to the building's fabric, delivered through wall and floor insulation.



The first step of retrofit can often reduce emissions by 60-75%, or more if solar PV is fitted.

Measures		Cost
	Heat pump (e.g. *air to water* or *air to air*) and direct electric hot water tank	£3,000 £10,000
	Improved draught proofing if necessary - e.g. filling cracks. Substatial airtightness should trigger a ventilation strategy overhaul.	£0 £1,500
	Loft insulation if requried - 200-400 mm (40m^2)	£1,000 £4,000
	Photovoltaic panels, 5 kWp array (10-12 panels) where possible	£6,000 £11,000
	Initial step (example)	**£3k - £26.5k**
	PV, if not installed earlier	£6,000 £11,000
	Good double / triple glazed single casement (per m^2)	£900 £1,300
	New entrance door (1 unit)	£800 £3,000
	Mechanical ventilation with heat recovery - MVHR with associated ducts (earlier if substantial airtigness in first phase).	£4,000 £7,000
	Final step (example)	**£17k - £38k**
	Wall insulation, external - 100-200mm (110 m^2)	15,950 £35,200
	Suspended floor - 100mm insulation (40 m^2)	£3,000 £5,000
	Exemplar step (example)	**£19k - £40k**

The above cost estimates are for a heat pump ready or close to heat pump ready house, which accounts for around 70% of Cornish homes. Some of the smaller "enabling works first homes" may also be able to achieve retrofit within these cost ranges, which would make this applicable to in excess of 80% of Cornish homes. These figures are estimated at Q3 2024 and are only indicative estimates per measure. A specific cost plan must be undertaken for each retrofit.

Information Classification: PUBLIC

Funding

Funding can come from a variety of sources, including: mortgages, loans, cash savings, investment, and grants. Grant schemes vary over time and have been directed towards a combination of social housing landlords, the public sector, and private homeowners. While they can be a useful way of accelerating decarbonisation, grants do introduce risk of creating dependency on support within the supply chain.

Direct funding by Cornwall Council

Direct funding of decarbonisation measures is unlikely to be affordable for the council. Providing loans rather than grants may be more effective but even so other sources of funding will be needed to reduce emissions within a 1.5˚C carbon budget.

External funding

Cornwall Council's time and resource may be able to achieve larger emission reductions faster by focusing on creating an internal team who are able to:

- Identify and track external sources of funding as they change.
- Quantify the number of buildings that could benefit from these sources of funding.
- Understand the eligibility criteria and develop strategies to efficiently maximise use of available funding.
- Link funding to eligible buildings.
- Identify funding gaps that need to be filled to ensure sections of the housing stock are not 'left behind'.
- Proactively mitigate issues that come with some funding, for example ECO4 funding has been associated with poor quality installations of heat pumps, fabric retrofit and solar photovoltaic technologies. Identifying competent installers, conducting system design reviews, installation checks, and/or post-commissioning checks could mitigate these risks.

Scheme	Funding	Years of funding in next spending review period	Status
Boiler Upgrade Scheme	£1545m	2025/2026 2027/2028	Active
Heat Pump Investment Accelerator	£15m	2025/2026	Closed
Energy Efficiency Grant	£400m	2025/2026 2027/2028	
Local Authority Retrofit Scheme	£500m	2025/2026 2027/2028	
Social Housing Decarbonisation Fund	£1253m	2025/2026 2027/2028	
Heat Network Transformation Programme	£530m	2025/2026 2027/2028	
Public Sector Decarbonisation Scheme	£1170m	2025/2026 2027/2028	
Industrial Energy Transformation Fund	£225m	2025/2026 2027/2028	
Industrial Energy Efficiency and decarbonisation	£410m	2025/2026 2027/2028	

Summary of current and recent funding sources for decarbonisation measures.

Energy costs for residents and affordability

The adjacent graph illustrates key measures that can be taken for the energy costs of heat pumps to be significantly lower than residents are currently paying with an oil or gas boiler. All scenarios use the levels of energy use assumed by OFGEM for energy price cap calculations: 11,500 kWh of heating fuel (assumed to provide 9,775 kWh of heat at 85% efficiency) and 2,700 kWh of electricity. Electricity prices are assumed to be the 2024 Q1 price cap rate of 28.62p/kWh unless otherwise stated.

Oil boiler - £1,900

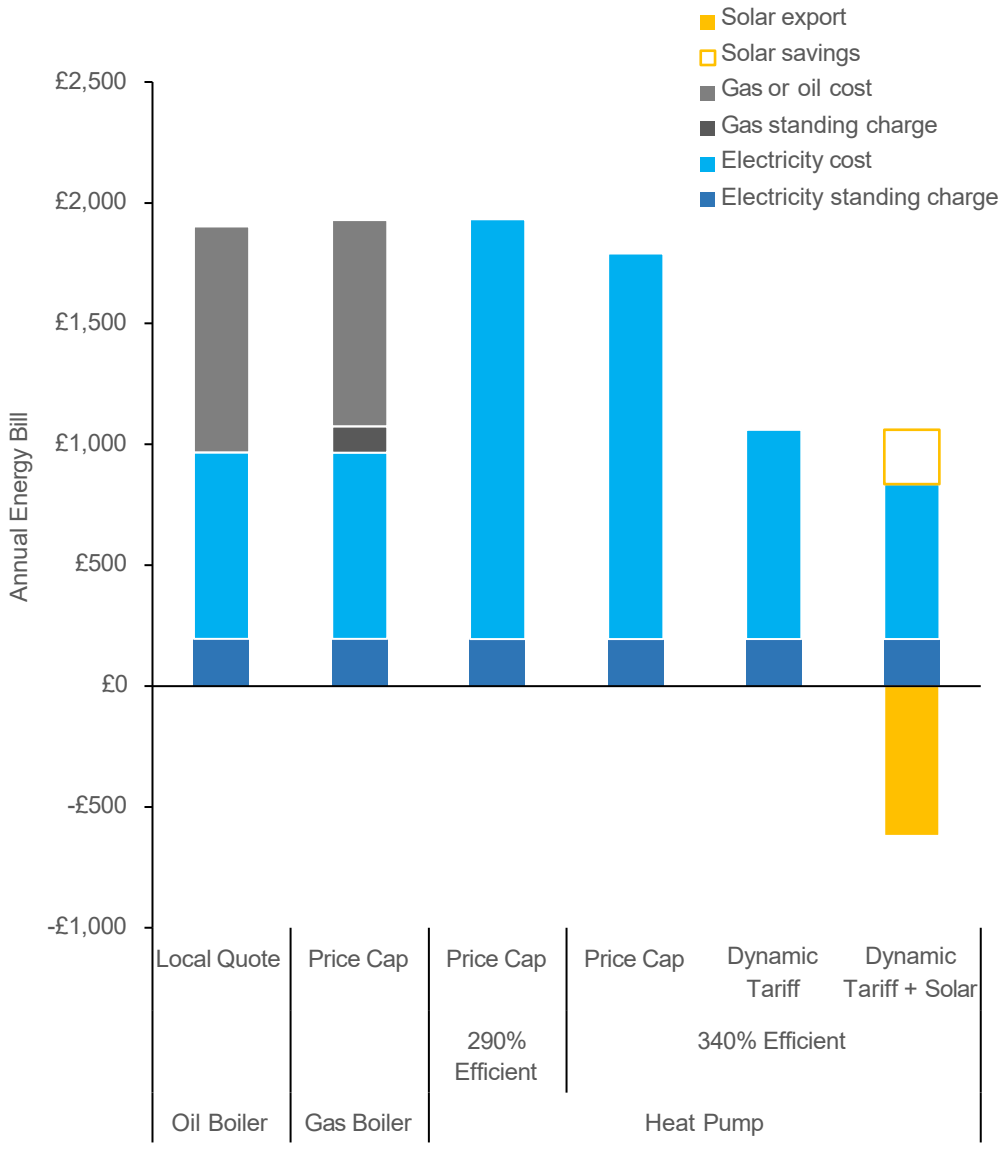
Oil prices are based on a 2024 Q1 quote for 1,100l (11,500 kWh) of heating oil including delivery costs from a local provider in Cornwall.

Gas boiler - £1,930

Gas prices are based on the 2024 Q1 price cap rates of 7.42p/kWh and 29.6p/day for the standing charge, resulting in annual heating costs that are similar to an oil boiler.

Heat pump

Four heat pump scenarios are considered. The first assumes a seasonal efficiency of 290%, the median achieved in the Electrification of Heat field trials, and the price cap rate for electricity, resulting in an annual cost of £1,930. The second scenario assumes an improved heat pump efficiency of 340%, a value achieved by skilled installers such as Good Energy and Heat Geek, reducing costs to £1,790. The third scenario assumes use of a dynamic electricity tariff. Based on analysis of historical price data this results in savings of around 45% relative to a gas boiler, with annual costs of £1,060. The final scenario assumes a 5.1kW PV array is installed so the property achieves a net zero annual energy balance. With an export tariff of 15p/kWh based on 2024 Q1 Smart Export Guarantee tariff comparison tables, and assuming 26% self-consumption based on MCS guidance for a home occupied for half the day. This results in energy costs of just £220, an 89% reduction compared to gas.



There is a clear pathway to affordable electrification for customers on direct debit by combining efficient heat pumps with dynamic electricity tariffs and on-site solar generation.

Social value

"The right home environment protects and improves health and wellbeing. A warm, dry and secure home is associated with better health and prevents physical and mental ill health"

Director of Public Health 2023 Annual Report

Decarbonisation doesn't only reduce carbon emissions

Decarbonisation of existing buildings generally and housing specifically brings wider benefits to residents, communities and the region. The key co-benefits of tackling fuel poverty, improving health for residents and supporting the local economy have been considered throughout the strategy.

There are other co-benefits of decarbonising homes:

Improving local air quality

Eliminating the burning of fossil fuels reduces air pollution locally as well as reducing carbon emissions to the atmosphere. Gas boilers produce carbon monoxide, nitrogen oxides.

Safety

There will be fewer accidents involving gas appliances and boilers.

Reducing costs to the NHS

Poor quality housing resulting in damp, mould, poor indoor air quality, excessive cold in winter, overheating in summer and other health impacts increases costs to the NHS. These effects especially impact the very young and very old.

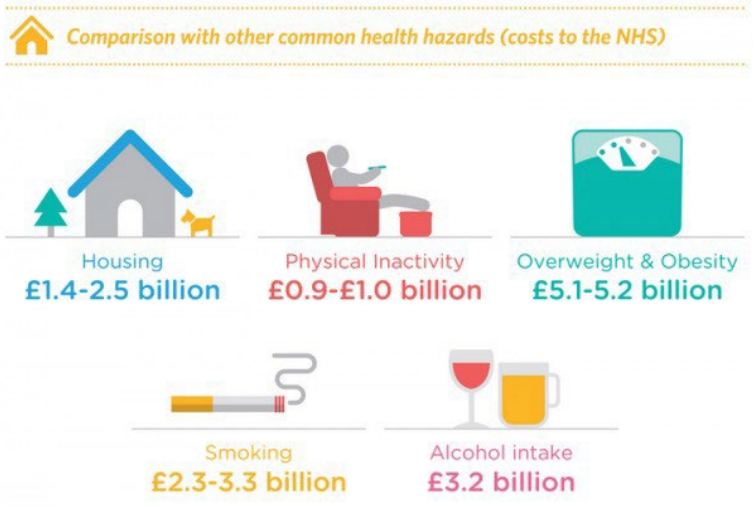
Skilled jobs in the local economy

A local programme of decarbonisation means consistent work for skilled installers, designers and maintenance operatives within the local area.

Combustion pollutants and their health effects

- Carbon monoxide (CO), a dangerous gas that when inhaled can interfere with the ability of blood to carry oxygen from the lungs to the rest of the body
- Nitrogen oxides (NOx), a respiratory irritant that causes airway inflammation, coughing, wheezing and increased asthma attacks
- Particulate matter (PM), a mixture of microscopic solids and liquids that affects multiple body systems and can increase the risk of premature death
- Air toxics, including as ammonia, formaldehyde, polycyclic aromatic hydrocarbons (PAHs) and volatile organific compounds (VOCs) that can cause cancer, birth defects and other serious health harms

Burning of fossil fuels including gas is a source of indoor and outdoor air pollutants. Source: American Lung Association



The Government predicts housing quality impacts will increase as the population ages. According to census data, Cornwall's population is generally older than the UK overall, so these effects could be more pronounced. NHS costs source: BRE, (image source: gov.uk)

4.0

Supply chain

Target Outcome

Support the growth of the local green economy to match the resources required for sustainable development and home retrofit at scale

The key strategic measures required to facilitate the decarbonisation of housing in Cornwall.

This section should be read in conjunction with Appendix 4

Information Classification: PUBLIC

Training and skills

Importance of training heat pump installers

When a heating system fails, often the first contact a homeowner has is with a heating engineer. Heating engineers are unlikely to recommend fitting a heat pump unless they have been trained to install them, so installer training is vital to increase uptake.

Good systems can operate reliably for many years providing low carbon heat for lower costs than fossil fuel or direct electric heating systems. Conversely, poorly installed heat pumps may not adequately heat a dwelling and be expensive to run. The performance of a system is largely dependent on the knowledge and skill of the heat pump installer and means adequate installer training is particularly important to delivering affordable electrification of heating.

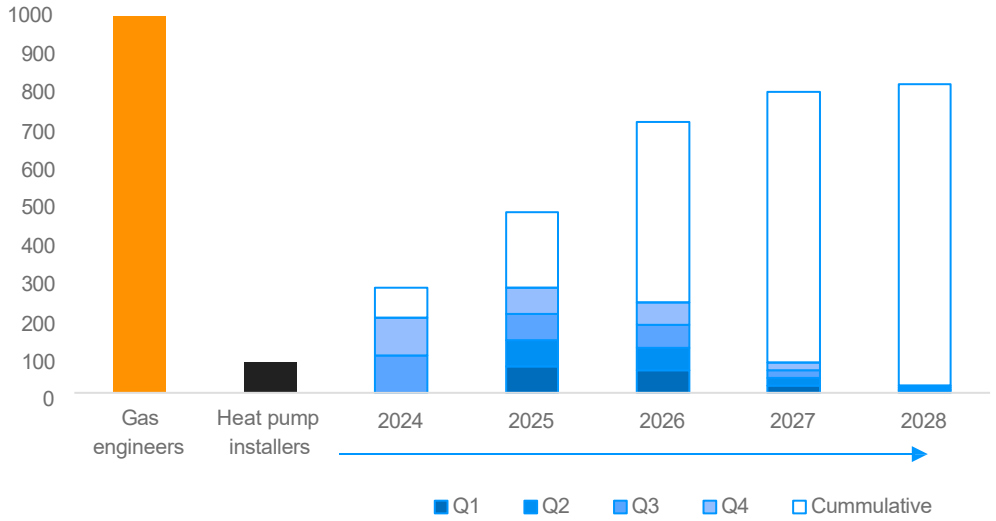
Planning training to deliver the required number of installers

There are currently 1000 heating engineers on the gas safe register records for Cornwall, but the number of heat pump installers is thought to be between 50 and 100 based on MCS database records, in addition to around a dozen companies that provide air conditioning and can be expected to install air-air heat pumps.

Replacing fossil fuel heating systems in existing buildings as they reach the end of their useful lives will require 500 heat pump installers, in addition to another 170 to meet demand for new-build housing throughout the 2020's. Another 200 are required to ensure 55% decarbonisation by 2030 is achievable.

Training must be affordable

Training or retraining can be prohibitively expensive. Trainees may have to take time off from paid work to attend courses, and will also have to pay for course fees, travel, and accommodation if local training is not available. Training should be available at flexible times and with shorter courses. This can mitigate the need to take time off for training over the potential loss of paid work. Potential direct funding of some of these costs by the Council should be considered as a key strategic investment in accelerating decarbonisation.



Approximate number of registered Gas Safe engineers compared to estimated heat pump installers in 2023. Required numbers of additional heat pump installers that need to be trained indicated from 2024-2028. Beyond 2028, an annual training capacity of 20-30 is expected to be sufficient.

Training required for other trades

The solar industry has previously dealt with two large growth cycles and has established training programmes in place, so less intervention is thought to be necessary here.

Suitable training needs to be in place to ensure adequate delivery of building fabric and ventilation upgrades to ensure correct design and installation of:

- Wall insulation, to minimize moisture risk and cold bridges
- Airtightness measures, often with a new ventilation system
- Replacement windows, often with a new ventilation system
- Ventilation systems

Retrofit coordinators trained to implement the PAS2035 British Standard for retrofit will be needed to provide oversight and management for complex and / or large projects and those that rely on Government funding streams.

Quality Assurance

Overview

The installation quality of the main technologies required to decarbonise homes in Cornwall and across the UK can be highly variable. Unfortunately, problematic installations are not uncommon, even when covered under the adjacent first-tier schemes. This presents a risk to successfully decarbonising the housing stock, which needs to be overcome. The main way to do this appears to be either for Cornwall Council to encourage the operators of first tier schemes to strengthen their requirements, or to encourage or require installers to use second and third tier schemes, for example when selecting contractors for projects on Council-owned homes. Technology specific quality assurance issues are considered below.

Heat Pumps

Heat pump installations currently rely on MCS and its certification bodies, in combination with the RECC and HIES Consumer Codes to maintain quality. Additionally, Trustmark registration is required for ECO4 and SHDF funded installations. PAS2035 has been introduced to make these schemes more robust, but the results for heat pump systems are not yet proven. At present, third tier schemes are strongly recommended to ensure good outcomes.

Fabric Efficiency & Ventilation

Trustmark and PAS 2035 are the main second tier schemes covering fabric efficiency. As with heat pumps, use of third tier schemes/training such as those offered by the Retrofit Academy, Green Register, and Passivhaus Institute are recommended.

Solar Photovoltaics

Solar installations currently rely on the same first tier schemes as heat pumps, which can result in inconsistent quality. Currently there are few third tier schemes, though the National Energy Efficiency Awards include a category for good solar installers.

Internal training programmes

Third tier: Voluntary schemes, often represent best practice

Second tier: Required for access to SHDF, ECO4 funding etc.

First tier: Required for to access BUS grants for heat pumps or solar export payments

A variety of schemes and training operated by different organisations aim to improve quality assurance and consumer protections for low carbon technologies. This is achieved either by covering individual projects, or the installers. While these provide important protections, experience suggests that poor quality installations are not uncommon under the first tier, while the third tier, which also includes internal training programmes, seems to more consistently deliver good outcomes.

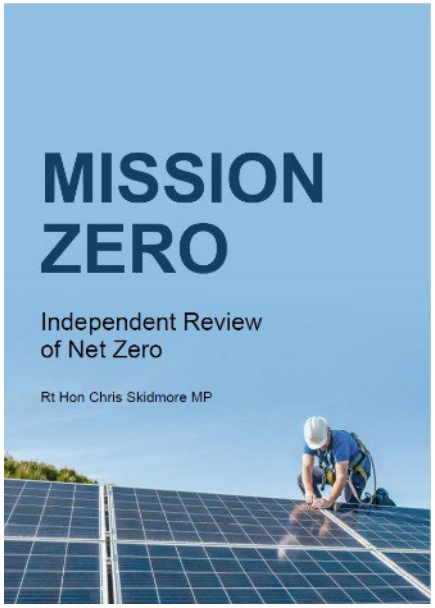
Information Classification: PUBLIC

Supportive environment for investment

There is a shortfall in Government grant funding

The University of Exeter "Reducing greenhouse gas emissions from housing in Cornwall" (2023) report highlights a shortfall in funding between estimated costs to meet Cornwall's carbon budget and the Government grants available. Private investment could make up some of the shortfall, but for that to happen, there needs to be an environment which encourages businesses to plan for a decarbonised future and take steps to secure it.

The 'Mission Zero' report published in 2023, highlighted the need for a stable policy environment: *"….the Review has heard from many respondents frustrated by a lack of long-term thinking, siloed behaviour from government departments, and uncertainty over the length of funding commitments. Evidence suggests this is holding back deployment of green technologies, hampering investment across all sectors, and inhibiting the ability to create British jobs."* Cornwall Council cannot change the policies of national government, but it can make a clear statement of the intent and ambition of the local authority to support and encourage decarbonisation of housing over the near term.



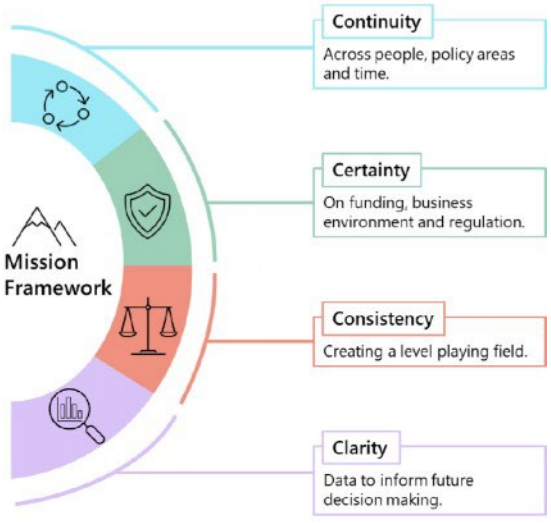


Figure 1.1 – *This Review takes a mission-led approach*

The Mission Zero report recommended a focus on stable policy and funding to encourage businesses and individuals to invest in net zero technologies (Image source: Mission zero report gov.uk)

Encourage community led thinking

Business investment is attracted to larger groups, which provide longer term and larger returns than individual homeowners acting separately. Place based archetyping can help identify groups of homes with, for example, similar window types or a whole village switching from oil boilers to heat pumps.

Innovation is great but don't overlook the basics

Innovative solutions to collective problems can unlock apparently intractable issues. But simple steps, such as installing heat pumps and insulating lofts, should not be ignored because they are less newsworthy.

There have been a number of community led projects in Cornwall and the southwest where businesses have been able to invest in decarbonisation which individual residents could not have afforded – e.g. Kensa Utilities 'Heat the Streets' project which was part funded by European Regional Development Fund (ERDF)

Delivery models

There is a lot of excellent and innovative work going on to scale up retrofit and refurbishment. The council and others can borrow and adapt existing models.

Parity Projects provide Whole House Plan web tools that show different 'pathways' and compare carbon and energy improvements across a whole stock to create a costed plan for retrofit of each home. It is aimed at local authorities, housing associations, homeowners and landlords who subscribe to the platform. Additional services and works can be provided to take it further,

Retrofitworks is a co-operative with two types of members, contractors and community groups or authorities. The cooperative brokers retrofit work between members and provides quality assurance. This provides contractors with a work pipeline, and authorities a trusted contractor work force. Retrofitworks was started by Parity Projects but is a fully independent member-owned cooperative.

The Carbon Co-op in Northwest England provide energy services and advocacy including consultant advice. Their tool, My Retrofit planner, gives a standardised format to give bespoke impartial consultant advice to homeowners. It recommends different strategies and helps householders form a whole house plan with the likely benefits at each step.

Bristol City Council Energy service is a dedicated Council team for improving energy efficiency in domestic properties. They provide: central application and dissemination of grant funding, guidance on grant schemes, and practical advice. Exploring crowd funding to raise capital for retrofit of community buildings and a strategic partnership with a provider to deliver some projects

Energiesprong is an implementation mechanism for retrofit to a net zero carbon standard. It uses energy cost savings from retrofit in a form of energy performance contracting. There have been a number of Energiesprong projects in the UK and more are currently in the planning stage, mainly through housing associations.

Engie Zero is Engie's version of the Energiesprong model helping councils to unlock finance on the basis of future savings, alongside an energy and comfort plan. An important difference however is that they act as a one-stop-shop, including delivery and, if needed, maintenance and monitoring (while Energiesprong act more as intermediaries).

SuperHomes, in Ireland, is led by the Tipperary Energy Agency. It is a one-stop-shop for homeowners taking them through the initial planning, tendering, and overseeing of the works. The packages include essential elements (e.g. homes have to have an air source heat pump, mechanical ventilation (demand control or MHVR) and insulation) as well as some tailored options. SuperHomes also help with grant funding of up to 35% of the works.

BetterHome, was started in Denmark by private companies Rockwool, Danfoss and Grundfos seeking to stimulate demand for energy efficiency products. It was a one-stop-shop for homeowners to partner them with an installer who would oversee the whole project delivery. There was no tie to using specific products. The scheme was successful and ran from 2014 to 2020 before being closed to new applications.

Infrastructure investment

Electricity grid investment

The electricity distribution network in Cornwall is operated by National Grid Electricity Distribution (NGED). Investment packages in the network must be pre-approved by OFGEM through the submission of business plans from each Distribution Network Operator on a 5 yearly rolling basis.

The current RIIO-ED2 price control period applies from April 2023-2028 and does include some allowance for investment in network upgrades ahead of need to facilitate the electrification of heat and transport. Nationally, average network costs for local electricity grids did not increase with this package, remaining at around £100 per billpayer.

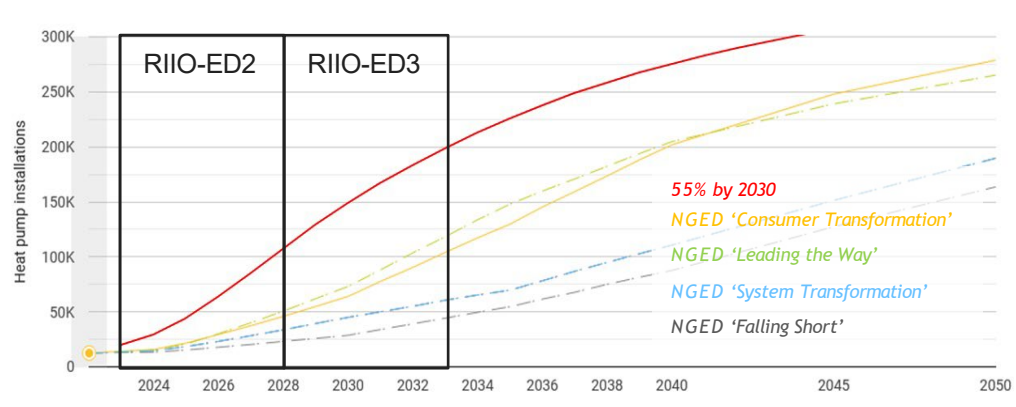
The proposed investment is based on NGED's Distribution Future Energy Scenarios that outline the range of credible futures for the growth of the distribution network, broadly aligning with the Electricity System Operator's (ESO) Future Energy Scenarios (FES).

The business plan submitted for the next price control period, RIIO-ED3, will need to be carefully designed through collaboration with National Grid Electricity Distribution to ensure the distribution network is able to support the ongoing decarbonisation of Cornwall's housing.

Gas grid decommissioning

The National Audit Office's recent report on decarbonising home heating highlighted that it is currently *"uncertain who will pay for the networks to continue in service with a decreasing customer base, or to be decommissioned, and how the government will ultimately manage the transition for the last remaining customers on a gas network."*

While decommissioning costs and processes are likely to be decided at a national level by OFGEM and the government and are currently being considered in the RIIO-GD3 consultation, it is an important subject that should also form part of local conversations around housing decarbonisation. At the scale of an individual dwelling, disconnection from the gas grid can be an important cost-reduction measure to eliminate standing charges and is often a key part of any retrofit plan.



The rate of heat pump installations required to replace 55% of fossil fuel heating systems by 2030 implies a more rapid rollout than is currently assumed in all National Grid Distribution Future Energy Scenarios. By 2030, the number of heat pumps could be twice as high as the most ambitious scenarios, and three times as high as the 'System Transformation' scenario, which is currently used as the 'Best View'. RIIO-ED2 and ED3 price control periods shown for context. (Image source: National Grid Electricity Distribution)

5.0

Raising awareness

Target Outcome

Raise awareness and provide support to enable homeowners and developers to follow the roadmap and pathways identified.

How to help the residents of Cornwall to recognise and respond to the need to decarbonise homes.

This section should be read in conjunction with Appendix 5

Information Classification: PUBLIC

Heat pump ready people

Public awareness of heat decarbonisation

Public awareness of the need for heat decarbonisation is relatively low, with only 5% of the people interviewed for DESNZ's most recent Public Attitudes Tracker 'very aware', and 28% 'fairly aware', of the need to change heating systems to deliver net zero.

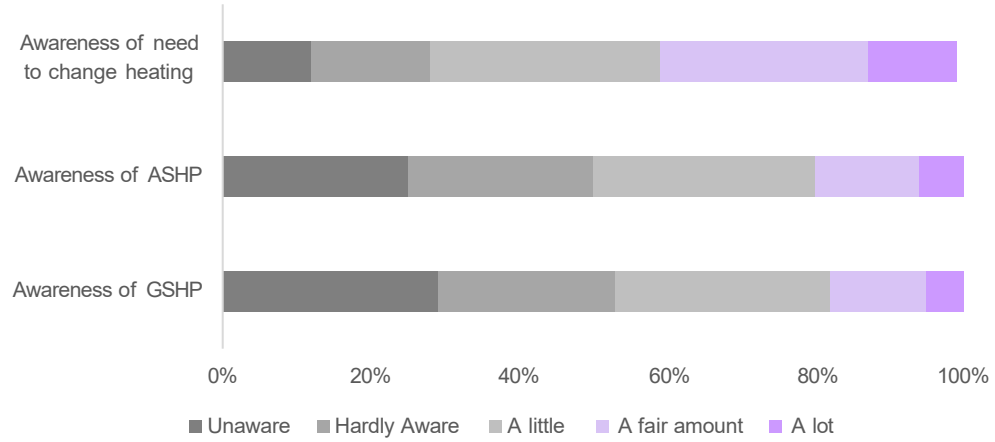
Only around 20% of people said they have a fair amount or a lot of knowledge about heat pumps, despite their role as the main low carbon heating solution. A similar proportion of people, around 15-21%, plan to install a heat pump the next time they need to change their heating system.

The most commonly cited reason for being unlikely to install a low carbon heating system was the perceived installation cost, with 51% of respondents stating this was a concern. Interestingly, the 2023 National Home Energy survey by The Eco Experts found that 73% of respondents were not aware of grants available for installing heat pumps under the government's Boiler Upgrade Scheme.

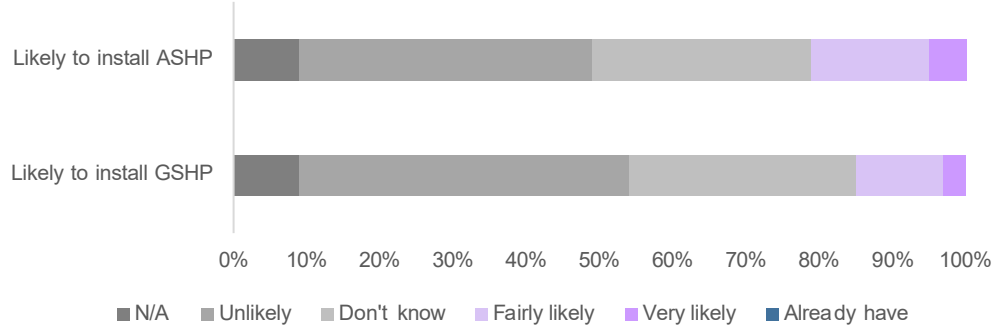
A plan to increase awareness

The low levels of awareness represent an excellent opportunity to increase the uptake of heat pumps, simply through public education efforts to ensure people are more aware of:

1. The importance of decarbonising home heating
2. The various types of heat pumps, and other low carbon heating systems
3. Capital costs and available grant funding and loans
4. Operating costs and how to reduce them
5. How to make a home heat pump ready
6. How to find a good installer and plan for boiler replacement
7. How to arrange maintenance and repair



DESNZ's Public Attitudes Tracker results from Winter 2023 indicate that only a third of people were aware of the need to change heating systems to deliver net zero, and less than 20% knew a fair amount, or a lot, about air or ground source heat pumps.



The tracker results also indicate that only 21% of owner-occupiers are likely to install an air source heat pump, or 15% a ground source heat pump, next time they need to change their heating system.

Awareness of fabric, ventilation and solar

Public awareness of insulation measures

Public awareness of fabric insulation measures is significantly higher than for heat pumps, particularly around double glazing where 89% of people either have it fitted or have considered it. Awareness of loft insulation is also fairly high, with 69% having fitted or considered it. Awareness around wall insulation (both cavity and external) is lower, while awareness of floor insulation is very low, with just 12% of people having fitted it and a further 10% considered it.

While these are national results, they indicate potential for increasing rates of floor, wall and loft insulation just by raising awareness.

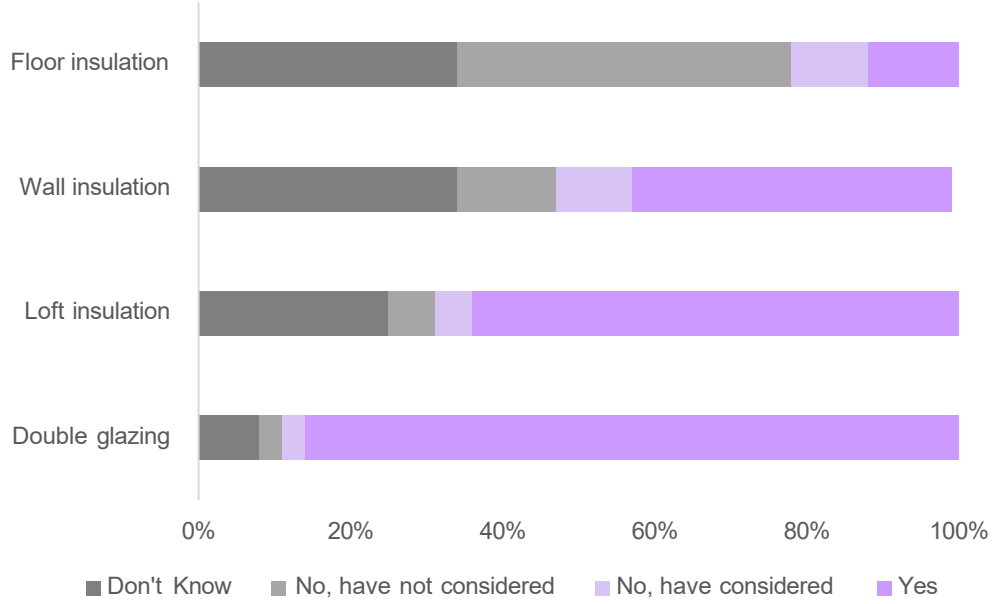
Public awareness of ventilation

The survey did not ask any questions around ventilation so no data is available. Given the importance of ventilation to creating a healthy and energy efficient living environment, particularly as airtightness is improved through better windows and other draught proofing measures, it would be helpful to establish a better understanding of levels of public awareness around the importance of ventilation. In the absence of this, promoting energy efficient ventilation as part of retrofit represents a low-regrets approach.

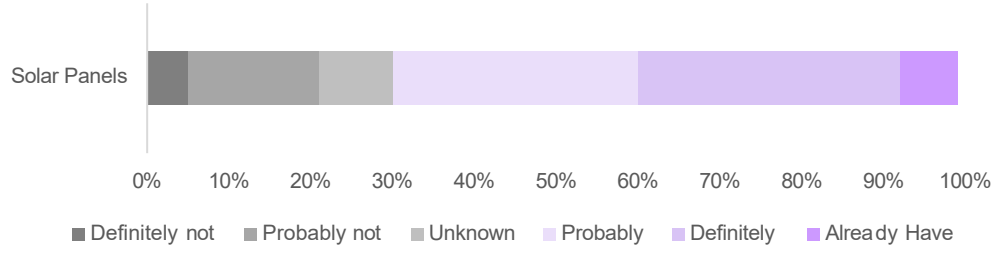
Public awareness of solar

Awareness of solar systems is very high, with 7% of people already having a system installed, 32% definitely planning on installing a system within the next few years, and a further 30% of people probably planning on installing a system. Just 5% of people definitely do not plan on installing a system.

This suggests that employing ‘nudge’ tactics may be an effective approach to increase solar deployment, for example by public awareness campaigns promoting ways of financing systems and communicating the benefits to encourage people to get on with installing a system.



DESNZ’s Public Attitudes Tracker results from Winter 2022 indicate that most people already have, or have considered double glazing and loft insulation. Around half of people have or have considered cavity or external wall insulation, while only 12% of people have floor insulation.



The tracker results indicate strong support for solar panels. When asked if they would consider installing solar panels on their home in the next few years, 7% reported already owning a system, 32% were definitely considering them and 30% probably considering them.

Heat pump ready policy

Planning policy is not a universal solution, but it can help

Local plan policies to facilitate and encourage decarbonisation of buildings cannot provide a comprehensive solution to the challenges of retrofitting buildings because the majority of retrofits and refurbishments do not require planning permission, but they can provide a framework for the process and signpost the priorities and approaches that others can follow. Crucially, the Local Plan policies need to not create barriers to retrofit by preventing or discouraging good changes from being made.

Environmental and heritage conservation hand in hand

Low carbon retrofit of heritage and traditional construction buildings is possible. Well-planned retrofit programmes can contribute to conservation by incorporating maintenance and repair and offer a new lease of life to buildings. They limit the risk of under-heating, with the associated risks of fabric degradation.

People living in heritage homes and conservation areas can be particularly worried about how or if they can carry out retrofit work. There is some variance in the constraints associated with conservation areas, and every listed building is unique, so it is useful to provide guidance on what is possible and what may be acceptable. Particular areas of concern may be window replacement and solar PV.

Historic England have published guidance that can be used as a reference for what should be allowed and the Improving Energy Efficiency in Cornish Historic Buildings guidance has local examples of good practice.

Local conservation area management plans and other parish council planning / guidance documents have often not been updated in line with the more recent county-wide policies and many are out of date. A review of what there is and whether it conflicts with the climate emergency aims would be useful to provide clarity for anyone looking for guidance.

Air source heat pump locations that are least likely to visually or acoustically obtrusive, especially in conservation areas, can be identified, not only providing some useful technical guidance but also evidencing the fact that they often can be located in acceptable locations, even in historic settings. .

Removing unused chimneys which, even when blocked, are a large air leakage path and often a large source of moisture ingress. Chimneys that are not protected or critical to a street scape should be decommissioned and removed wherever possible.

Changes to window frame widths or removing glazing bars is often necessary to accommodate improved window performance. Glazing bars significantly impact window performance by being a thermal bridge through the glass and reducing useful solar gain.

Ventilation grilles are needed in external walls to provide supply and extract air and improve air quality. The MVHR location is important, sometimes the best location is on a street facing wall.

Space for external wall insulation and roof insulation in the pitch may require an overhang to the street or neighbour, or an increase in ridge height. Providing clear process for applying to highways, party wall surveyors, and even local permitted development for ridge height increases would make rolling out retrofit easier in many situations. This would need consultation with heritage officers.

Some examples of where retrofit could require planning and where guidance to suggest what may be possible could be helpful. (Image source: Rightmove)

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How to get a heat pump

Why awareness of this process is important

From the perspective of a property owner, the process of getting a heat pump will often be more complicated than replacing their existing heating system. Some of the steps required may involve lead times of several weeks or longer, meaning that if people have not made sure their property is heat pump ready before their existing heating system fails, they may need to consider living without a heating system for a period of time using a temporary heating system, or installing a replacement boiler. This is likely to be less of an issue for portfolio property owners, who have better understanding of their housing stock and heating systems and are able to plan heating system replacement at a stock level.

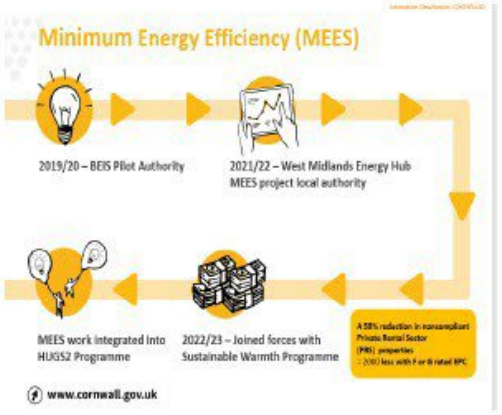
The following steps are typical for most heat pump installations in existing homes:

1. Check electrical supply capacity – as upgrades are usually done for free by your electricity distribution network operator, but can take some time to book in, it is sensible to ensure an adequate (usually 80A) supply is in place.
2. Heat loss estimate – as heat pumps are much more sensitive to oversizing than boilers, a detailed heat loss survey is important. This may cost several hundred pounds and usually includes calculations on any radiators that may need upgrading.
3. Insulation upgrades to reduce heat loss that may have been identified in the heat loss survey should be carried out.
4. System design – once the heat loss has been estimated, a heat pump can be selected, and the new heating system designed.
5. Planning check – most heat pumps are likely to be classified as permitted development, however planning checks may be necessary in some situations.
6. System installation & commissioning – the system may now be installed and commissioned.

Various components of older electricity supplies like this one may be below the 80A service capacity that is currently offered by National Grid Electricity Distribution. For smaller homes this may not prevent installation of a heat pump, depending on what other electrical loads are in the home. For larger homes the supply may need to be upgraded before a heat pump can be installed, and this work should be done well in advance of a boiler failing. (Image source: Energy Networks Association)

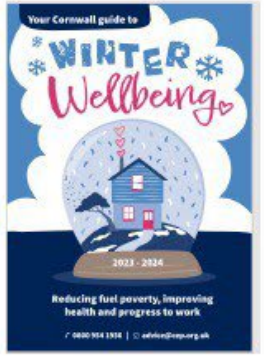
What we are already doing

CORNWALL HOUSING



CORNWALL COUNCIL | Healthy Cornwall

Public Health England



citizens advice

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Some of our partners and community groups

RAISING AWARENESS

Cornwall Climate Action Network

COMMUNITY ENERGY PLUS

Community Area Partnerships

Sustainable Construction Advisory Panel (SCAP)

Winter Wellbeing

South West NET ZERO HUB

lendology·cic

CORNWALL & ISLES OF SCILLY LOCAL AREA ENERGY PLAN

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6.0

Road map

Target Outcome

Provide the roadmap and pathways to eliminating emissions produced through heating and hot water provision in Cornish homes while reducing running costs and improving quality

Bringing together the actions from each section to suggest the next steps that could be taken by Cornwall Council and by private organisations and individuals.

This section should be read in conjunction with Appendix 6

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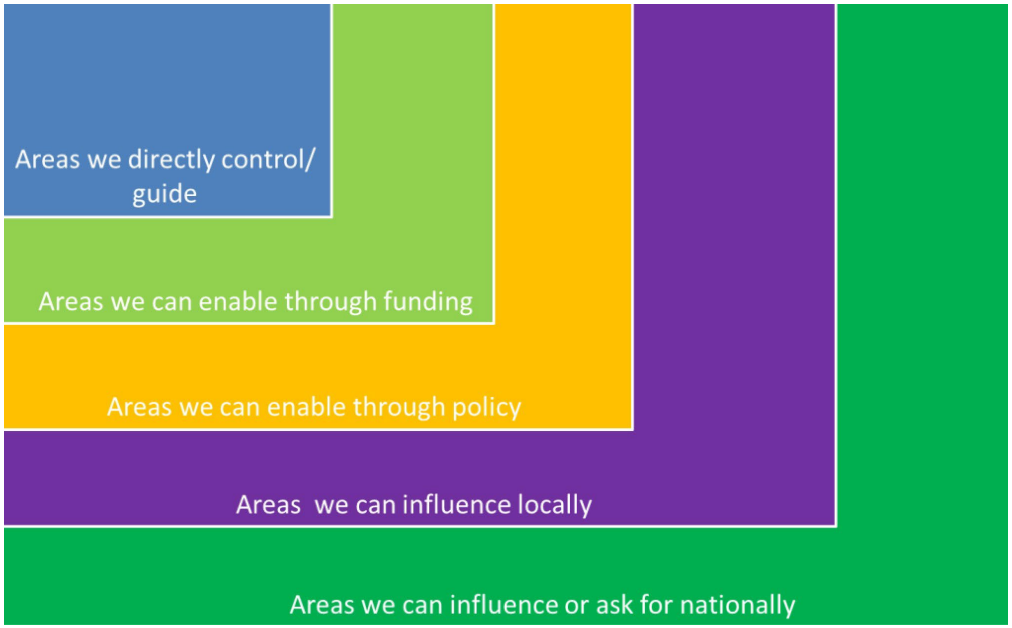
Suggested next steps

This housing decarbonisation strategy for Cornwall has identified twelve actions that could be taken by Cornwall Council to enable decarbonisation of existing homes. The actions are summarised below.

The first four actions are specifically required to deliver a tipping point in heat pump installations. Beyond this point it should become common knowledge that heat pumps are the current go-to replacement heating system for emission reductions, warmth, and affordability. This will lock-in decarbonisation as the new status-quo:

1. Facilitate training for heat pump installers
2. Public education campaign on heat pumps, heat pump readiness, fabric retrofit and solar photovoltaics.
3. Highlight the importance of decarbonisation for Council homes
4. Set long term carbon neutral targets for Council homes
5. Work with all tenure groups
6. Facilitate training for building fabric efficiency and ventilation
7. Close the feedback loop on heat pumps and fabric retrofit
8. Actively identify, target and connect funding sources with eligible homes and prioritise funding to those in greatest need
9. Work with National Grid Electricity Distribution to align their investment plans with this strategy, and co-ordinate street and neighbourhood level distribution system upgrades.
10. Implement frictionless planning policy for heat pumps and building fabric retrofit
11. Work with national heat pump installers to ensure Cornwall is not left out and is provided with adequate support services
12. Identify areas for heat networks



Cornwall Council's original Climate Change Action Plan introduced the concept of 'spheres of influence' to describe areas the Council can directly control, versus those that can be enabled or influenced. This is a helpful framework, which has been used to inform the roadmap outlined in this section. © Cornwall Council

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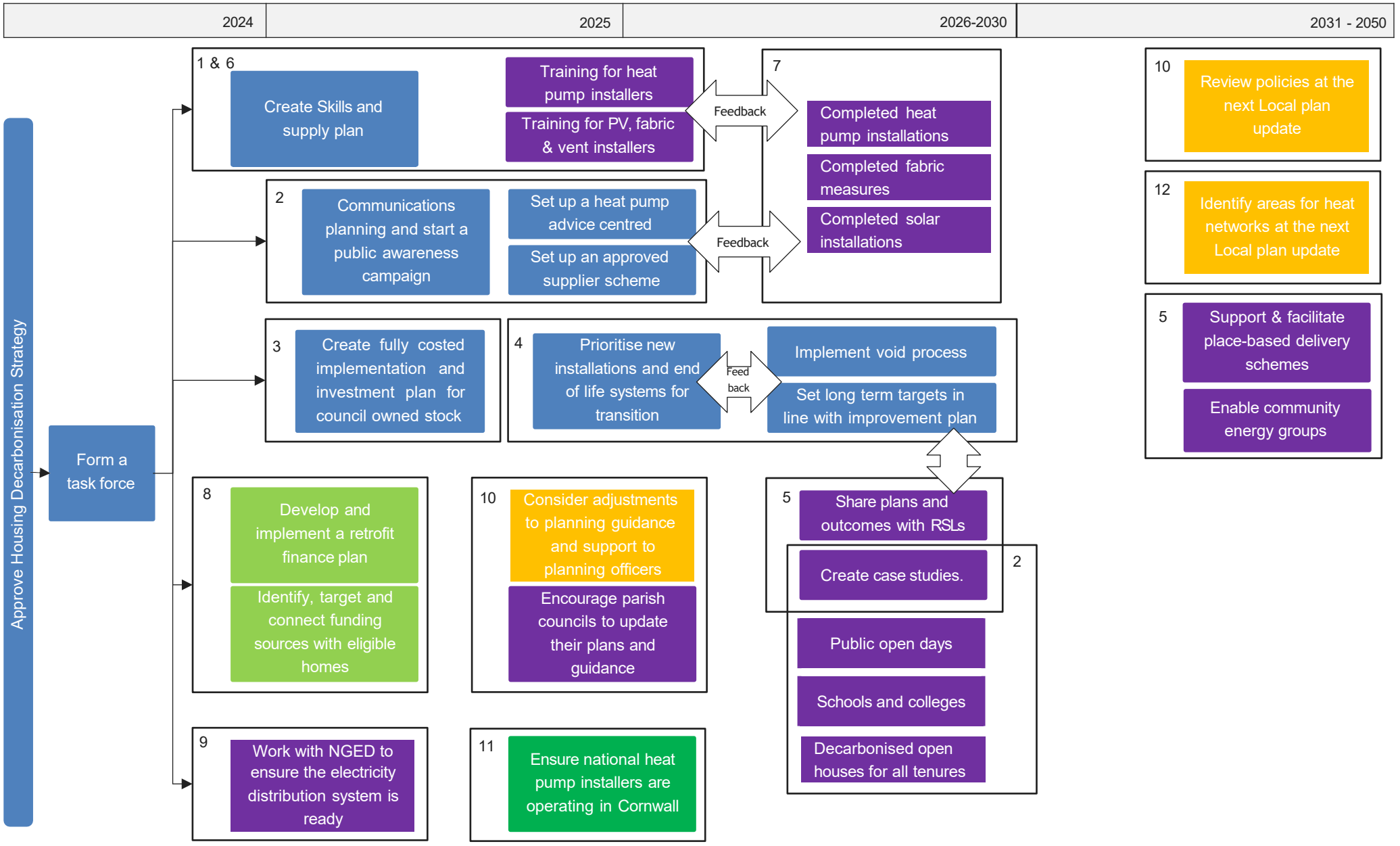
Road map

Key: Direct actions | Enable with funding | Enable with policy | Local influence | National influence



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Glossary

Heat Pumps: An efficient form of low carbon heating that extracts ambient heat from the environment to provide space and/or water heating'. See appendices for examples.

Airtightness or air permeability rate: A measure of how much air naturally leaks out of or into a building, through gaps around doors, windows, cracks, etc. Usually measured in $m^3/m^2/hr$ @50Pa.

Building fabric: A term used to describe collectively the walls, roof, floor, windows and doors and junctions of a building.

Carbon budgets: A term used to qualify the remaining carbon emissions, or share of carbon emissions, that can be emitted before the amount of cumulative emissions exceeds a climate change target.

Carbon footprint: The amount of carbon emitted by a person or organisation in a given timeframe.

Carbon offsets: A way of balancing emissions in one area by reducing emissions in another or through carbon sequestration.

Climate resilience: Enabling a building, dwelling, geographical area or organisation to adapt to the changing climate.

CO_2: Carbon dioxide, a greenhouse gas.

Coefficient of Performance (CoP): A measure of efficiency usually used for heat pumps. The CoP is the amount of useful energy (heating or cooling) produced from every unit electricity used. See appendices for more information and discussion on how seasonal efficiencies (SCoP) figures are estimated.

Energy efficiency: The relative amount of energy a building or system uses to achieve a certain aim (e.g. maintain a specific internal temperature).

Building fabric efficiency: A measure of how effective a building's fabric is at retaining heat.

kWh: Kilowatt hour, a measure of the amount of energy used or generated in one hour.

LETI: the low energy transformation initiative - a voluntary network of over 1,000 built environment professionals, working together to clarify what net zero carbon means in the built environment

Mechanical Ventilation with Heat Recovery (MVHR): A type of ventilation system that recovers heat from extracted air before it is vented outside the building and uses it to warm incoming fresh air.

Renewable energy: Energy produced from a renewable source e.g. wind or solar.

Retrofit: The introduction of new materials, products and technologies into an existing building to reduce its energy use and/or increase its renewable energy generation and/or reduce its carbon emissions.

Space heating demand: The amount of heat energy required to heat a space to the required temperature. Space heating demand is a good proxy for the building fabric efficiency and is usually expressed in $kWh/m^2/yr$.

Solar photovoltaic (PV): A form of renewable electricity generation from solar energy well suited to buildings and urban environments.

Thermal bridge: A point, line or area in a building's external envelope which loses more heat than its surroundings, i.e. a weak point from a heat transfer point of view.

U-value: The metric used to quantify the rate of heat loss for different elements. The higher the U-value, the more heat the element will lose.

Waste Water Heat Recovery (WWHR): A proprietary system which uses heat from waste-water and transfers it to the incoming cold water.

Our vision

- Green house gas emissions from our homes do not negatively impact the environment
- Homes are well insulated and have low carbon heating systems supported by renewable technology
- Homes are affordable to heat, and no one has to choose between heating and eating
- Our homes promote a healthy lifestyle and enable us to thrive
- There is a solution for all, and no one gets left behind

If you have any questions or comments email:
HousingDecarbonisation@cornwall.gov.uk

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