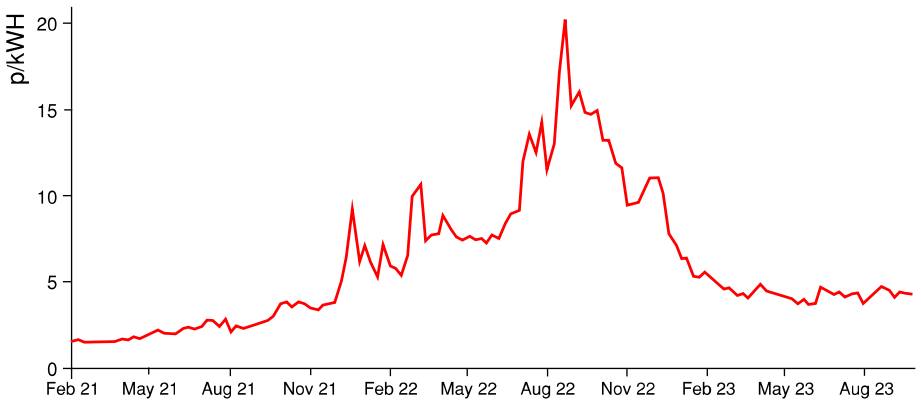
Why retrofit?

Retrofit: Work to improve a home's energy efficiency, making it easier to heat, able to retain that heat for longer, and replacing fossil fuels with renewable energy

High energy bills

Recent **extreme fluctuations in energy prices** have focussed our minds on the cost of energy and the UK's reliance on imported fuels



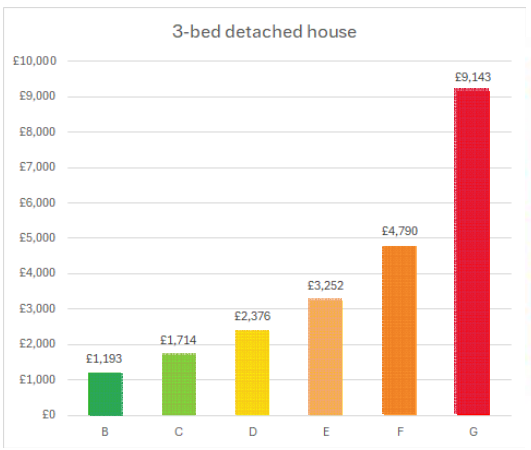
Wholesale gas price

Source: House of Commons briefing 9714: Gas and electricity prices during the 'energy crisis' and beyond

UK consumers were shielded to an extent by the price cap on what energy companies were able to charge but clearly these mechanisms are not sustainable in the longer term.

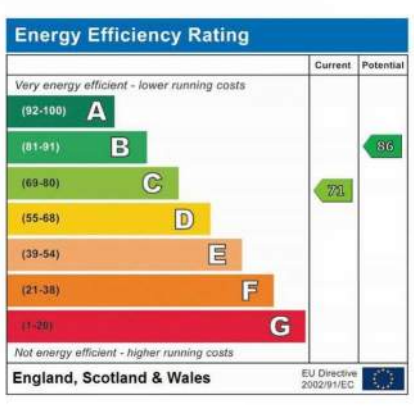
A home's EPC (Energy Performance Certificate) is a useful indicator of its energy efficiency. An EPC is required when a home is sold or rented (unless it is Listed). Homes are rated A to G in a similar way to electrical appliances.

A D rated 3 bedroom house typically costs about 30-40 % more to heat than a C rated house, depending on whether it is terraced, semi-detached or detached. For an E rated home the difference might be 80 - 95%.



Annual space heating cost
3 bedroom semi-detached home

Source: Rightmove website April 2024



Example EPC Rating

Government policies, regulations and incentives

In response to the global climate crisis, the Government has a **legally binding commitment to reduce UK carbon emissions to net zero by 2050**.

Homes are responsible for about 27% of UK energy consumption, of which over 60% is used for space heating , typically using natural gas. Reducing this is, therefore, a key part of the Government's strategy to meet their overall emissions reduction targets.

The UK has the oldest and worst performing housing stock in Europe with over 50% of homes having an EPC rating of D or below.

To address this, the Government set out an **ambition that as many of these as possible should be brought up to EPC band C by 2035**, and proposed a policy to require rented homes to meet this standard by 2025 for new tenancies. The introduction of this policy was delayed in September 2023 but this does not mean that the challenge has gone away.

However well insulated, a home with gas heating can never be zero carbon as it burns fossil fuel. The Government's strategy, therefore, is that **home heating should switch from gas to electricity using heat pumps**, which, as fossil fuelled generation is replaced by low carbon alternatives, will become increasingly low carbon.

Personal commitment to reduce CO_2 emissions

Improving comfort, combatting condensation

MARSHFIELD Community Land Trust

Supported by a grant from Retrofit West CIC under their Retrofit Accelerator programme

Retrofit West

WEST OF ENGLAND Combined Authority

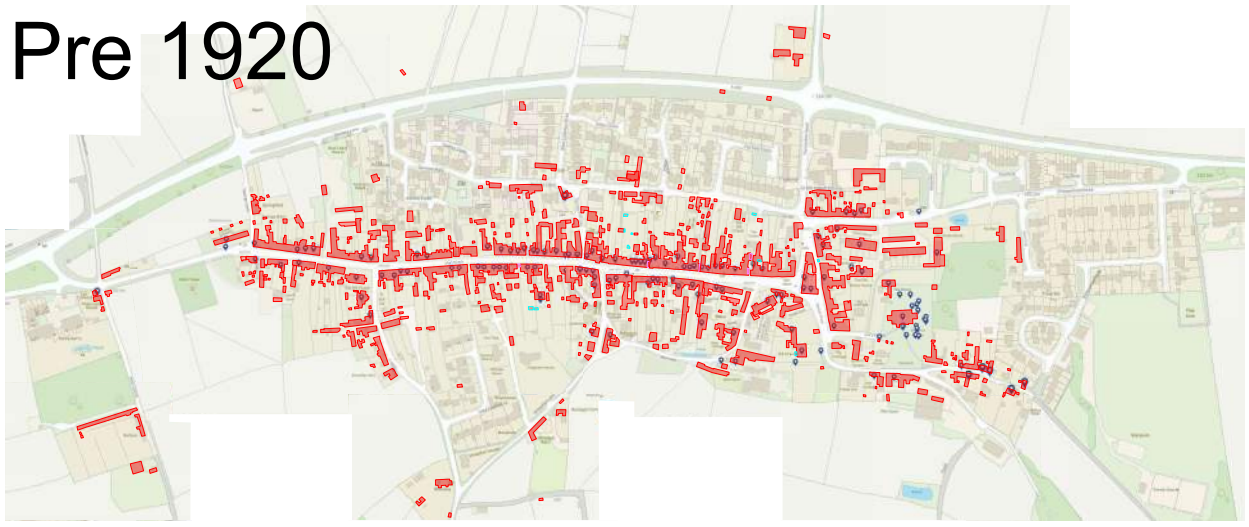
Marshfield change over time

As you can see from the colour coded map below, Marshfield's historic core of traditional Cotswold stone houses, strung out along an extended High Street, changed little in the first half of the twentieth century. Since then, it has grown considerably with the addition of a series of housing developments broadly following the historic field patterns and contained by the by-pass built in the late 1960s.

Whilst the external appearance of our traditional buildings has changed little, many of them have been extensively altered and extended and internal conditions and standards of comfort have changed beyond recognition since the early part of the twentieth century.

Marshfield change over time

Pre 1920

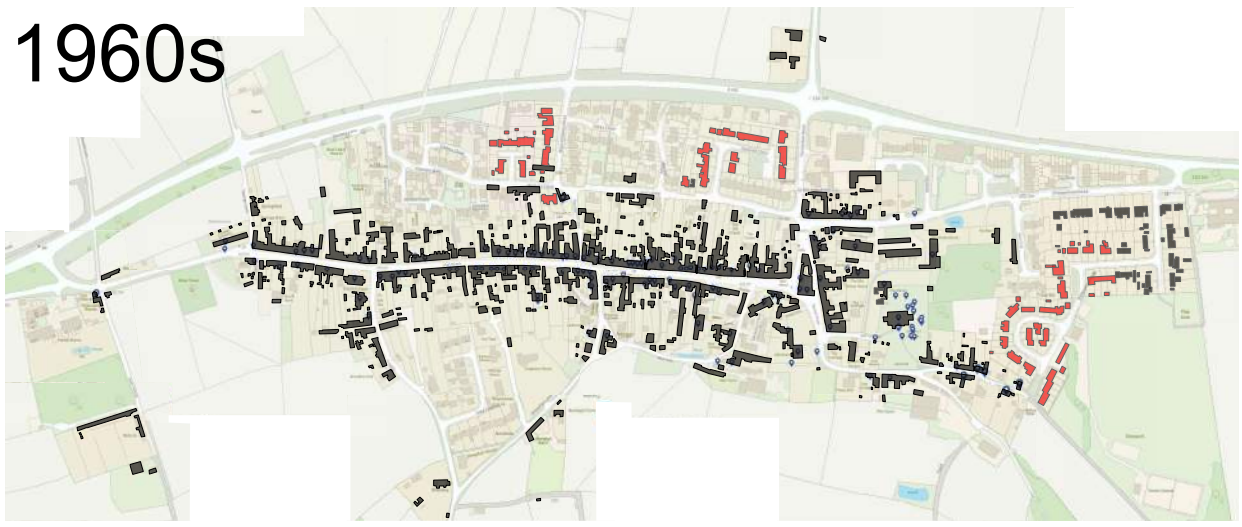


Historic core in 1921 includes 141 Listed Buildings

1950s

South side of Chippenham Road, north end of Withymead Road

1960s



Robbins Close, west side of West Littleton Road, Fairfield Close, Withymead Road

1970s

North side of Back Lane, Barn End

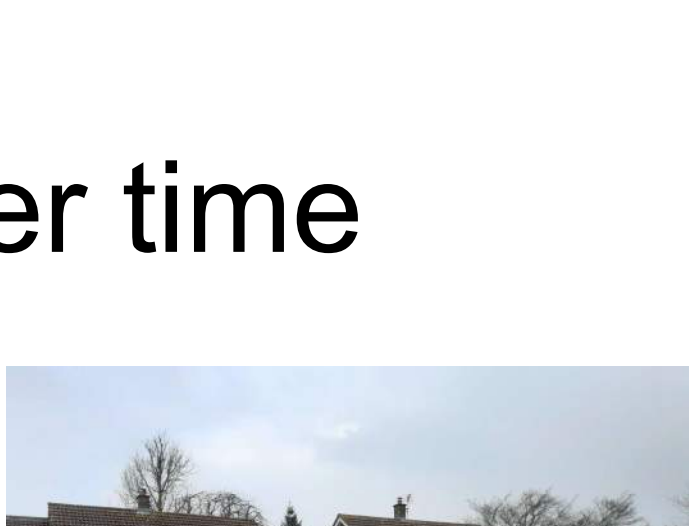
Where planning permission information was not available, dates have been based on personal recollection or estimated - any corrections gratefully received

Marshfield change over time

1980s

St Martin's Park, Hibbs Close, Hitchen Close, Hayfield

1990s



St Martin's Park, Houses off Sheepfair Lane

2000s

Home Barns, Tanners Walk, Tanners Close, Bences Close, Old School Court

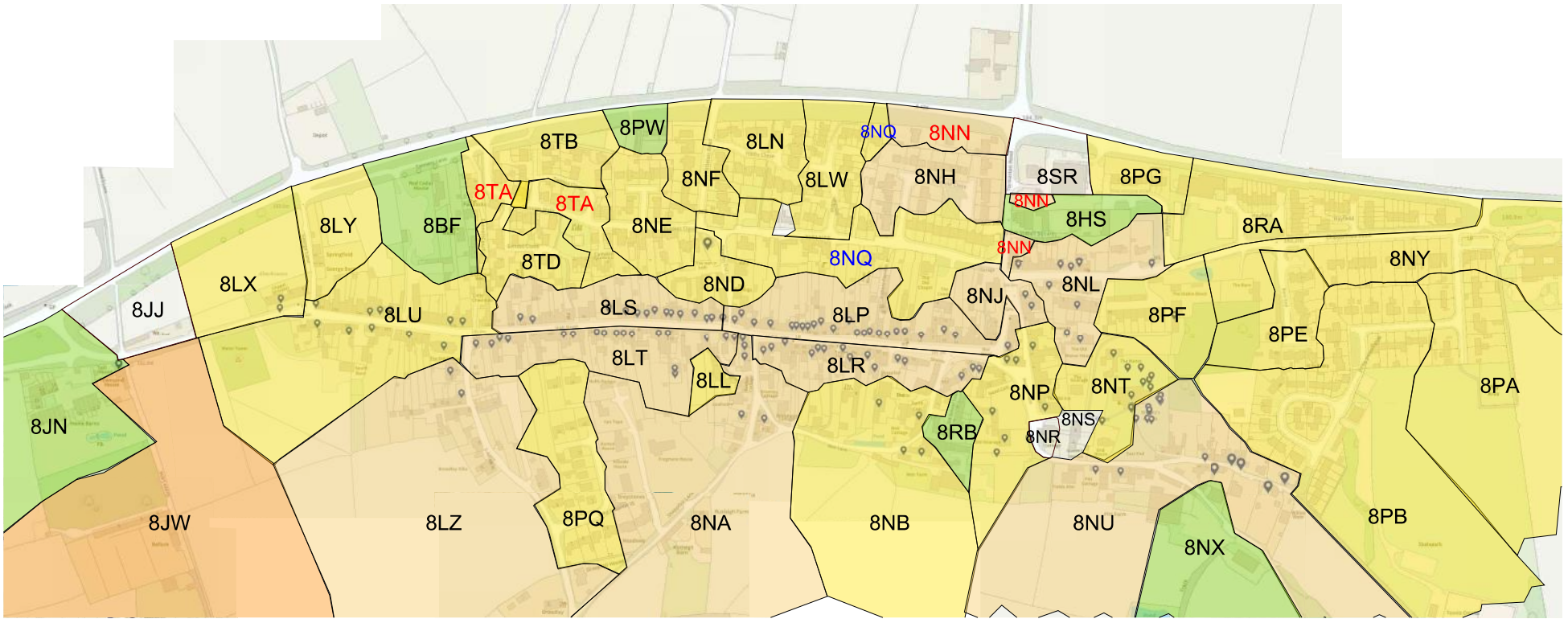
Post 2010

Camden Gardens, Tanners Lane, Hayfield

Where planning permission information was not available, dates have been based on personal recollection or estimated - any corrections gratefully received

How much is enough?

EPC (Energy Performance Certificate) rating



Averaged EPCs for each postcode Listed buildings

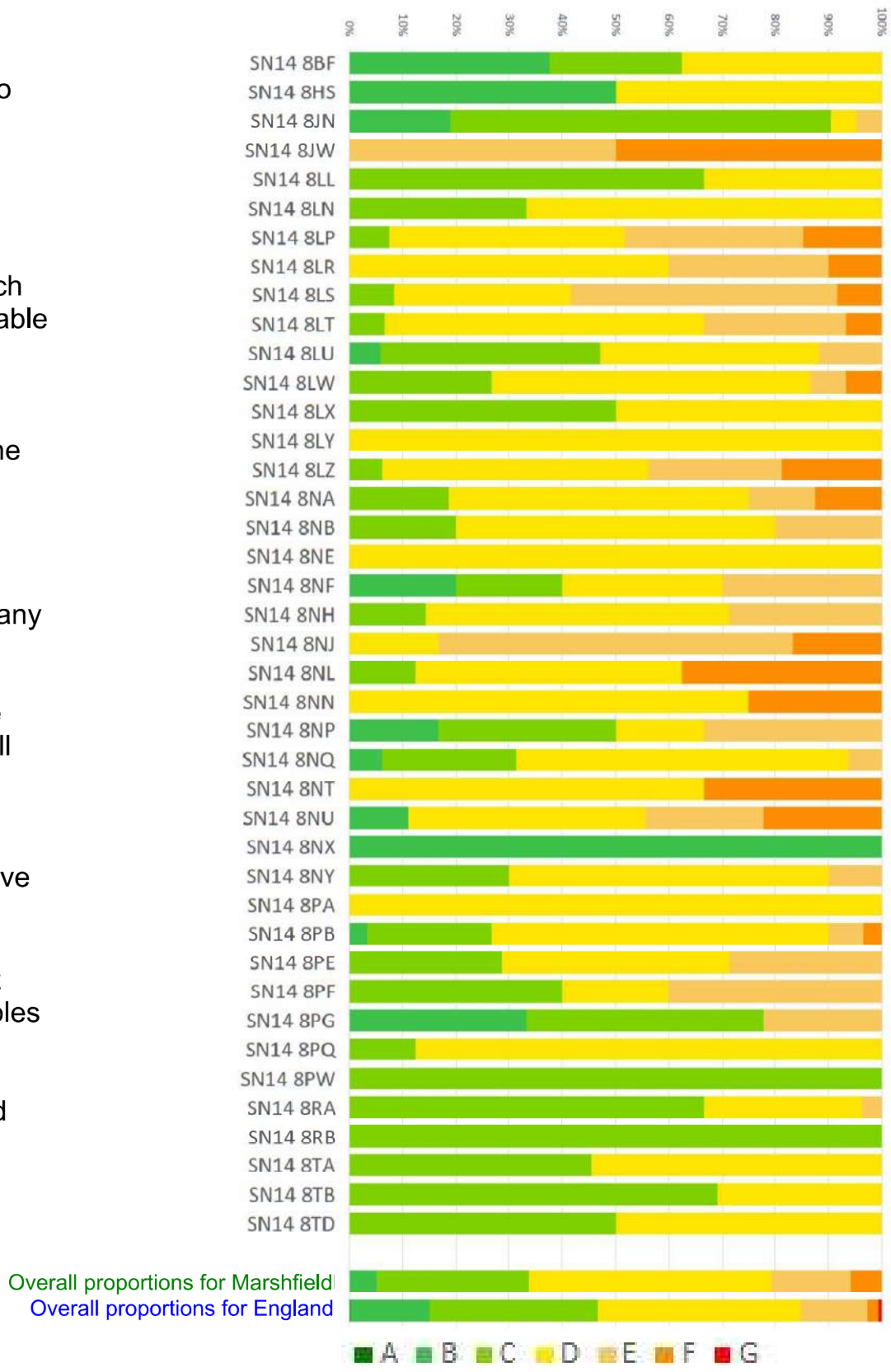
Energy Performance Certificates are a useful guide to compare the energy performance of homes with similar heating systems. Currently the overwhelming majority of homes in Marshfield (and throughout the UK) have gas heating.

The map shows an **average EPC rating** of homes in each postcode area in the village (based on 391 publicly available EPCs). How the **EPC ratings breakdown for each postcode is shown on the chart** on the right, with the breakdown for the village as a whole at the bottom. The breakdown for England is also shown for comparison. The overall EPC average for the village is Band D (just!) with 66% of EPCs being below C (compared with 53% nationally).

About 280 homes in the village do not have EPCs. Many of these will be Listed properties, which are exempt (and likely to be towards the lower end of the rating scale). However, some recently built high performing homes are also missing, including our first A rated homes. These will be added to when the Community Land Trust's new affordable homes are completed.

To meet the aspiration for the majority of homes to achieve a minimum rating of C, **the map needs to turn green!**

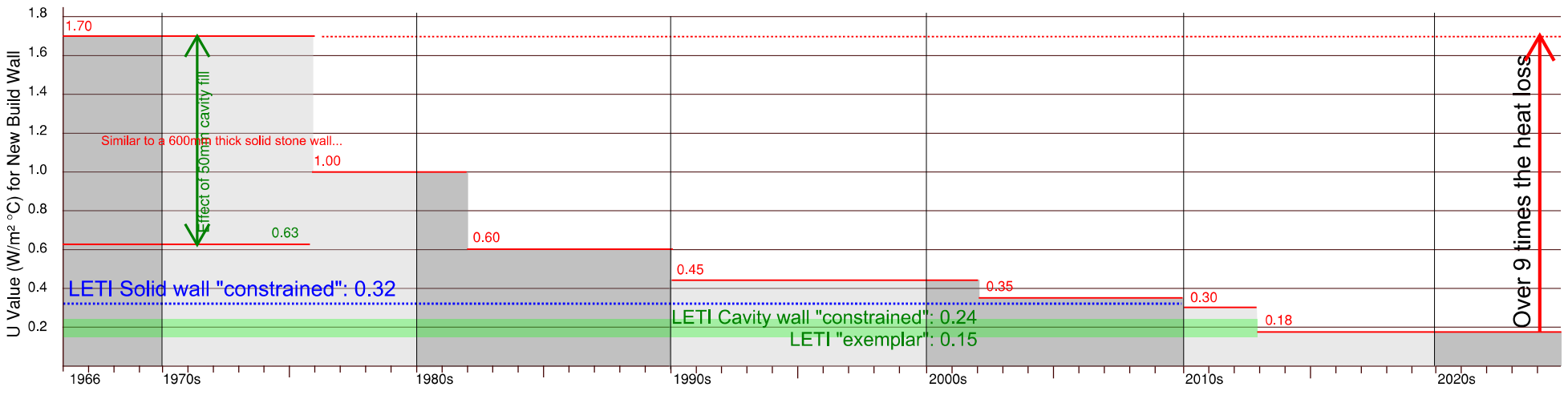
EPCs are less useful when comparing homes with heat pumps against those with gas boilers and when renewables such as PV/ solar electric panels have been installed. A poorly insulated home with gas heating and a large PV array could achieve the same A rating as a well insulated home heated with a heat pump.



Proportions of EPC ratings for each postcode

How much is enough?

Insulation and air tightness



Improvements in standards of wall insulation since regulations started (1966) - the lower the better

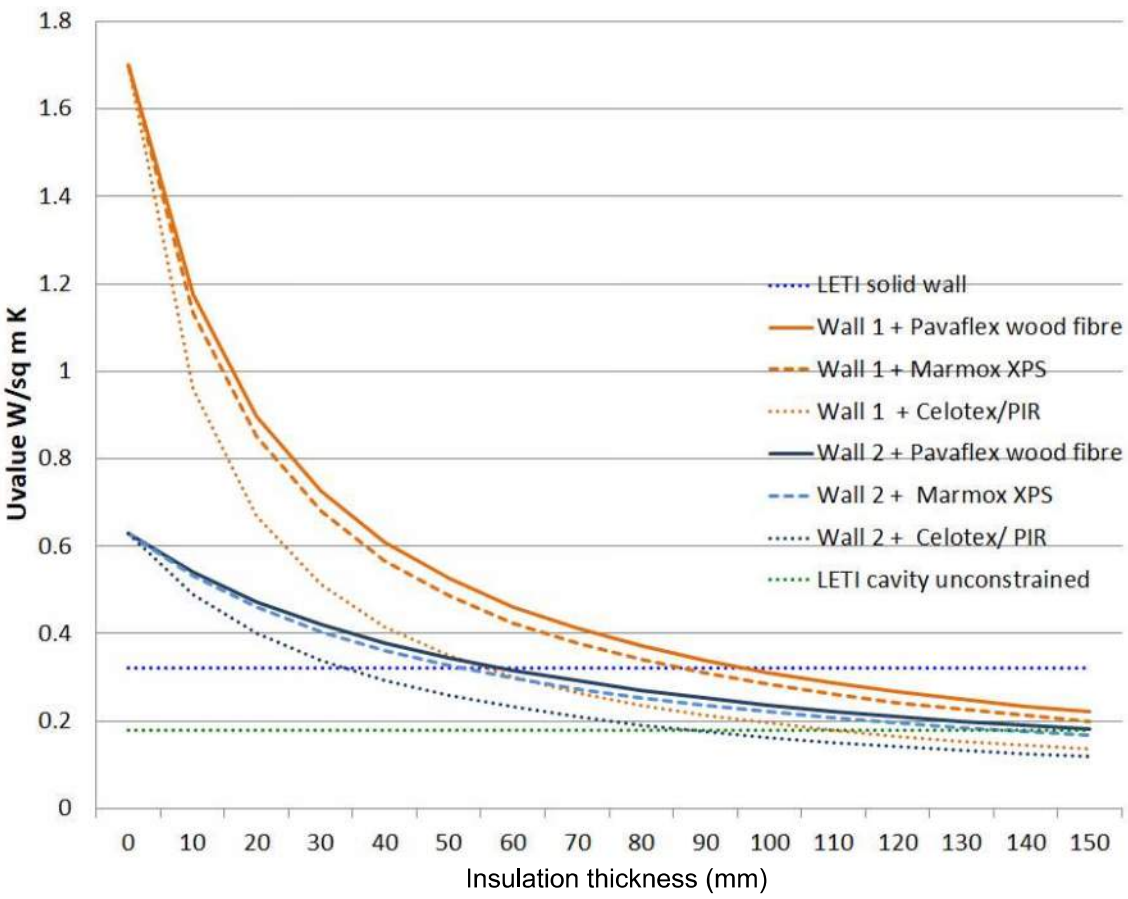
The energy needed to heat a home depends on how well its fabric (walls, roof, floors, windows and doors) is insulated and how draughty it is.

Until 1966, there were no regulations for the thermal performance of buildings. Since then, standards have increased steadily, driven by global energy crises and, more recently, by the drive to reduce CO_2 emissions . **The chart above shows the requirement for walls**, measured in watts of heat lost through the wall per degree C of temperature difference between inside and out (the U-value). The lower the figure, the better. There have been similar improvements for other building fabric elements.

The **improvement from installing cavity wall insulation** in a 1960s wall is shown. It is significant but the wall's performance is still 3.5 times worse than a wall built to current standards.

"Deep" retrofit target standards proposed by LETI (Low Energy Transformation Initiative) are shown (**blue and green horizontal bars**). Their recommendations recognise that retrofits may be constrained by space available, conservation concerns or tolerance of disruption, so a range of targets are suggested.

One of the key challenges for retrofit is how it may change the way moisture moves through the home and its structure, particularly when insulating internally. In this case, the more you insulate, retaining heat inside the building, the colder the original walls become, reducing their ability to dry out. **Traditional solid walls are more vulnerable**, particularly were exposed to driving rain. This puts limits on the amount of insulation that can safely be used and the type of insulation fitted as walls need to be allowed to dry out inwards and outwards through vapour open insluants such as wood fibre boards.



Effect on U-value of increasing insulation thickness

Insulation is subject to the law of diminishing returns. The graph shows the effect of increasing thickness of different types of insulation on a 1960s cavity wall before and after cavity insulation (Walls 1 and 2 respectively).

Where space is critical, (expensive) "super-insulants" such as Spacetherm (about 40% more effective than Celotex) can be used.

Reducing air leakage can have a very significant effect on heat loss at low cost.
An air tightness tests can be carried out to see how draughty a home is overall and to pinpoint problem areas.

Effective ventilation is essential, ideally removing moisture laden air at source (bathrooms and kitchens). For deep retrofit, either permanent extract or a whole house mechanical ventilation system with heat recovery is desirable.

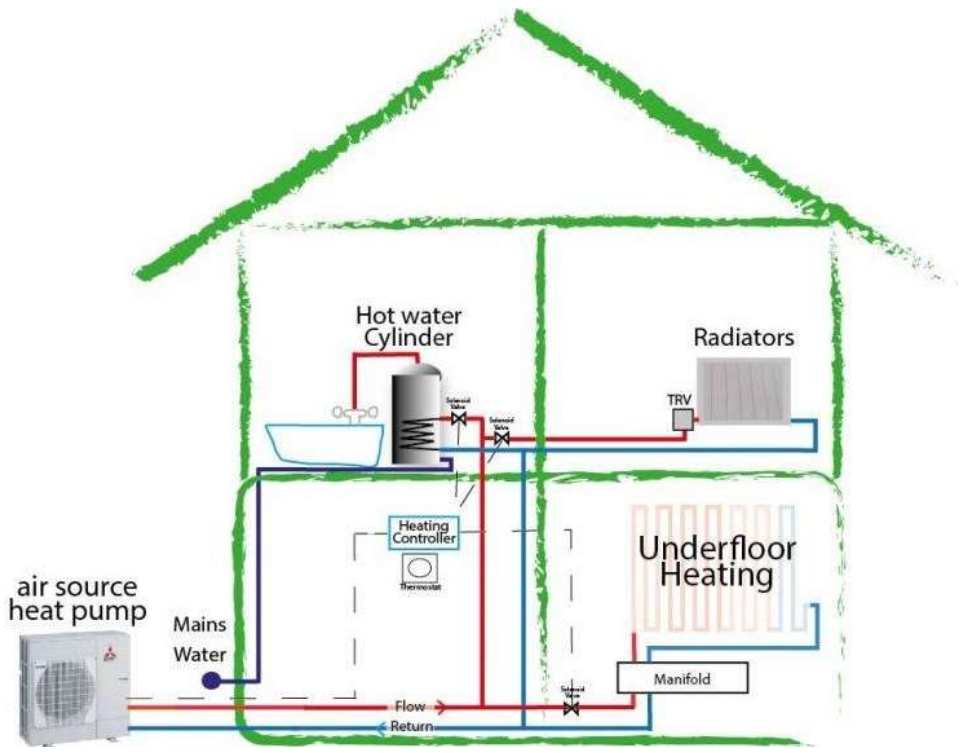
An **infrared camera** can be used to identify which elements are loosing most heat and any cold bridge/ weak spots.

Heat pump ready?

Over the coming years, **home heating is set to change from gas to electricity**, using heat pumps.

Heat pumps take low temperature heat from the air, the ground or a water body, raise its temperature and transfer it into a building. Typically **the heat energy provided by a modern air source heat pump will be about 2.8 times the electrical energy needed to power it**. Efficiencies are rising as heat pumps improve and installers become better trained and more experienced. **Some installers will now guarantee minimum efficiencies of 3.5**, however, some poorly designed or installed systems have an efficiency well below 2.

This level of efficiency means that the **CO_2 emissions from a heat pump system will be very significantly lower than from an equivalent gas boiler system**, As the UK shifts to lower carbon electricity generation sources, these will reduce further.



Typical Air Source Heat Pump system (© 2019 Great Home)
Underfloor heating works well with a heat pump (but is not essential)

Heat pumps systems operate most efficiently at a lower temperature than a conventional gas boiler system. Existing radiators operating at 45°C (recommended heat pump flow temperature) will provide just over 40% of the heat they did when operating at 70°C (conventional boiler temperature). So, if replacing a gas system, either **larger radiators may need to be fitted or insulation improved** to match the lowered output of the existing radiators.

The lower water temperature also means that more water needs to be moved around the system to deliver the same amount of heat so **heat pump systems will not work with microbore** systems.

External (disguised!) heat pump unit

Heat pump systems require **outside space for the main pump unit** (and its condensate drain) and s**pace internally for a large hot water cylinder/ thermal store**.

Heat pumps have been **successfully used in all types and ages of property**.

If replacing an old inefficient gas boiler with a well designed and installed heat pump system, energy costs are likely to reduce even though electricity is currently about 4 times the price of gas per unit of energy. However, **if replacing a modern condensing boiler, running costs may increase unless heat loss is reduced by improving insulation or dealing with excessive draughts.**

From a national perspective, **reducing home heat loss is essential** to make the challenge of increasing electricity generation and grid capacity to meet the peak heating demand achievable. It will be difficult and costly enough to replace our fossil fuel based system with renewables without building in unnecessary capacity.

To address this challenge, LETI (Low Energy Transformation Initiative) have developed "deep retrofit" **energy consumption targets and guidance** on appropriate thermal performance targets for walls, roofs, floors etc. (see Insulation and air tightness board).

Fitting photovoltaic (PV panels) will obviously contribute directly to heat pump running costs. Adding a battery and combining this with a flexible electricity tariff enables homeowners to optimise personal generation and energy use.

Typical thermal stores

A way forward

Working together

Retrofit is not necessarily straightforward. It needs a **coordinated whole house approach** to get best value for money and to avoid some potential pitfalls - the devil can be in the detail.

The retrofit market has its share of self interested spivs and scammers, however, there is good quality guidance out there, for example from organisations like the Centre for Sustainable Energy in Bristol.

However, moving from generalised advice to specific recommendations for your particular home can involve significant cost for tailored advice from a retrofit coordinator or building professional and it can be difficult to find reliable experienced contractors to carry out the work to the required standard.

Whilst there are things that are unique to a particular house (not least their occupants) there are many common characteristics. It makes no sense for neighbours to go through the same process of discovery, potentially employing separate specialist advisors, when that information (and its costs) could be shared

The idea behind his exhibition is to get together groups of interested owners of similar properties to develop a common retrofit approach for their type of home that can then be tailored and adjusted to suit any particular features of an individual house. The aim being to:

Share the costs of professional advice for their type of property

Compare notes from testing (e.g infra red and air tightness surveys)

Compare information on energy consumption before and after retrofit

Share retrofit ideas

Share information on **potential grants and incentives**

Develop connections with **skilled contractors**

Share experience of **what works well**

The initiative would initially be coordinated by the Energy Working Group (EWG) of the Marshfield Community Land Trust but it is anticipated that it will generate its own momentum and expertise.

To get involved

Homeowners

Advisors

Contractors

Fill in your details on the form. or email tony.kerr@marshfieldclt.org with your name, address and contact details, whether you are a homeowner, advisor or contractor.

A member of the EWG will contact you to explain the next steps.

Thanks to the Retrofit Accelerator programme, the EWG has been able to buy an infra red camera for community use

MARSHFIELD Community Land Trust

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