Improving warmth and comfort on Henbury Hill

About the author

Rob Benington first lived on Northover Road in 1986; he moved away from Bristol to study Town and Country Planning and Environmental Impact Assessment and to work with environmental consultancies and local authorities in a variety of policy and sustainability roles. In 2012, he moved back to Northover Road and used his interest and experience of home energy conservation to undertake many DIY improvements. He started as a surveyor with the CHEESE Project CIC in 2019 and now plays a leading role in training new surveyors.

Rob is happy for you to contact him with feedback about anything in this document. It may be possible to publish an update as we learn more about what works to keep the townhouses at a comfortable temperature while energy costs rise and the summers become hotter. All ideas, comments and experiences are welcome.

You can email Rob at **vo2max@hotmail.co.uk**

Acknowledgements

Hopefully, this report will help and inspire those wanting to improve their homes. It would not have been possible without financial support from the Retrofit West accelerator programme. The CHEESE Project CIC, especially Mike Andrews, Managing Director, and Joshua Mudie, Director of Finance, have been helpful and supportive throughout the project. Thanks to all those living on Henbury Hill who were surveyed or who contributed to the project in other ways, especially those who's comments on the first draft improved the final document significantly.

Special thanks go to Jon Lane for designing the cover and the graphic on pages 11 and 12.

Disclaimer

Date of publication

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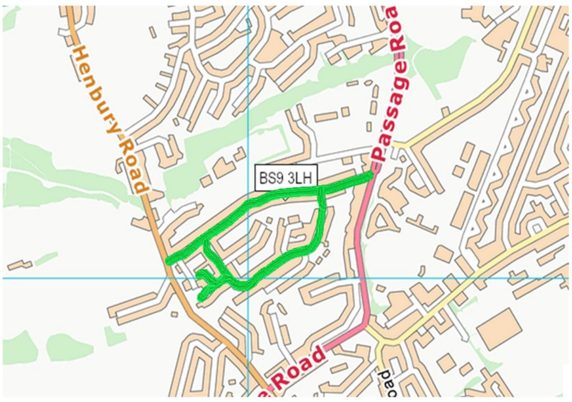
1. SPAN-style houses in BS9

1.1 Townhouses on the Henbury Hill estate

Construction of the homes named by the developers as “The Henbury Hill Estate” took place between 1965 and 1970. The houses were designed by Kenneth Nealon Tanner and Partners of 28 Orchard Street BS1, and include a variety of ‘new-build’ terraced properties built on the farmland between the older detached properties constructed conveniently close to Henbury Hill and Passage Road.

This report concerns only the three-storey townhouses that form the majority of dwellings on Northover Road and a large proportion of the homes on Westover Road and Westover Gardens.

The townhouses are in the style of homes built by SPAN Developments Ltd, a British property developer formed in the late 1950s, which built around 2,000 homes, predominantly in South East England. Originally, the designs for the townhouses included more variety, but quite a few years passed between the approval of the original plans (submitted in more than one application between 1959 and 1963) and completion. The variety of “Types ‘A’, ‘B’, ‘C’, ’D’ and ’T’” was whittled away, with relatively minor variation in wall coverings, room layout and window design remaining at completion. However, there is one major difference in wall-design, with the later-built homes featuring walls with a narrow cavity to the front and back, while those built earlier (1964/1965) have a single skin of concrete block. Some of the early houses feature shiplap cladding in black or white, but the majority are clad in green tiles.



Location of in-scope homes is marked in green

Google Earth shows that solar panels are becoming more common as their price drops, energy costs rise and owners recognise the energy -potential of the south-facing roofs.

A powerful fan helps find hidden draughts

But the high solar-gain of some homes can cause discomfort from overheating in summer. As our carbon emissions to the atmosphere result in hotter and hotter summer temperatures, insulation and other measures to protect us from high summer heat will become more and more important.

Where heat is lost from inside in winter, it is gained from the outside in summer, potentially causing overheating. Officially, the thermal performance of the townhouses is quite poor, with most homes having a score of around 65, or ’D’, according to their Energy Performance Certificates, (see page 21). The national average is 68, suggesting there is plenty of opportunity for improvements which will keep the townhouses warmer in winter and cooler in summer.

1.2 The study

Funding from Retrofit West's Community Group Retrofit Accelerator programme enabled the project to go ahead. Thermal surveys carried out on a sample of 12 townhouses identified the common causes of heat loss. The results are presented in this report, which was shared with all townhouse residents.

The motivation for the project is primarily to reduce wastage of energy and thereby tackle one of the leading causes of climatic disruption—energy use in the home. The logic is that when residents are aware of how they can reduce heat loss in winter, they will be more able to take action to reduce winter fuel bills and summer heat stress.

During January and February 2024, at least one leaflet promoting the project was posted to all the eligible townhouses and the project was promoted on the Northover Road WhatsApp group which had 51 members at the start of the project. A total of 12 surveys were carried out in the 112 townhouses. At some point during the study, 8 homes were empty, for sale or to-let, and two displayed 'no junk mail' notices, reducing the number of homes available to take part to 104.

Q To what extent do houses that look the same share the same thermal characteristics?

1.3 The CHEESE Project C.I.C.

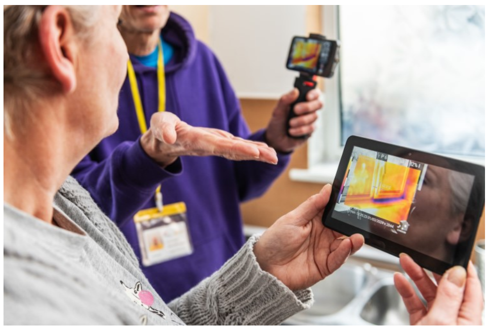
An internal thermal survey is the perfect starting point for retrofit. CHEESE (Cold Homes Energy Efficiency Survey Experts) is an award-winning not-for-profit Community Interest Company (C.I.C) that has been combating fuel poverty and reducing carbon footprints since 2014. Surveyors use a bespoke Heatview® thermal camera and software designed by their own technical experts.

Their powerful fans lower the air pressure indoors and working with residents they find the hidden draughts and thermal weaknesses. A thermal camera reveals where heat is being lost in winter (and gained in summer) and surveyors give information to clients about their options.

They were fully operational and ready to deliver at the beginning of the project, and were approved by Retrofit West as valid recipients of the accelerator voucher funding in November 2023. CHEESE C.I.C. also agreed to reduce their charges slightly, meaning participants only had to pay a £10 booking fee for a thermal survey previously priced at £306.

www.cheeseproject.co.uk

A To find out, a sample of homes had thermal surveys carried out by the CHEESE Project CIC and the results are presented in this report.



A CHEESE survey in progress

1.4 Summary

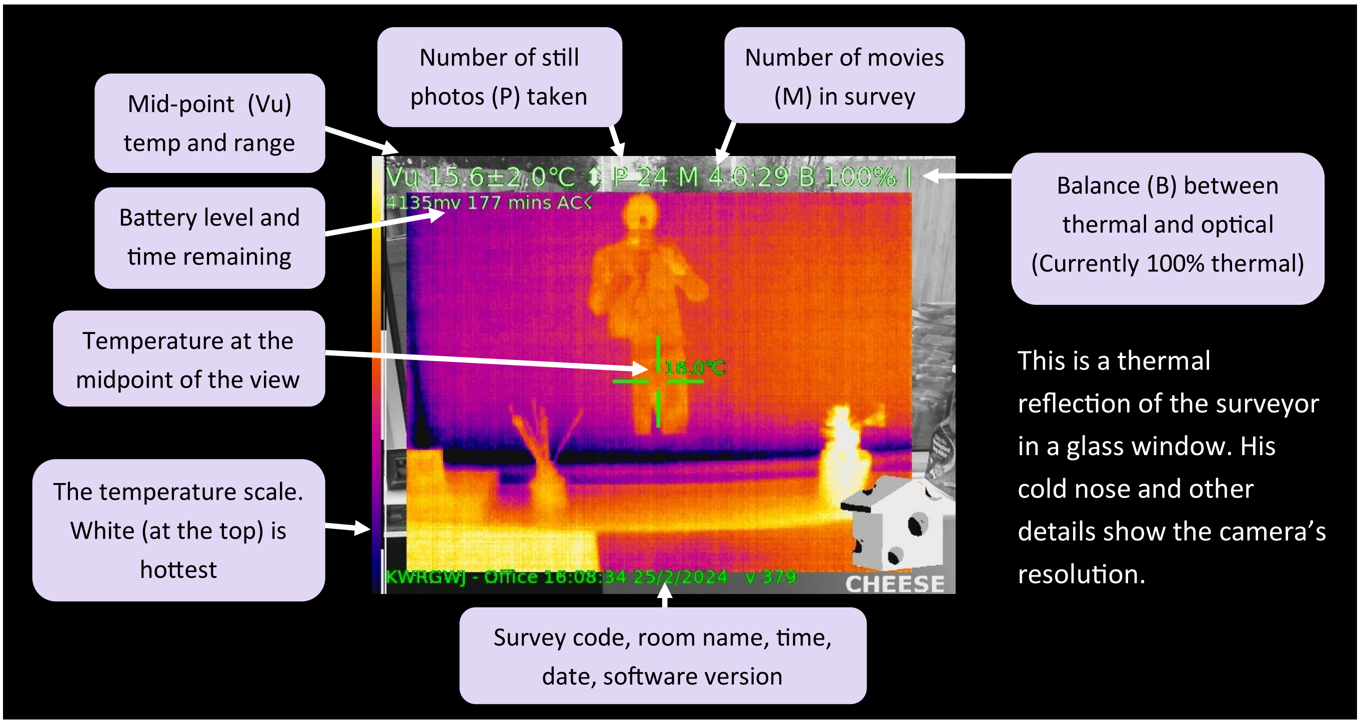
The main findings from the survey are:

- Homeowners in the survey like their SPAN-style homes;
- There were some mixed feelings about whether the houses are warm or cold;
- Analysis of Energy Performance Certificates (see page 21) suggests the townhouses are slightly less efficient than the national average;
- The surveys surprised homeowners by revealing previously hidden thermal weaknesses;
- The features causing most heat loss and heat gain are the area of the windows, the design and construction of the internal garages and the draughts brought into the houses by the waste pipe - most noticeable in the kitchens and bathrooms;

Descriptor	Meaning
Universal	Present in all (100%) of the homes surveyed
Common	Present in 50—99% of homes in the sample
Occasional	Present in less than half (50%) of the homes

- Loft insulation in more than half of surveyed homes is not at the recommended minimum (270mm) and the low roof height in the eaves makes them difficult to insulate;
- Draughty loft hatches are a very common problem, as are draughts that come under and around skirting boards, and
- The internal garage doors are not well sealed.

1.5 Interpreting Heatview© thermal images



The images in this publication are generated by Heatview© software operating on thermal cameras custom-built for use by the CHEESE project C.I.C. Other thermal cameras are available for purchase, hire and loan, but without an extractor fan to reveal hidden draughts, the results are unlikely to be as comprehensive. Trustpilot reviews show how much clients value a surveyor trained and experienced in interpreting the thermal images. **www.trustpilot.com/review/cheeseproject.co.uk**

2. Thermal findings

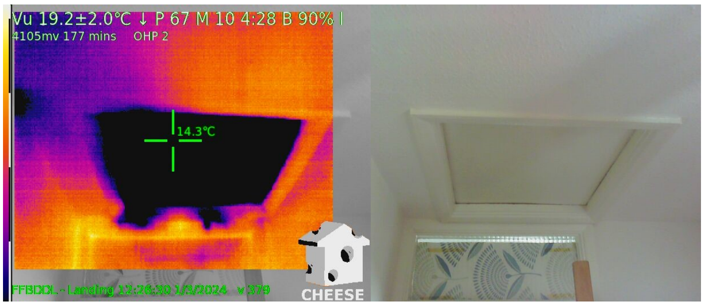
A total of 12 homes were surveyed and included in the sample. Not every thermal finding is listed; some homes had unique features that are unlikely to be found elsewhere. Also, the findings below are those that provide opportunities for improvement; some homes have had works carried out to improve insulation and draughtproofing; these are not listed below but are referred to in the discussions about making improvements. Unfamiliar terms in the table may be explained in the **Glossary** on page 23.

Feature	Frequency	Notes
Chapter 3: Loft		
3.0 Loft hatch uninsulated	6 (50%)	
3.0 Loft hatch draughty	11 (92%)	
3.1 Thin / irregular loft insulation	6 (50%)	In areas other than the eaves
3.2 Thin insulation in the eaves	7 (58%)	
3.3 Holes in ceilings	8 (67%)	
Chapter 4: Windows and doors		
4.0 Cloaking profile draughts	8 (67%)	
4.1 Failed rubber seals	6 (50%)	
4.2 Thin plastic doors	11 (92%)	
4.3 Trickle vents	4 (33%)	
4.4 No curtains	6 (50%)	Curtains on less than half the windows
Chapter 5: Pipework problems		
5.0 Internal waste pipe draughts	12 (100%)	
5.1 Ventilation fans - backdraught	7 (58%)	Includes cooker hoods and ventilation fans
5.1 Poorly sealed boiler flue	4 (33%)	
Chapter 6: Draughty skirting boards	12 (100%)	
Chapter 7: Internal garage		
7.0 Thin single-skin garage walls	8 (89%)	Eight of the 9 unconverted garage walls uninsulated
7.1 Uninsulated garage ceiling	8 (89%)	Eight of 9 unconverted garage ceilings uninsulated
7.2 Unsealed garage ceiling	8 (89%)	Eight of the 9 unconverted garage ceilings unsealed
7.3 Draughty internal garage door	9 (100%)	
7.4 Uninsulated central heating pipes	4 (33%)	
7.5 Uninsulated concrete floor	10 (83%)	None have dug up the concrete; Two have multiple layers of insulation laid on top of the concrete slab.
Chapter 8: Walls and windows		
Five older homes: no insulation on single-skin front and back elevations	5 (100%)	Two homes had filled cavities in the side-walls
Seven newer homes (narrow cavity): no insulation	6.5 (93%)	One home had some insulated cavity walls

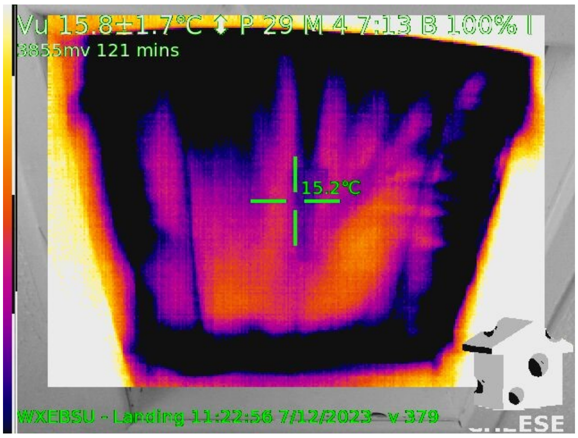
3. Loft

3.0 Cold loft hatches

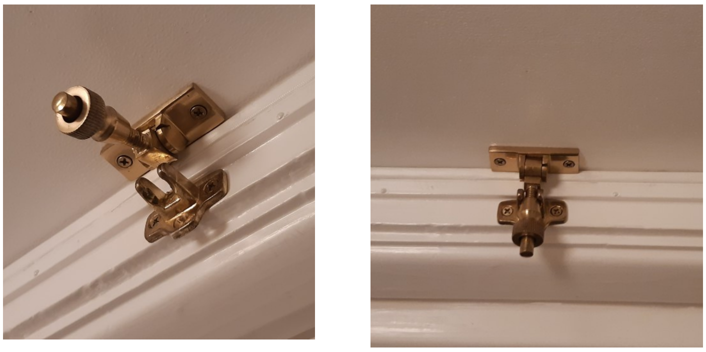
Common



Draughty and uninsulated



This hatch has some insulation attached to it, but is very draughty.



Clamping hatches closed helps stop draughts

A well-insulated loft hatch with 100mm of Cellotex PIR insulation glued on with PVA adhesive

The thermal qualities of loft hatches in the homes surveyed varied from reasonable to very poor.

To improve warmth, the traditional loft hatch (usually just a board of plywood or solid wood) needs to have a layer of insulation attached directly to it on the loft side. About half have some, but its often too thin to be making much difference. An easy and effective improvement is to glue PIR to the hatch (the deeper the better, 100mm is good) with PVA adhesive. Alternatives to PIR include polystyrene, wood-fibre products and rockwool insulation, but PIR is the most thermally resistant.

Loft ladders can restrict the depth of insulation that can be attached to parts of the hatch, but PIR is easy to cut to shape and there is often room for at least 50mm.

Draughtproofing loft hatches is very important. Cold air falls (it is heavier than warm air) through any gaps and on downwards, cooling the house. When inside temperatures are high enough, hot air rises through any gaps and escapes, lowering the air pressure inside the house. This allows atmospheric pressure to force colder air in at the bottom of the house. This is called the Stack Effect. It makes houses operate like a chimney. Opening loft hatches in hot weather helps cool houses down.

Many draughtproofing products are available to buy, but most rely on the weight of the hatch itself to compress them and block out the air. They work much better if a fastener (like the ones pictured which are also used on wooden sash windows) is used to clamp the hatch down, forcing the gaps closed and creating a tight seal. The fastener pictured has a screw fitting, so the tightness can be easily adjusted.

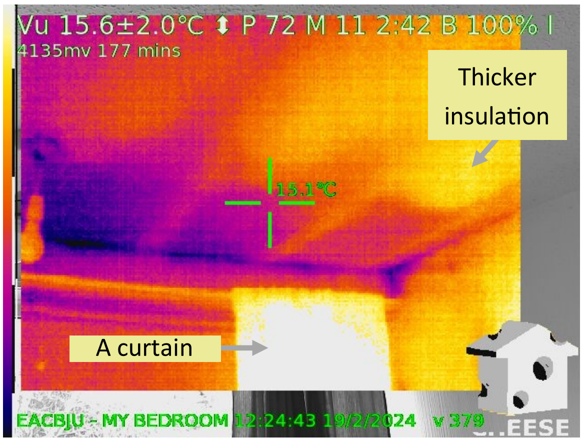
3.1 Thin or irregular loft insulation

Common

Patchy, inconsistent loft insulation

3.2 Thin insulation in the eaves

Common



Cold eaves where insulation is too thin

The homes surveyed showed variation in the depth and consistency of loft insulation—most did not have the recommended minimum depth. The minimum has steadily increased; installing it may be a fit-and-forget job and if done years ago to the standards of the time, adding more now may make an improvement.

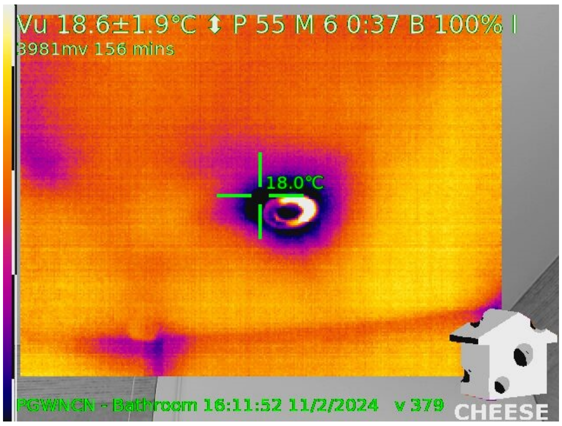
And of course placing boxes on top of rockwool squashes it and reduces its usefulness. Boarding also limits the depth, but ways around both problems exist. Rockwool is not the only material that can be used: better products do not have to be as deep to get the same benefit, but tends to be more expensive. But if use is limited to areas under boarding or in the eaves, (see below) it may be desirable.

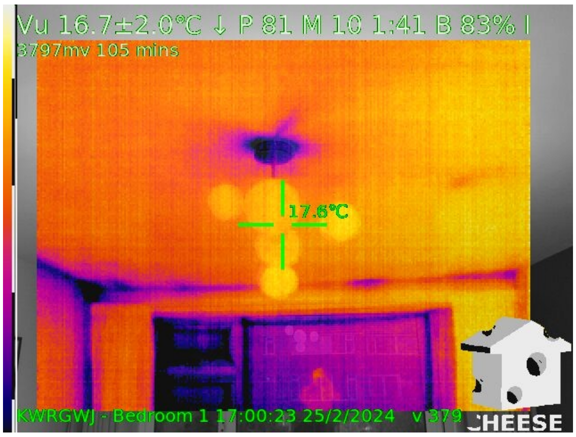
In the eaves, the low height of the roof above the top-floor ceilings means it is difficult and unpleasant to work in these areas. In some cases, the original thin glass fibre is the only insulation present, and over time this this breaks down and doesn't work as well.

It is impossible to achieve the recommended minimum 270mm depth because an air gap must be left to allow fresh air to flow over the insulation and ventilate the loft, otherwise condensation problems can occur. Using an alternative material (such as PIR) can improve the level of insulation because it has double the thermal resistance of rockwool so only half as much is needed. Using expanding tape along the edges of the insulation board will allow a looser initial fit, while still achieving air-tight joins with the joists once the tape has expanded.

3.3 Holes in ceilings

Common



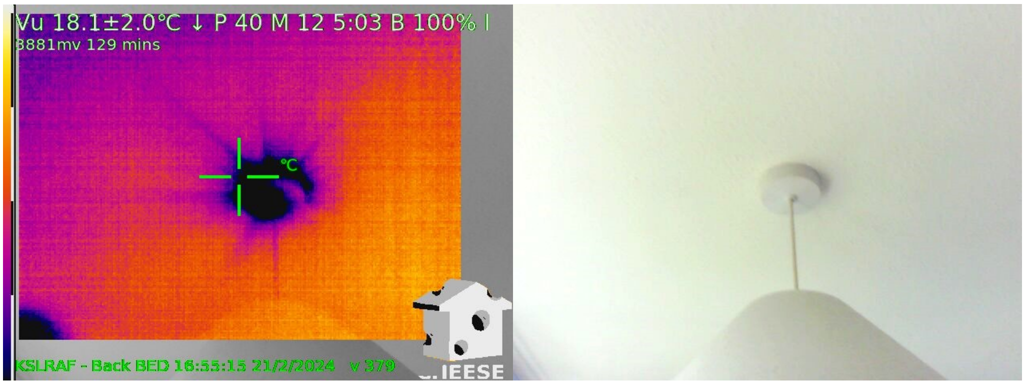


The surveyed homes had many places where cold air comes down from the loft into the house through holes in the ceiling made for electric cables (light pendants and light switches), ventilation fans, downlighters and plumbing pipework. Holes made for water pipes are especially common in the cupboards on the top floor landings and let in lots of air, especially when the pipes are removed.

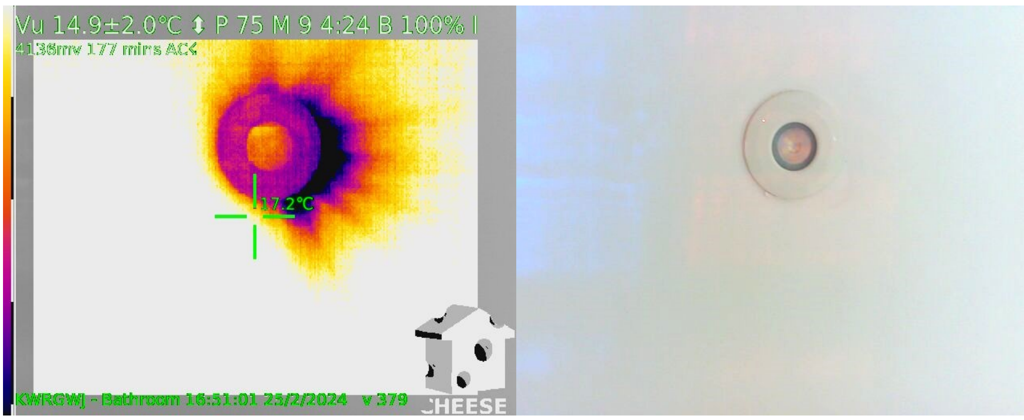
Usually holes can be filled in, but care is needed around electrical cables which should not be thermally insulated. Using electrical tape to seal around the cables is better. Filling and sealing holes can sometimes best be done from the loft.

Downlighters can be very draughty, with air coming through the light around the bulb and from under the surround. Those that are Ingress Protection (IP) rated can be very much better. The one pictured has an air tight seal between the shroud and the bulb and a fitting that tightly clamps the bulb to the plasterboard of the ceiling.

IP rated downlighter



A typically draughty light pendant



Draughty downlighter

4. Windows and doors

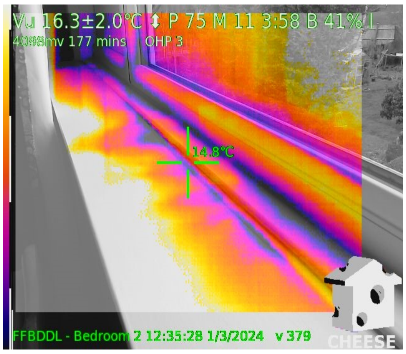
4.0 Cloaking profile draughts

Occasional

Strips of plastic called window trims, or cloaking profiles, are often used to tidy up the installation of uPVC windows. They make it quick and easy to hide cracks and holes between the window frame and the wall that were made when the frames were installed. They are usually held in place with double-sided adhesive tape and finished with silicone sealant, so are quite easy to remove. This exposes any holes and allows them to be filled. They are just for decoration, so don't have to be replaced.

Alternatively, without removing the plastic, filling any gaps between the plastic trim and the wall with silicone sealant can prevent draughts.

Windows installed after 2022 should be compliant with the new building regulations. As well as making the glass panels and frames more energy efficient (meaning new windows should allow less heat loss in winter and heat gain in summer), the new regulations tighten-up on the methods of installation, meaning fewer gaps between the frames and walls.



Draughts around cloaking profiles

Gap between frame and masonry

Expanding foam fills gaps

4.1 Failed rubber seals

Occasional

uPVC windows and doors use rubber seals, (also known as bubble-gaskets), to seal the gaps between opening windows and the frames. After 15 years or so, the rubber starts to deteriorate due to exposure to ultraviolet light and repeated heating and cooling. Eventually they lose their flexibility—and with it their ability to seal the gaps—and windows and doors can become draughty. If gaskets don't feel soft and flexible anymore, or if the rubber is cracked or damaged, simply replacing the gasket may solve the problem.

Most surveyed homes had some gasket issues. Gaskets are usually quite easy to replace, (YouTube has videos showing how), but the design of the gasket can vary with the design of the frame, so it is best to get a sample pack, (from online retailers or local glazing companies). These will help identify the correct gasket.

Adjustment of the hinges and fixings may becomes necessary after years of opening and closing.

4.2 Thin, plastic doors and window panels

Common

Many homeowners in the sample said how cold their thin plastic and glass front doors are. As well as having poor thermal resistance, any weaknesses in the adjustment of the hinges or quality of the gaskets will let in draughts. The letterboxes are especially vulnerable to cold air where the front doors face north. Improvements include:

- Sliding doors and porches;
- Heavy curtains;
- Use of wall-mounted letterboxes, and
- Lining door panels with acrylic to create an insulating pocket of air.

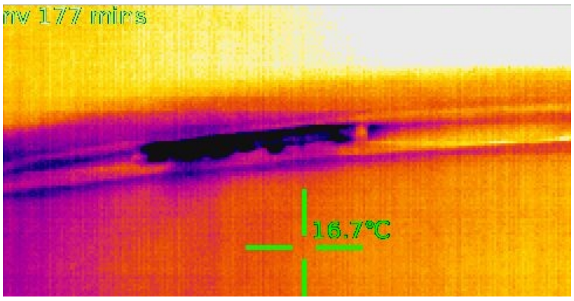
The door pictured (left) is typical of the older doors and panels still used in most townhouses, except the letterbox has been filled, covered over and replaced with a wall mounted box on the outside and both the upper and lower portions of the side panel have been covered with acrylic sheet. The space created behind the acrylic on the lower portion has been filled with a layer of double-sided foil to add extra insulation.

A product called "Liteglaze white glazing strip" has been used to mount the acrylic sheet to the door frame. This is made from white PVC, so matches perfectly.

4.3 Trickle ventilators

Occasional

An example of a trickle or background ventilator



A recent change to building regulations now requires ventilation to meet certain standards and not to be reduced when windows are replaced. Background or trickle ventilators in windows and doors are becoming more common. (See *Approved Document F: Ventilation*). Unfortunately, most let in cold air, whether or not they are 'closed'.

The regulations are there to maintain healthy indoor air quality; this is important and can be achieved in various ways, (page 14). Demand for fresh air depends on occupancy levels and behaviour and many homes currently do not have or need trickle ventilators. Sealing them closed is an option in some cases, but care should be taken to maintain an adequate supply of fresh air.

4.4 Which are better; curtains, shutters or blinds?

A thermally efficient window covering will help control both heat loss in winter and heat gain during the summer. Given the orientation to the sun and the large windows in many of our SPAN-style homes, window coverings are particularly significant and improvements to them can make a big difference to our comfort.

A thermally efficient window covering will have:

Tight seals. Fitting them closely to the wall or window frame so air cannot pass around them, perhaps by design or with Velcro, magnetic tape or hooks, can improve performance of curtains by 19%, (Fitton, R. et al,(2017), published in *Energy Efficiency,* 10). Curtains should overlap generously in the centre and rest on the window sill or the floor so cold air cannot come out underneath their lowest edge. Pelmets help stop warm air escaping down the back, and cold draughts getting in over the top.

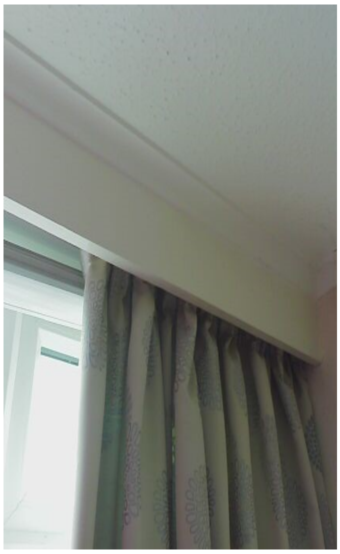
Honeycomb blind

Reflective surfaces. Coatings that reflect heat will also help to prevent excess heat from entering the room during hot weather.

Pockets of air. Still air is an insulator. The folds in curtains trap air naturally—so make sure they are wide enough to create deep pleats. Some blinds have a cellular or honeycomb structures that attempt the same effect. Just like layers of clothes, multi-layered structures will trap more air and be warmer.

Resistance to the movement of air. Some shutter systems are weak in this regard. The higher the thread count, (TPI) the more resistant to air a material made from a given thread will be.

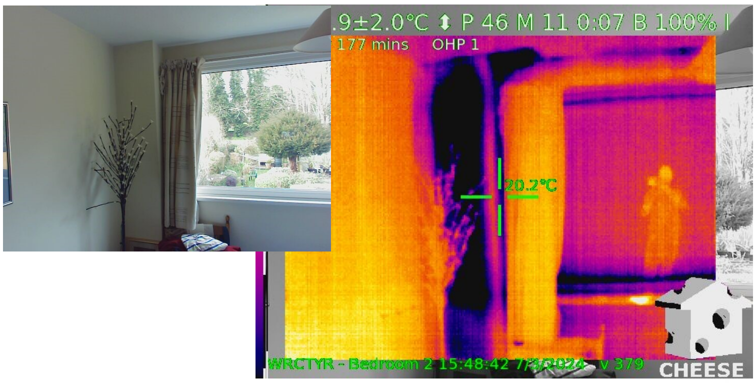
Resistance to the movement of heat. Wool and velvet have better insulating properties; they tend to have higher density, (measured in grams/m^2). Additional insulating layers or 'thermal liners' made from foam, polyester or fleece will further improve thermal resistance.



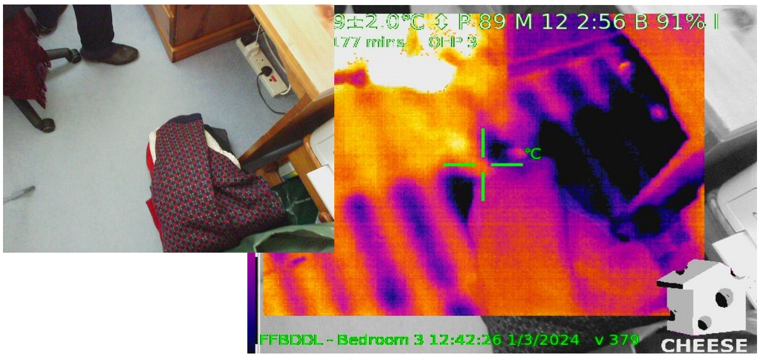
A pelmet controls air-flow behind the curtain

5. Pipework problems

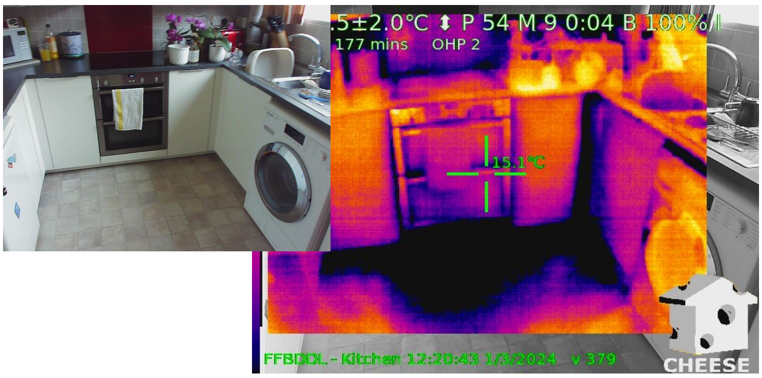
5.0 Internal waste pipe draughts Universal



Cold waste pipe in a bedroom

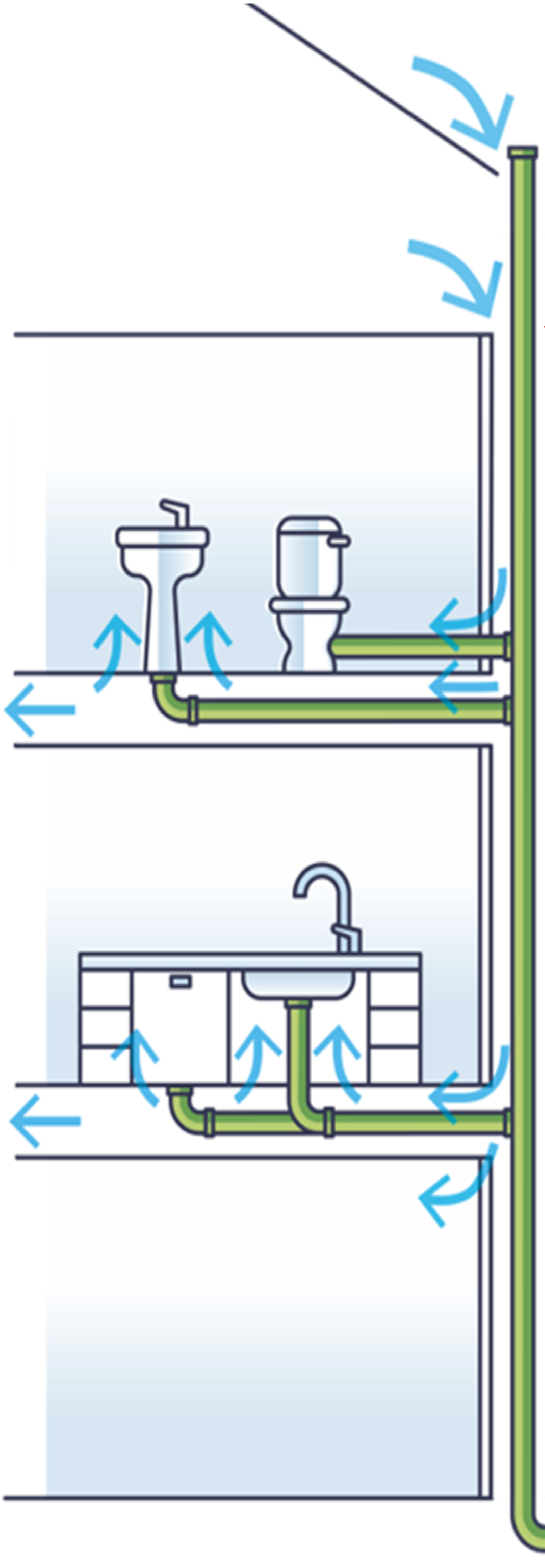


Cold between floorboards



Kitchen draughts

Cold patches on boxed-in waste pipe



The problem: The 110mm grey soil or waste-pipe goes up through the top floor ceiling, into the loft and out through the roof tiles. The pipe-hole in the ceiling can be large, and is rarely airtight. Lots of cold air from the loft can fall through the hole and down into the house inside the boxing that hides the pipe in the bedroom or bathroom, kitchen and downstairs utility areas. Cold air also falls into and through the pipe itself, cooling it and the air around it.

A solution: Filling the hole in the ceiling with expanding foam will stop a lot of cold air finding its way in around the pipe.

Soil pipe in a bathroom (with boxing removed)

Bathroom / bedroom: In most homes, thermal images of the boxing around the pipe show the tell-tale dark patches that reveal how cold it is relative to the surrounding walls and ceiling. In bathrooms, the boxing is often penetrated by the toilet and sink waste-pipes, and the gaps around the pipes are usually very draughty. The pipe passes through the floor. Air from the loft gets into the floor and can mix with air from other sources (gaps in the mortar in the walls or around the joists) cooling the floor and creating draughts at the floor edge. Sometimes, air follows the bath waste-pipe and emerges around the bath panel.

Upper floors: Once in the upper floor, cold air can come out in many places including the (sometimes uncarpeted) floors of landing cupboards, underneath skirting boards and up between floorboards, (see thermal images opposite).

Kitchen: Nearly everybody notices the draughts in the kitchens. Their strength varies, but every home that was surveyed had some cold air coming out from under and around the cupboards. A number of strategies for stopping the kitchen draughts have been tried: these include removing the kick-boards under the cupboards and packing the space with loft insulation; sealing the gap between the outside wall and the floor with expanding foam and taping the gaps between the kickboards and the cupboards. Improving these secondary lines of defence can help, but air will also find its way in around pipes for hot and cold water as they come up through the floor, and around pipes for washing machines, dishwashers and sinks as they find their way back to the waste pipe. The more effective approach is to seal in the waste-pipe properly.

Downstairs: The pipe usually connects with the sewer in the back gardens through the floor. The junction between the pipe and the floor is not usually draughty, but in some homes the waste pipe is in an outside cupboard. If the ceiling of the garden cupboard is not sealed air-tight around the pipe, cold air can travel up into the kitchen floor—adding to the cold air from the loft and elsewhere—and out underneath and around kitchen units.

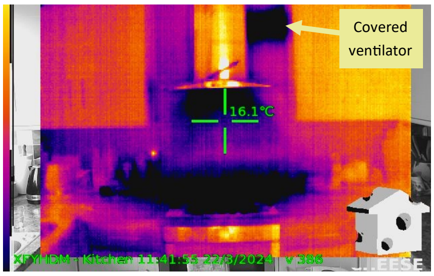
5.1 Ventilation fans

Common

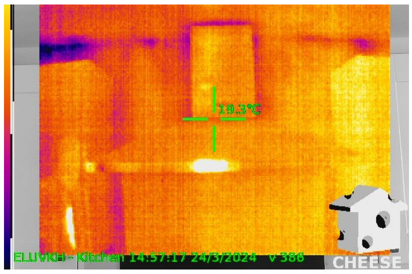
Ventilation penetrations are another common source of air leakage on the Henbury Hill estate. Typical examples include cooker hoods, extractor fans and boiler flues.

Cooker hoods

Cooker hoods work in one of two ways; some circulate air internally, trapping grease and other particles in a filter. Others have a fan blowing air out of the house through a hole in the wall and can be very draughty if there is nothing to stop backdraught when the fan is not working. The photos are both of hoods with a hole in the wall for the exhaust; one shows air pouring in and cooling the hob below. The other has a shutter that you can hear clunk shut when the hood is switched off. The same hood can often be changed from external extraction to internal filtration, in which case the hole in the wall can be filled.



Ineffective closure lets in cold air


A hood with an effective closure

Extractor fans

Ventilation fans, whether in windows, walls or ceilings, also create air leakage if the devices intended to stop backdraught are not fitted, or are not working properly. Sometimes the louvres on the outside are missing entirely, or have got blocked with leaves or moss, or lack lubrication and are not moving freely enough to close tightly and stop draughts. Ventilation fans may have been required by building regulations, but they may not be needed to manage humidity if the number of people living in the house has reduced or if enough air is infiltrating from elsewhere. It may be possible to remove or temporarily cover them for greater warmth. To test, tape a plastic bag over the fan to see what effect any changes would have.


Kitchen fan cools the window

Boiler flues

Gaps between boiler flues and the wall should be sealed with mortar to prevent exhaust gases and cold air coming back into the house. There is usually a thin plastic shroud around the flue at the wall which hides the gap, but it is not designed to be airtight and is only there for appearances. It is not present in the picture.


A huge hole around a boiler flue that was letting in a lot of air. This isn't on the Henbury Hill estate, but many flues have smaller gaps which should be filled with mortar, (a mix of sand and cement).

Draughts v ventilation

According to the Energy Savings Trust :

"Draught-proofing is one of the cheapest and most effective ways to save energy – and money – in any type of building.
Controlled ventilation helps reduce condensation and damp, by letting fresh air in when needed. However, draughts are uncontrolled: they let in too much cold air and waste too much heat".

www.energysavingtrust.org.uk/advice/draught-proofing

All buildings need ventilation, but most have too much, or it's in the wrong places. The most modern and energy-efficient Passivhaus designs (Passive houses) are effectively built within giant plastic bags, the idea being to cut out every draught. Great care is taken to make sure there is nowhere for air to leak inside. Some companies help make buildings more airtight by blowing a pressurised mist of plastic inside. As it finds its way to the outside, it sets hard, sealing small cracks and gaps and dramatically improving air tightness.

Draughts are neither healthy nor necessary. But controllable ventilation is essential. Requirements are set out in *Building Regulation Approved Document 'F': Ventilation*.

Passive houses are so efficient they don't require any heating in addition to that derived directly from the sun and that is produced by cooking, lighting and from body heat. Fresh air is introduced through an energy-efficient system of Mechanical Ventilation with Heat Recovery (MVHR) which warms the cooler, fresh air being brought in with the heat from the warm, moist air that is being expelled. Small MVHR fans are available and are designed to replace the old-fashioned extractor fans found in many of our kitchens and bathrooms.

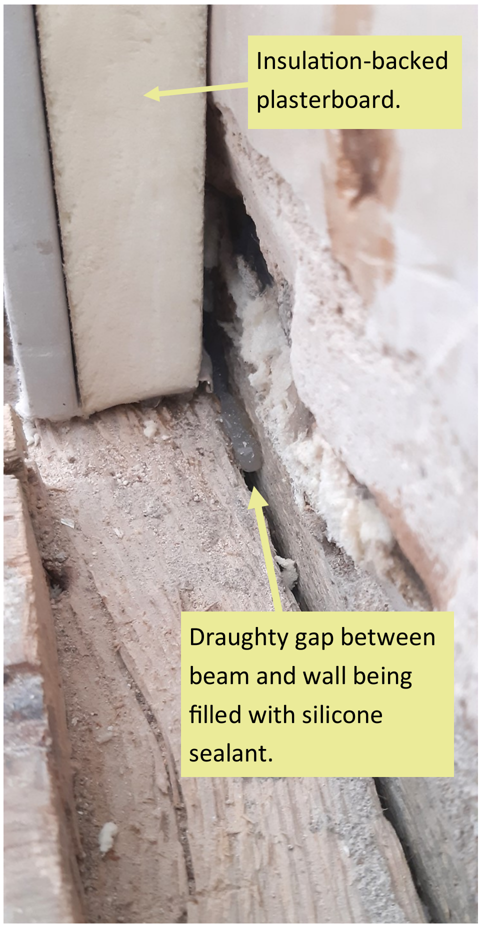
Controllable ventilation is very important for all sorts of reasons, but most homes are just too draughty and let in more air than is necessary.

c. 15% of heat loss is caused by draughts

A small MVHR extractor fan suitable for one room.

6. Draughty skirting boards on upper floors

Universal

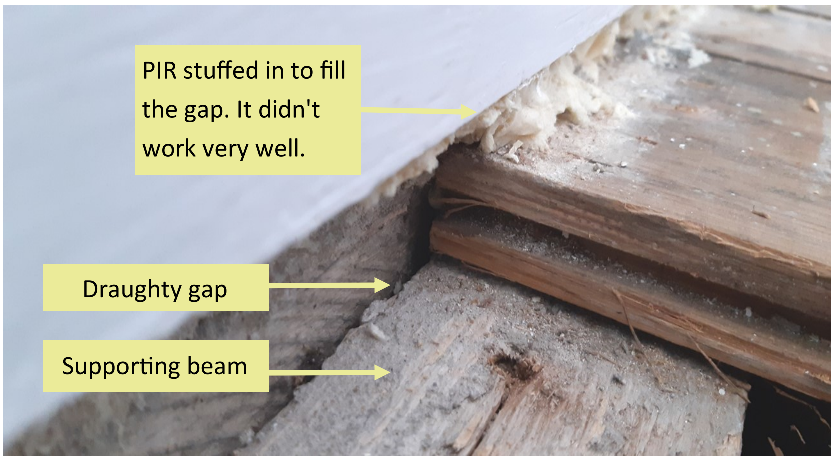


All the homes that were surveyed had cold air coming up underneath skirting boards, and the surveys showed that the strength of the draughts vary from house to house. Air can get into the upper floors from the boxing around the soil pipe, gaps in the garage ceiling, gaps in the mortar between the concrete blocks in the walls and around the joists where they are built into the inner-skin of cavity walls.

The photographs show top floor floorboards resting on a wooden beam that is fixed to an outside wall. There is a gap between the beam and the wall which lets cold air in underneath the skirting board, (the skirting is not shown in the photos).

The gap can be filled with mastic or silicone sealant. The photos also show internal wall insulation being fitted to insulate the wall.

Floorboards were originally tongue and groove; this helps block out draughts, but if they are raised, gaps can open up. Carpet and underlay are useful insulators and draft-proofers.



Join between floorboards and wall showing the gap between supporting beam and wall (which is draughty)

Do you use a lot of fuel?

Many factors affect fuel consumption and each household will use energy differently, but the range of use from the 12 sample homes shows that consumption is not set in stone or fixed by external forces and that we can influence the amount we use.

Keep warm, keep well: If there are reasons we need to be especially careful about keeping warm, the Government recommends we keep our homes to a minimum of 18 degrees.

Kilowatt hours per year	GAS (kWh)	ELECTRICITY (kWh)
Average per house	7,265	2,391
Highest consumption (house) (From estimated readings)	14,403	5,776 (with electric car)
Lowest consumption (house)	1,070	393 (with PV panels)
Annual average per adult	3,658	988
Highest annual use per adult	10,925	1,925
Lowest annual use per adult	1,070	393

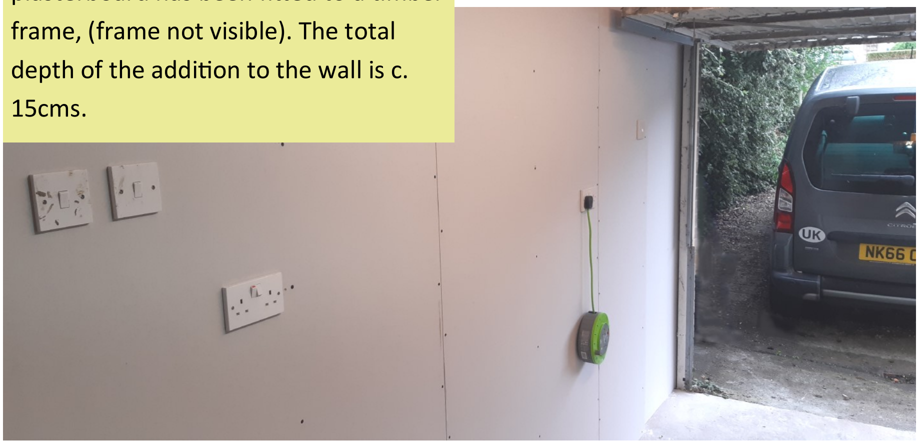
Some commentators describe home energy as 'invisible'; we tend to focus on things we plug in or switch on, even though 'hidden' uses like water and space heating consume much more power. Some in the sample did not know how much energy they were using or even the less-accurate estimate provided by their energy company. This makes it more difficult to monitor changes and manage costs because the biggest uses may be hidden, especially where dual-fuel contracts obscure the split between gas and electricity use.

The warmer, wetter winters and hotter, drier summers with the increased frequency of the intense weather events we are now experiencing are exactly what climate scientists predicted would result from failure to reduce greenhouse gas emissions. Powering homes accounts for c.13% of the UK's greenhouse gas emissions, (ONS, Mar 24) but potentially a larger proportion of our own personal liabilities. Improving draughtproofing and insulation is certainly one of the best ways for most homeowners to reduce their carbon pollution, given the extra comfort and financial benefits that will be achieved at the same time.

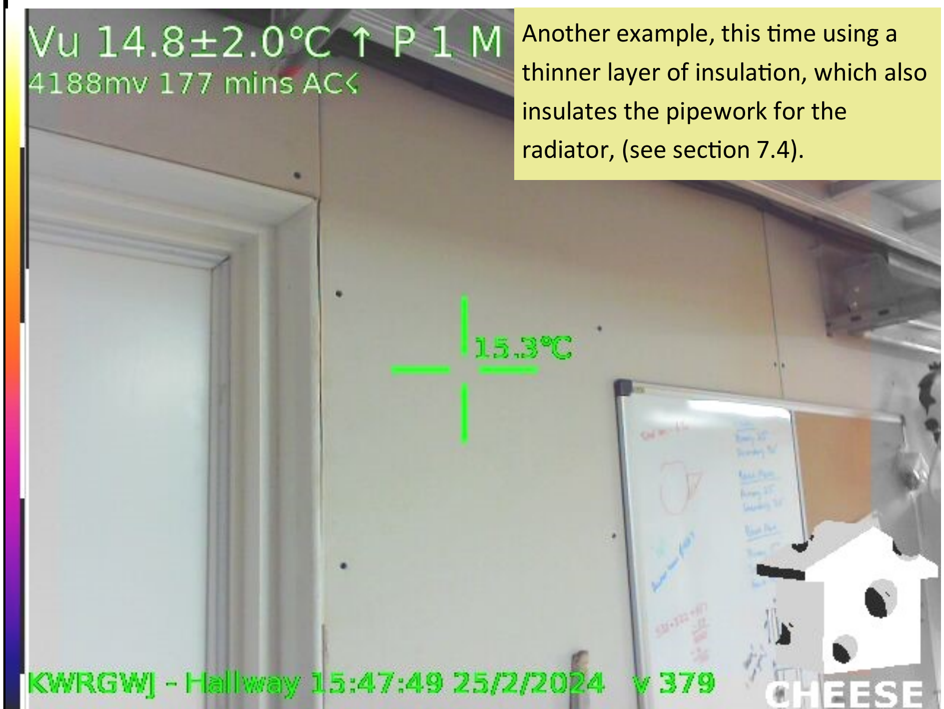
7. Internal garage

7.0 Thin, single-skin walls

Common



100mm PIR insulation board being installed onto the hall wall, halfway through the job (above) and once plasterboard has been fitted to a timber frame, (frame not visible). The total depth of the addition to the wall is c. 15cms.



Another example, this time using a thinner layer of insulation, which also insulates the pipework for the radiator, (see section 7.4).

Two garage walls (hall-side and rear) are built from a single layer of standard bricks, laid end to end. The total depth of the walls is therefore the width (not length) of the brick—around 10cms. This is extremely thin for an external wall and means heat will be lost from the heated hall into the unheated garage relatively quickly.

Conversion to living space should solve this problem if the wall replacing the up-and-over garage door is built to modern standards. But without conversion, and left untreated, rapid heat loss from the hall will occur to the sheltered but unheated (and usually very draughty) garage.

Insulation can also be added to the inside face of the hall and back-room walls. In the hall, this is complicated by the need to remove the radiator, but may be practical in some circumstances.

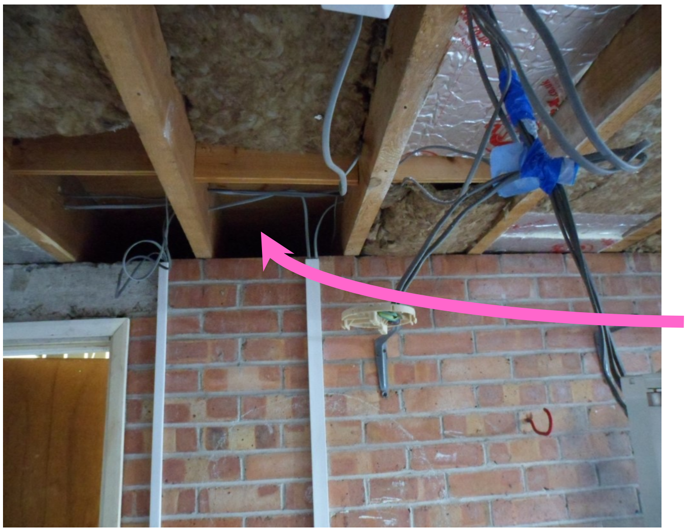
7.1 Uninsulated garage ceiling — Common

Garage ceiling with boards removed

As built, the ceilings of the garages are uninsulated. Heat from the lounge above will be lost into this space.

Lifted lounge floorboards to install insulation

The photo (arrowed) shows the haphazard installation of rockwool loft insulation and PIR insulation board, without the recommended use of tape to seal the edges of the PIR against the joists. Insulation is probably better done from above because it is easier to align the top of the insulation with the top of the joists. But this means lifting the floorboards in the lounge.



The joists are supported on the single-skin brick wall. Between the joists, there is nothing to stop draughts that come through gaps in the garage ceiling from getting into the floor/ceiling, where they will cool the rooms above and the hall below.

7.2 Unsealed garage ceiling — Common

A tightly sealed garage ceiling.

The ceiling board / wall gaps are not sealed

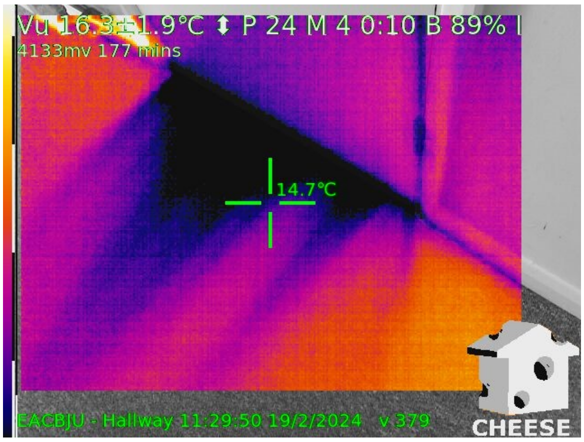
Holes and gaps in the garage ceiling let cold air into the sitting room and hall floors, from where it finds its way under the skirting boards—and sometimes through gaps in the floorboards— into the lounge. A well-finished garage ceiling will help stop this. As draughts will find their way, so too will any polluting chemicals that may have been released in the garage.

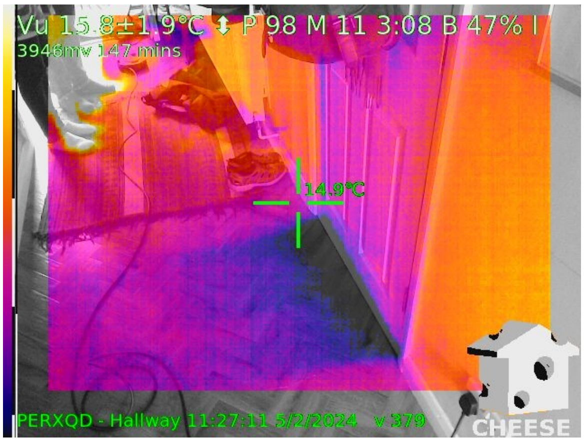
A skim of plaster is often applied to finish the ceilings, but visible gaps can also be filled with a mastic or silicone sealant.

The original ceiling boards contain asbestos.

7.3 Draughty internal garage door

Universal





The photos above show the typical pattern of cold air coming in along the bottom of the garage door. All garage doors in the survey were draughty, unless the garage had been converted to a room. Draughtproofing measures such as foam tapes and rubber seals can be used to reduce draughts around the door, and draught-excluding brushes can be applied to the bottom edge. Further measures include hanging a curtain on the garage-side and fixing insulation to the back of the door to reduce heat loss into the garage. The photos concentrate on the bottom edge because these create the best thermal images as the cold air cools the floor, but draughts around the other sides are very common.

7.4 Uninsulated central heating pipes

Common

Uninsulated central heating pipes in the garage lose heat destined for the hall radiators before it gets to where it is wanted. The best option is to relocate the pipework onto the warm side, but this is a relatively big job and will probably only be undertaken along with other works to the central heating or plumbing. Foam pipe insulation is widely available and will help reduce heat loss. If the pipes are too close to the wall, thinner foil pipe-wrap products are also available to wrap around the pipework. Other options to increase the heat reaching the radiator include boxing-in the pipes and insulating the box, or covering the pipes when insulating the wall, (see 7.0).

7.5 Uninsulated concrete floor

Common

None of the homes surveyed had the concrete floor insulated to modern standards. The construction, while typical and common for the 1950s and 1960s, is now well out of date. The four inches of solid concrete specified on the original designs will conduct heat well, and so the floor can act as a ‘heat sink’, pulling warmth out of the hall and ground floor rooms and making the floor feel relatively cold to the touch. Modern floors include a significant depth (usually at least 100mm) of solid insulation.

None of the original thermoplastic tiles remain in the sample homes; they have been replaced with a variety of finishes all of which make a thermal improvement to the original 3mm hard plastic tiles that were fixed directly to the concrete. Warmer floor-surfacing materials include underlays such as fibre board, foam rolls, felt underlay and foil products. Overlays including cork, carpet or carpet tiles and insulated laminate also help keep feet feeling warmer.

New cork floor

8. Walls and windows

Mid-terrace SPAN style homes are likely to lose more heat through the windows than the walls.

Which loses more heat? Walls or windows? Many homeowners were interested in having wall insulation installed, but tackling the windows first may have more effect. Standards for windows were significantly improved in 2022 and all new windows will lose and gain (from the sun) less heat than older ones.

U-values are a measure of how well a material conducts heat. A lower U-value means better insulation. Energy transfers (in watts) increase with the U-value, the area of the surface and the temperature difference on either side of the surface.

You can estimate if the windows or walls are a bigger problem in your house by measuring their areas, finding the correct U-values and using the formula in the box below. Making accurate calculations is very complicated, but this will give you a rough guide.

Energy transfer (in watts) = temperature difference (^{o}C or ^{o}K) x area (m^2) x the U-value.

Clad walls. For heat loss calculations, the air behind the cladding is a 'well-ventilated' air space where the air is assumed to have the same temperature as the outside air—it offers no thermal resistance. But it does provide some shelter from the wind, and this is included in the U-value estimations provided. The area of front and back wall on a shiplap clad home is approximately 22m^2, slightly less than on the older single-skin houses that are usually tile-clad.

Windows. Heat loss through glass is generally higher than through walls and the townhouses have large areas of glass—in some cases exceeding the current limit of 25% of the floor area. To meet current standards, new windows may use triple glazing, low emissivity coatings, well-insulated frames and wide gaps filled with inert gas between the panes, as well as improvements to construction and installation.

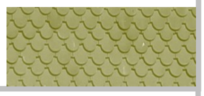
An example

With a 10 degree temperature difference between inside and outside, a mid-terrace home with a narrow cavity (usually shiplap cladded) with old double glazing will gain or lose—continuously—c. **152 watts** through the walls (10 degrees x 22 m^2 x 0.69 wm^2/k) and c. **725 watts** (10 degrees x 29m^2 x 2.5 wm^2/k) through the windows. For context, it may help to imagine a single bar of an old electric heater which uses about 1,000w of power.

These figures are based on simplified calculations to produce an estimate and should be checked if they are used to inform investment decisions.

Most walls clad in green tiles are made from a single skin of concrete block with the tiles attached to battens. Lightweight blocks have better thermal performance than denser blocks and the value assumes their use; depth is not verified but is assumed to be 90mm.

Approximate U-value = 1.04 wm^2/k



Twin-skin (cavity) walls are more common on homes with shiplap cladding and have a narrow cavity of c. 50mm. The U-value assumes the inner leaf is a lightweight concrete block of (90mm or 3 5/8 in), the same as the outer leaf, (see photo on page 24).

Approximate U-value = 0.69 wm^2/k

Side walls that end the blocks of four houses have a 50mm cavity and two skins, the outer is obviously brick and the inner leaf construction material is assumed to be 90mm concrete block.

Approximate U-value = 1.0 wm^2/k

Wall U-value calculator: https://www.vesma.com/tutorial/uvalue01/uvalue01.htm

Type of double glazing	U-value
Double-glazing (low-E, εn = 0.15, air filled) 16mm gap between panes	2.5
Triple-glazing (low-E, εn = 0.15), 16mm gap between panes	2.0
Triple-glazing (low-E, εn = 0.15, argon filled) 16mm gap between panes	1.8
2022 building regulations 'Notional Target', (NT) and the minimum 'Limiting Standard' (LS).	NT 1.2 LS 1.4
Passivhaus standard	0.8

Window U-values. Search SBSA Tables of U-values and thermal conductivity

8.1 Wall insulation

Insulating the cavity of end-terrace walls will achieve a continuous reduction in heat flow, perhaps in the region of 600w when the temperature difference is 10 degrees C or K. 600 watts of continuous heat loss equals 4.8Kwh in an 8-hour period. Double the temperature difference and you double the savings in winter and halve the heat gained in summer.

Two houses in the sample were end-of-block homes which have had the cavities in the sidewall filled. Others on Northover Road have had the front and back walls insulated with insulation panels fitted behind the cladding. But the space available limits the depth of insulation to 30-50mm, raising the question; would more heat loss be prevented for the same cost by replacing old double glazed windows? Details of costs, window areas and window and wall construction would be needed to make an accurate assessment. But particularly for those living in mid-terrace homes, the benefits of improving windows should be considered alongside wall insulation. Are better curtains a good place to start?

Looking into the empty cavity of a first floor wall under a window, facing Northover Road, (sill removed). Expanding foam has been used to fill the gap under the window frame and some has fallen into the cavity.

What's an EPC got to do with it?

Energy Performance Certificates (EPCs) provide an indication of the energy efficiency of a property, typically issued upon construction, sale, or rental. Introduced into the UK by the Energy Performance of Buildings Regulations (2007), EPCs play a role in informing homeowners, tenants, and prospective buyers about the energy performance of buildings.

However, EPCs may not always provide homeowners with an accurate impression of their home's energy consumption. Firstly, EPC ratings are based on standard assumptions about occupancy, heating patterns, and usage, which may not reflect individual household behaviours or specific features of the property. Secondly, EPC assessments rely on visual inspections rather than comprehensive energy audits, potentially overlooking nuances in building construction that

can significantly impact energy performance. And while EPC assessments take into account certain factors relating to insulation and building fabric, they do not thoroughly address issues such as draughts or air leakage, which can significantly affect energy consumption and comfort levels.

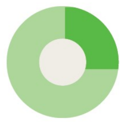
The average (median) EPC for dwellings in England and Wales is 68—or 'D', (2023). The EPCs were only available for seven homes in the sample producing an average of 65, slightly worse than the national average. But this is a small sample and some of the seven EPCs are over 10 years old. The highest score achieved was 71 (2 properties) the lowest, 51.
You can take a look at your EPC at:
www.gov.uk/find-energy-certificate

Healthy homes for a greener future

As a Community Interest Company, we are dedicated to providing concise and independent advice to homeowners like you so you can make informed decisions, reduce energy consumption, and contribute to a more sustainable future.

Expert Guidance

Our team, backed by the West of England Combined Authority and the Centre for Sustainable Energy, brings you expertise in planning, designing, and delivering energy-efficient home improvements. We guide you through every step of your retrofit journey.



25% of our home's heat is lost through the roof

40% of the UK's carbon emissions come from buildings

Comprehensive Service

From the initial consultation to finding the best services and installers, we've got you covered. Our comprehensive service package includes impartial expert advice, quality assurance, and a commitment to ensuring your retrofit project meets the highest standards.

What Next?

There are several DIY solutions for your home that you can implement to start saving energy. Speak to the Retrofit West advice team on how to start your retrofit journey today.

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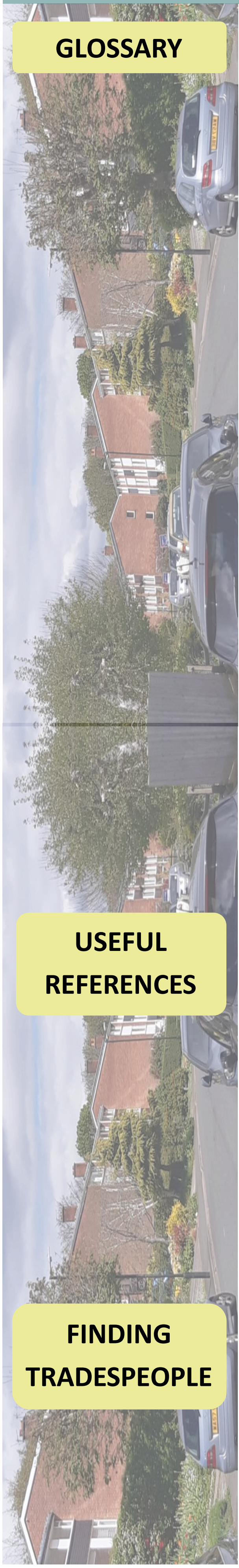

GLOSSARY

Building Regulations	Some works to buildings are controlled by standards and rules called Building Regulations. www.gov.uk/guidance/building-regulations-and-approved-documents-index
C.I.C.	Community Interest Company. One type of organisation that operates on a not for profit basis.
Eaves	The eaves are the part of the roof which overhang the walls.
MVHR	Mechanical Ventilation (usually a fan) with Heat Recovery (a heat exchanger). Helps recycle the heat from the stale air being expelled.
Polyisocyanurate (PIR) insulation board.	A commonly used insulation material that has low thermal conductivity. PIR is highly effective, but oil derived. Wood-fibre alternatives exist.
Shiplap cladding	A style of wall covering used on many homes at Henbury Hill featuring interlocking pieces.
Tongue and groove	Tongue and groove floorboards help reduce draughts.
U-value (w/m²·°C)	The unit of thermal transmittance. The lower the U-value, the better the material is as an insulator.
Wall ties	Used to link together the two skins of a cavity wall, the ties can act as thermal bridges.

USEFUL REFERENCES

www.cheeseproject.co.uk. The CHEESE Project CIC has a useful list of "resources for taking action" including 'moisture guidance' and 'best practice on external and internal solid wall insulation' from a variety of sources including Bristol City Council and the UK Government.

www.cse.org.uk/resource/home-energy-fact-sheets. A comprehensive list of guidance and information notes on all sorts of home insulation issues.

https://energysavingtrust.org.uk/energy-at-home/reducing-home-heat loss. The Energy Savings Trust is an authoritative source of advice and guidance.

FINDING TRADESPEOPLE

It can be difficult to find people interested in taking on the smaller jobs, but it might be worth investigating those registered with Trustmark, the only Government-backed quality assurance scheme. **www.trustmark.org.uk/homeowner**
The Green Register lists construction professionals skilled in sustainable building practices. **www.greenregister.org.uk/the-register/**
We Care and Repair provides a handyperson service for those over 60 or disabled. They also have a small fund for a free emergency service for those who cannot pay. **https://wecr.org.uk/**

Top Tips

Every thermal survey revealed areas of heat loss that homeowners were unaware of, even in some cases after 30 years of residency. Surveys are a very helpful way to draw up the (usually long!) list of opportunities to improve comfort levels, including simple jobs that will only take minutes, to bigger jobs that will take longer. Having the list helps most homeowners to plan and prioritise.

The information in this report should make it possible for most owners of townhouses on the Henbury Hill estate to make some improvements without having a survey carried out, based on the common thermal characteristics of the buildings. A visual check for common findings will probably identify many simple actions that will make a difference. It is important to attend to the small jobs—which on their own may seem insignificant— because the cumulative effect of lots of small improvements will equate to filling a sizeable 'hole'.

The following tips are drawn from the findings of the sample surveys. You can find many other lists of generic energy-saving tips on the internet, for example the Centre for Sustainable Energy's fact sheets about insulation and ventilation: **www.cse.org.uk/resource/home-energy-fact-sheets/**

In no particular order:

- Check your rubber seals and/or get windows serviced, (page 9);
- Check that backdraught prevention on ventilation fans is present and working, (page 13);
- Find out how many kWhs of energy you are using;
- Make sure the loft hatch is properly insulated and draft proofing on the internal garage door is effective, (pages 5 and 19);
- Fit a heavy curtain in-front of thin external doors to cut out draughts and keep in heat, (Page 9);
- Fill-in letterboxes and replace with an external, wall-mounted, lockable box;
- Check rockwool loft insulation is at the recommended minimum depth of 270mm and top up if necessary, (page 6), and
- Fill in the hole in the ceiling around the waste pipe and any holes in the ceilings of the airing cupboards on the top floor.

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www.makeitwild.co.uk