Beginners Guide to Eco Renovation

Understand the basics and the best questions to ask

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Chapter Six - Insulating your home

If you'd told me two years ago that I'd be utterly fascinated by insulation, I'd have thought you were bonkers. Now I can't think of anything more exciting to talk about.

Insulation is the baseline for an eco home of any sort. The task is to create heat in the most environmentally friendly way possible, then hold onto it – and insulation is a key part of making this possible.

There are three main areas that need insulation:

- Walls
- Floors
- Loft

Each one will make a real difference to the warmth in your house and the amount of energy you use. If you can do all three, then even better.

Three terms to understand before exploring your options in terms of insulation:

- The importance of airtightness.
- Knowing what a thermal bridge is
- Understanding U values

Airtightness

Let's start with airtightness. We made the assumption that insulation would create a cosy layer to keep the house warm and also be key to cutting out the many draughts that plague old houses like ours. Sadly this is only half true.

Insulation and airtightness go together - you need both. I'll talk about airtightness more in chapter 7 so please read it alongside this one before you get going. Suffice it to say that insulation on its own won't make you airtight. That depends on how the insulation is installed. No matter how tightly insulation materials are fitted together some air will come through unless everything is sealed up.

In our front room we spent many hours putting in the underfloor insulation (described below). We then laid the original floorboards back over the top in preparation for that wonderful day when the new carpet would go down. Fortunately I was able to arrange an airtightness test before that happened and we soon discovered that despite our best efforts there were draughts coming up between the floor boards. It was a very depressing moment, but a good lesson in understanding how different airtightness is. And we had time to go back and sort it all out.

What is a thermal bridge

Which brings us neatly onto thermal bridges. You'll hear the phrase banded around a lot and it can take a while to work out what builders/architects are referring to.

A **thermal bridge**, also called a **cold bridge**, **heat bridge**, or **thermal bypass**, refers to an area that conducts heat more easily than the surrounding materials. This means that overall the area will lose more heat that would be expected and need more heat to keep the space warm. It may also produce condensation as warm air hits the cold surface/thermal bridge. So to take really good care of these areas when insulating.

Reasons for a thermal bridge are:

- a break in insulation
- less insulation than the surrounding area
- an exposed metal surface without insulation.

A good example was lagging the water pipes in our kitchen. Pipe insulation materials had been put around the front of the warm pipes which gave some protection, but not at the back where they butted up against the cold wall. This meant there was a cold bridge unprotected by a warm material.

Another place was along the steel that holds up the original edge of the house. We had been very concerned that there wasn't enough insulation along the steel, leaving a cold surface underneath the plaster that would draw the warm air away. In fact, we were able to check out with the thermal imaging camera (see below) and found that it was nice and warm, so no thermal bridge after all.

Understanding U values

U value tells you how effective your insulation will be.

The U-value measures the heat lost through a given thickness of each material. You don't need to know how it's calculated or have an in-depth knowledge. All you need to know is that lower is best. Once you know that then you can determine if the material of your choice will give the results you're looking for. To give you a clue as to the standards, building regulations for new builds currently expect maximum U-values of:

- Walls – 0.3 W/m2K
- Roof – 0.15 W/m2K
- Windows - 1.6 W/m2K

The measure is: watts per metre squared ie W/m2K. The K refers to a Kelvin which is a base unit of temperature. I can say that because I've looked it up. If you need to understand in more depth, please do the same yourself. I am totally out of my depth now!

To give an example:

- An uninsulated 225 mm solid brick wall will have a U value of **2.7 W/m2K.**
- Add 120mm of wood fibre insulation and this comes down to **0.29 W/m2K**

This is why it's worth insulating wherever you can.

R value – this is the other measure that comes up when researching insulation. In fact, U value and R value are very similar, but measure from the opposite direction. While U value measures the rate of heat transfer, R value measures the ability of the material to block heat transfer. So as the R value goes up, the U value goes down. Please don't ask me why there are two measures saying roughly the same thing, but I do suggest looking into it further when it's relevant to your choices.

TYPES OF INSULATION

The exact amount of insulation needed to achieve a lower U value will depend on the material you use. There are a number of options to choose from with the main point of difference being the method of manufacture and the impact this has on the environment.

The most commonly used insulation is not the most environmentally friendly, so this is the moment to refer to your touchstone. Once you are clear on your priorities – environment or budget – then you can review the different options available in your chosen area.

Environmentally friendly materials

To be environmentally friendly the mostly commonly used materials are made from wood fibre board. It's a robust and flexible insulation that can be used for floors, roofs and walls. It is recyclable, locks in carbon as it grows and is relatively free of pollutants. It also has low U values and is 100% compostable and recyclable at the end of its life. This is always a major question for me – will it rot down at the end of the day? If it won't then however good it is now, it's going to cost the earth in the end.

There are other benefits to wood fibre board. It gives high levels of noise insulation, so if you have noisy neighbours (or you are noisy neighbours) it will work well on adjoining walls, having 6 to 12 times the density of synthetic options. Surprisingly it also gives an added level of fire safety and reduces humidity so helps to prevent dampness. So this is the best option for the environment.

There are other environmental options. Sheep's wool is a good one since sheep need to be sheared at least once a year and often the fleeces go to waste. There is the argument that encouraging meat production is bad for the earth, which is well proven. However if it is being produced then it makes little sense not to use the waste materials. That it is organic also means that it will rot down at the end of its life.

Other options are**:** cork, straw, hemp, jute – there is even insulation made from old denim jeans! So there is no shortage of options, it just takes some time to go exploring and researching to make sure you know what you are doing.

Sort of environmentally friendly

Another insulation material that can be used is mineral wool - rock / stone/ glass wool. It is made from molten rock combined with a binder and a small amount of oil. It is exposed to very high temperatures during production making it highly non-flammable.

In terms of the environment, mineral wool isn't as friendly as wood fibre, but much better than oil based synthetics. It is also less expensive than wood fibre, so could be a good choice if you're concerned about both environment and budget. They come in soft batts or hard boards, similar to wood fibre, so can be used in all the same situations: roof spaces, walls and suspended floors. It can also be tightly packed to reduce draughts and it is both non-combustible and resistant to rot.

The downside of mineral wool is that the main material does need to be quarried. If it gets wet the thermal conductivity is increased so it becomes less efficient plus a lot of energy is required to produce it.

Not environmentally friendly

PIR is the most commonly used insulation board and has better fire performance than PUR which is a similar material . You'll recognise PIR by the silver 'tin foil' style coating on the outside and you'll see it on most building sites. PIR is [JP1] made from petrochemical substances, so not well liked by those with an eye to the earth. During production, emissions are released into air and water, as well as creating hazardous waste and it has high embodied energy i.e. it takes a lot of energy in production.

Very important is the fact that, should the material catch fire, higher levels of toxic gas will be produced than with other insulation materials and it is considered to pose a real danger to health and environment.

If budget is a big issue, then PIR is cheaper than other options and it is easily available. It can be used in a house with cavity walls, but its lack of breathability makes it a poor match for old single breathable brick constructions. It is OK for walls, but its rigidity makes it less useful in lofts and under suspended floors, since it can't be packed closely together and it may shift over time producing gaps for draughts to come through.

Which material to use

In terms of choices, the first and most important is to insulate. This will make a real difference to your comfort, your bills, your carbon footprint and your kids future.

If your budget is limited and your only option is to use PIR then go for it - much better then not insulating at all. However, if you can also use environmentally friendly materials, you will do even more for the earth, so your carbon footprint and your kids will thank you in the long run.

INSULATING WALLS

Because environment is important to us, we asked our architect to keep this in mind when designing our extension. His recommendation was to use Pavaflex – a wood fibre insulation that comes in flexible batts (large oblongs of fibre) plus rigid boards of Isolair that is the wood fibre equivalent of plasterboard. We then decided to stick with it as we worked our way back through the house.

We found out about these products by speaking with the technical people at Ecological Building Systems (link) and Unity Lime (Link). They were very helpful and remarkably balanced in their view despite the fact that they were also selling the products and we got to know their experts pretty well by the time we'd finished.

The structure outlined for our extension, which we continued through most of the house, was to build a timber frame on the inside of the wall with pieces of timber which allowed for individual batts of 80mm thickness to be placed into each gap. The final layer of 40mm rigid Isolair in place of standard plasterboard finished the construction and together it provided 120mm of insulation. All this makes the house feel very cosy indeed.

If you do decide to go with PIR, it can be attached directly to the wall with either adhesive glue or insulation anchors (screws with a big circular plastic head). By the way, if you have any issues with penetrating damp, make sure these are dealt with before adding this type of insulation, because it will only make the damp worse and the moisture will downgrade the insulation.

Quality control

Once the materials were chosen and the wood frame for the insulation was constructed, inserting the pavaflex wasn't rocket science and was something we could do ourselves. Cutting the batts requires a saw but is very light work and the wooden frame holds them safely in place. It does require a sense of perfection because each gap or missed angle means more draughts and cold spots, so it was important to get it right. We became adept at putting the jigsaw together and stuffing each gap with little bits of the wood fibre.

If your builders are not familiar with the material or you want really high levels of insulation it may be worth keeping an eye out at this point. You can easily make good on your own and half an hour stuffing gaps can be really satisfying at the end of a long and dusty day.

Plastering – the final layer

Since Pavaflex and Isolair are breathable materials, they need to be covered with lime plaster, which is also breathable. (See chapter 8) It doesn't look very different, just slightly more rustic in finish. The downside is that it takes a number of coats to complete, with drying time in between, so it is a longer job overall. As long as this is

scheduled into the programme it's not a problem. Once finished it behaves as ordinary plaster in all but one area – the paint you use must also be breathable. (see chapter 13)

Once you've found a lime plasterer that is. If anyone reading this is looking for a new profession or specialism, this could be just the thing. There are specialists out there, but they tend to focus on proper old grade 1 listed buildings, not just slightly old like Victorian; and big renovations, not just small ones like ours. The demand is sure to increase, so there will soon be a regular flow of work looking for a provider.

Anyone know a lime plasterer?

I had no idea there were different kinds of plaster until some wise soul thought to tell us we needed lime plaster on our breathable insulation. First reaction was to get onto the web and go looking for someone to help us. Only when the pages came up blank did we begin to suspect what was to come.

Lime is always needed in really old houses – stately homes, Shakespearian cottages – you know the sort of thing. Sexy, interesting work that takes up months at a time. Enter the owner of a 'young' Victorian terrace with just a few walls that need doing and the level of interest drops off the chart.

We were right up against the wire with the arrival of the kitchen looming and the time necessary for the lime to be applied and dried reducing. Christmas was on the horizon, so little sun or warmth to rely on and we were getting desperate. I was so fed up of cooking in one square metre in a building yard, I really wanted us to move on.

We finally sorted it with the help of our kitchen provider (Link). Turns out someone's son had a friend who did lime and he was willing to take us on. Overall it went well. It does take longer and Matthew soon felt like a family member. So if you're on for the environmental approach, start looking from the outset – this definitely isn't one to get caught out on.

Insulating cavity walls

Houses built from 1920 onwards are likely to be built with cavity walls. This is a double skin of bricks with a gap in between, designed to prevent problems with damp. The cavity stops moisture from the outside entering the inside of a building, and helps the water drain back out of the wall again.

If your house was built after 1970 there is a chance that the cavity will automatically have been filled with insulation. If built in the 1990's then it was compulsory. However it is important to keep an eye on it, because some types of insulation will settle or DIY work may create holes that disturb the materials, creating cold bridges.

Polystyrene balls have been used to fill cavity walls in recent years. It is more insulative than anything else and has a low U value, so a good choice. It will also tell you straight away if the cavity is breached by DIY work, because balls dribble out of the wall!

Wood fibre can be blown into the cavity as a good environmental option.

Spray foam insulation needs careful thought and research. In the first 24 hours while it cures, toxic gases are given off so occupants need to vacate the house while this process takes place. However there are also some foams that continue to give off toxic fumes that can cause asthma and other breathing difficulties. So please ask questions and find out **more** before agreeing to its use.

WORD OF CAUTION about spray foam – it's extremely difficult to remove and mortgage/insurance companies don't always like it. This is especially true in lofts where it gets stuck around the roof timbers and causes problems. The foam can trap dampness, which can then lead to mould and rot, so unless you are completely certain you can keep it dry it would be worth looking into different options.

Interesting fact: If you live in a terraced house with cavity walls make sure to insulate the adjoining wall. Where the party wall is an uninsulated cavity wall it can create a Thermal Bypass Effect which means that the cavity acts like a chimney and carries heat out of the house.

If you need to insulate for acoustics please remember that natural materials have much better acoustic qualities so go for wood fibre.

Insulating irregular walls - discovering Diathonite.

There are always going to be occasions when the shape of the wall or design of the space won't allow for a wood frame system. Which was exactly the situation with the traditional Victorian bay window in our front room.

To put the same depth of insulation around the window would have impacted the room size and taken away the distinctive shape of the bay. It was a challenge for a long time.

In moments of frustration we even discussed not doing that room at all. Fortunately my perfectionist side kicked in and I went on the hunt for a solution. It had to be possible.

Clare Nash, an architect in Oxford, kindly responded to my rather desperate email. After long, unproductive discussions with every professional we could think of, I took a punt and wrote to her. She had given a talk to Sustainable St Albans (link) so I knew she was a keen environmentalist. Thankfully, she was generous enough to respond and tell me about **Diathonite** – a thermal plaster that copes well with corners and angles.

The beauty of Diathonite is that it can easily vary in thickness, so we could have maximum thickness on flat walls and reduce the thickness in order to maintain the corners of the bay. The biggest problem was finding the right expert – it is applied by lime plasterers. Need I say more!

The first step was to remove the old lime plaster and get back to the bare brick. The original coving would also have to be removed, so we sought out a specialist who could make a template before it came down. The final pre-work was to build a deeper frame to the bay window to accommodate the increased depth of wall once the thicker Diathonite was in place.

The specialist plasterers trowelled on the Diathonite in three layers, which meant it was no problem to shade the thickness in different areas. It took a few days of waiting for each layer to dry before the next one could be applied. Finally they put a fine skim of finishing lime plaster to give a smooth surface.

We are delighted with the end result. Our desire to retain the bay window did cost us something in thermal efficiency. No fault of Diathonite. It was our choice to reduce thickness in order to retain the shape. So while the bulk of the walls have a thickness of 60mm, around the window it is down to 40mm.

External insulation – Sometimes it is easier to insulate the outside of a property to avoid internal disruption and loss of space in the relevant rooms. The choice of insulation material is the same as for inside: wood fibre, mineral wool or PIR.

The usual method would be to fix rigid boards to the wall – tongue and groove to prevent any gaps – or to use insulating render such as cork. Diathonite is also produced in an external form.

If you're considering external wall insulation you'll need to take account of water vapour in order not to create damp problems in the future. You can do this either by using breathable materials or creating a continuous vapour barrier to make sure no moisture gets into the wall from outside.
If external insulation might be an option for you, this looks like an interesting article with plenty of information. It clearly isn't totally straightforward, so make sure to find out as much as you can about it before reaching your decision.

INSULATING FLOORS

Cutting out the cold from beneath the floor (the sub floor void) has been a game changer in our house. I know the prospect of moving all the furniture and getting in amongst the floorboards is daunting, but I guarantee it will be worth it. So please do include this in your plans for home insulation.

How you go about it will depend on the type of floor you are dealing with:

Concrete floors

In the new extension we have a concrete block & beam floor. By its nature concrete is freezing so must beinsulated to reduce cold coming up from the floor and to stop it leaching heat from the house. This is a standard construction method:

- Concrete/block & beam is laid and allowed to dry.
- Rigid insulation is laid on top of the concrete to form a barrier between the cold of the concrete and the room/heat of the pipes
- Underfloor Heating pipes (if you have having them) are laid on top of the insulation
- A screed is put on top of the insulation/pipes to protect them and to provide a smooth, flat surface for the floor.

Given the need for a thin, rigid insulation, we did in fact go for 100mm of PIR here – in this case Kingspan. We since discovered that Passive Haus recommends 200mm

NB if you have a concrete floor that you can't now insulate (and you don't have UFH), putting down a good thick rug with a rubber underlay will help keep the heat in the room.

Suspended wood floors

Suspended floors are common in any house built before the 1960's so we have them in all the original parts of our 1901 house.

The walls of our house are built on very shallow foundations that are just slightly wider than the thickness of the walls themselves. In between walls there are joists and floorboards and underneath them is basic earth. Slightly alarming when I first saw it, I must say.

Wooden joists run between the walls and, when covered with floorboards, they form the floor we walk on. The cavity beneath the floor - the sub floor void - needs continuous air flow to avoid damp and condensation, which is great for the health of the building, but desperate in terms of draughts coming up through the floor and making the rooms cold.

So adding insulation is a must and now we've done it, I think it might be one of the most significant alterations we made. No more cold feet when watching the TV at night and no more rampant draughts rushing through the house.

The conventional way would be for the builder to fix PIR between the joists. There is plenty of literature and YouTube videos on how to do this, if you want to do it yourself. However PIR really isn't the best option for a suspended floor. In any floor there is will be movement and with old houses in particular the gaps between the joists are unlikely to be even. The rigidity of PIR means it can't mould itself to the space plus as time goes by it will settle leaving gaps in the insulation.

Given our priority was to be more Eco, we continued with our plan to use wood fibre batts. Turns out this is also the best option for floors because it is highly flexible and can be stuffed into the space really tightly to block any gaps.

We decided to do this part of the job ourselves. This was partly out of a need to make sure it was done really thoroughly and to save some money, but also that we felt ready to get our hands dirty – for the first hour anyway! The level of underfloor insulation we wanted was going beyond what our builders expected and we wanted to make the house really cosy. When it's your own toes getting cold, you're more prepared to go above and beyond to get it right.

The task was to fill the gap between each joist with wood fibre, in our case 2 x 80mm Pavaflex batts one on top of the other. But how to do it was a bit of a puzzle. We couldn't find any literature or videos to guide us so we had to get inventive – fortunately this is one area where we've discovered that John came up with the right way all on his own.

- We created a holder/ saddle for the Pavaflex batts between each joist by stapling a continuous waterproof, breathable roofing membrane to both sides with sufficient slack to hold the Insulation. **NB:** it's very important to run a continuous layer to minimise draughts getting through. Where we were unable to do this, we made sure the join was sealed before replacing the floorboards. 2. We went for 2x80mm batts per space, giving us a total of 160mm insulation throughout the underfloor space.
- Given the need for air flow in the sub floor void, we made sure there was still sufficient air space below the saddle to keep the space aerated and dry.
- We measured each gap individually since the spaces between the joist were always different and each batt was cut to the correct size. The density of the batt is such that it is very easy to cut with a saw on a table surface.
- We made sure that we cut each batt slightly oversized so that it had to be pushed into place, aimed at reducing any draughts coming up from the floor void.
- We then replaced the original floorboards and later on (after the airtightness test) we went back and raised the floorboards to put another layer of roofing membrane over the joists/ insulation to cover the gaps between the floorboards. If you are using new floorboards, choosing tongue and groove will save you this extra task
- Once the floorboards were re-laid, we sealed up the junction between the wall and the floor throughout. For this we used Contega, a very sticky indoor sealing tape that stops any air emerging through the wall/floor junction.

I have since discovered that just 100mm of insulation under a suspended floor can reduce heat loss by 65% - so it was a job well worth doing.

Where's your lorry parked?

We had a moment of panic when insulating under the dining room floor. The next big job on the list was the underfloor heating (UFH) and pinning down a date hadn't been an easy task. When the plumbers suddenly told us they would be with us the next day, we realised we'd need to burn the midnight oil – we couldn't bear to put them off. But ……. we didn't have enough batts to finish the job and the building merchants would have to order it in. You can imagine the expletives - they heated the house up all on their own!

It was decided that John would start with what we did have, while I drove to Northampton to pick up as much pavaflex as I could get in the car. So that dark and stormy night (and I really mean stormy) I found myself searching for a large builders yard just off the motorway. The person behind the desk was remarkably helpful given it was nearly closing time and I was in a bit of a flap. But my spirits lifted when she asked me where I'd parked my lorry. Clearly I wasn't at my most elegant – building site home and covid, what did you expect – but none of that mattered when she thought I might be someone who could drive a lorry. Go me!!

Needless to say, I got myself and the batts home – pretty hairy at times, but we made it. And of course, the plumbers changed their schedule so it was all in vain, but it was done and I looked like someone who might drive a lorry. Made my month!

LOFT INSULATION

A nugget of the physics I remember from school is that hot air rises, so every bit of energy you put in your house is heading for the loft and straight out through the roof. So adding in a layer of warm, cosy material has to be a good option.

This is an area of insulation that we're all familiar with and there are still Government schemes in place for a while giving a subsidy for the cost of doing the work.

In wintertime the easy way to check the effectiveness of your loft insulation is to see how long it takes for your roof to clear on a frosty day. Unless there is very strong sunlight – in which case all the other roofs will clear at the same rate – any melting will be caused by heat coming up through the roof tiles. A well insulated roof will hang onto frost for a long time.

As with underfloor insulation, using a flexible material is a must. PIR will not work well, because it shifts and settles, leaving gaps in the covering.

The options here are the same as for underneath the floor:

- Wood fibre, sheeps wool, hemp etc – low U value, sustainable and effective
- Mineral wool – rock or stone wool – reasonably sustainable and low U value
- Foam spray – non-sustainable, with some possible risks to health

You need to review all the options just as you have done for walls and floors. For example, check out any risks to using a spray foam i.e. that there may be a risk of toxic fumes being given off – both immediately and, in some cases, long term. So please ask

plenty of questions and take the time to learn as much as you can about the risks and advantages.

How you go about insulating the loft will depend on how you use it:

1. An empty loft space
2. A loft space that is used for storage
3. A loft space that is used as a room

An empty loft space

When your loft is an empty space, insulating is straightforward. Your task is to line the floor of the loft with maximum warmth to stop heat from the working house being lost into the vacant space.

The recommended thickness for insulation material is a minimum 270mm. This has increased from just 25mm in the 80's so good to see we are achieving some changes on behalf of the environment.

You are looking for a U value of 0.15 in a renovation or extension, so exact thickness of material you need will depend upon which you choose to use.

The ideal way is to put a layer between the ceiling joists, then cover with subsequent layers at right angles. This will prevent any thermal bridges and unwanted heat loss – as long as you also seal up the joins between the insulation material.

There is one exception to loft coverage - make sure not to put insulation underneath the water tank. This is the one time you actually want a thermal bridge so the warm air penetrating from the house to the tank stops the water freezing.

Clearly 270mm (10+ inches for those who still visualise on the old system) is a huge amount and rises well above the level of the joists. So this is only possible when the loft space is not being used.

It's also important to improve airtightness/vapour control at ceiling level as well as insulating, and also to increase ventilation to the roof space if you can. When you increase the insulation at ceiling level you create a steeper temperature gradient between the warm room below and the cold loft above. This means that any water vapour that gets into the loft space is much more likely to condense in the loft and create perfect conditions for mould growth. Creating an airtightness layer (see chapter 7) will reduce the risk of such unintended consequences. You don't necessarily need to

introduce a membrane to do this, just be sure to seal up any cracks in the ceiling, and the junction between the ceiling and the top of the wall. Also watch out for any pipework that might penetrate the ceiling and seal around this.

When you want to use the loft for storage

If you want to use your loft for storage, please remember not to compress the insulation material since this reduces energy efficiency. Like a duvet on your bed it's the thickness of the material that keeps your house warm so anything that reduces that thickness will cost you in lost heat.

To achieve this without squashing all the warm air out of your insulation material, you can put in a system of supports - loft legs - that hold a floor above the level of the insulation. The supports are set in place as the insulation is goes down, then the boarding is laid on top. This prevents you touching the insulation when you get something out of the loft (more of an issue with synthetic fibres) and retains all the benefits for heat retention.

When the loft is also a room

If the loft is also a room then the insulation must go between and below the rafters, stopping hot air leaving through the roof tiles and cold air coming back in the same way. The building regulations require a U value of 0.18 so we're talking about similar thickness of insulation material applied between the ceiling rafters – ie 270mm. This means you reduce the head height considerably. Best to consult a loft extension expert to do this work. You will find ideas for how to go about it here

If the room is already completed and you're concerned about the effectiveness of the insulation, there is the option to line the ceiling with a wooden structure and a thick layer of insulation. Of course, this requires that you have a high enough ceiling to still be able to stand up in the space.

In our case, the central part of the loft space has been made into a useable room, with the eaves serving as storage space, so we needed a combination of approaches. We have a cantilevered staircase so it can't be used as a bedroom, but it has provided a great office space for home working over the years. Not quite ready to close it up for good meant that we had to think about insulating both the floor and the roof.
In the eaves space, we used sheeps wool of 100mm thickness with wooden board underneath. This allowed us to continue with storage, but didn't give the full quality of insulation needed. So we also insulated between the rafters using 50mm pavatherm

and 40mm isolair to make up the difference. We continued the same process in the living space.

Dealing with the floor reduced the loss of warm air coming up from the house, while lining the ceiling of the room blocked any heating in the office space from flying away through the roof.

If you're going the whole hog and retiling your roof, the best option is to put insulation above the rafters, to create a "warm roof". This is often done in new houses and will give the best results.

Another note: when putting insulation between the rafters, take care to keep it in line with the tops of the rafters. There needs to be a ventilation gap above the rafters in this scenario and you don't want to block this airflow.

Inside the loft

Full disclosure - we didn't do this work ourselves – I can't think of anything worse! Insulating the loft had become a thorny subject. Not only was it a challenging task – strange shapes, low head height, hot or very cold – there was the question of all the stuff accumulated over the 40 years we've lived in the house. And the equally thorny fact that one of us is a hoarder and one is a thrower. With all the change in the house, this was just a step too far, so it was the last thing to happen.

Every sentimental school painting, mother's day card, cuddly toy was there – you name it, we had it. On days when we felt strong we'd started weeding, returning large bin bags of stuff to each of our girls to do with as they wished. It was a great relief – for us, not them! I spent hours on Freegle (see chapter 14) and the charity shops took some of the strain.

Eventually we found someone willing to do the job, but by now it was summertime – and one of the few really hot weeks we had in 2021. I felt so sorry for them up there, sweating away in a tight stuffy space. We do have a large dormer window that was wide open so at least there was some fresh air, albeit hot and steamy.

It was towards the end of the job that they realised: where they had been really hot they were now very comfortable and where it had been noisy was now much quieter. It was proof positive that the insulation was working – heat from the

house and through the roof was so much reduced they were cool and the play noises from a nearby school were only a faint murmur through the window. What a success!

Big hint – don't forget the loft hatch! It's so easy to line the floor and forget that the top of the hatch is also a bit of floor. We did this, then had to go back and put it right.

It's also important to make sure the hatch closes tightly to make it airtight. We overlapped the sheeps wool on the back of the door so it covered any gaps. We also added in a very tight fastener – like the fastening on a kilner jar – to make sure the close was as efficient as possible

Thermal Imaging Camera – checking your insulation

At some point you might want to check on the effectiveness of your insulation and a Thermal Imaging Camera is the ideal way to do this. Some councils have them to borrow - certainly that is true in St Albans . The only barrier to use is that you need to do it in cold weather with a well warmed house so you have a temperature difference of at least 10 degrees between inside and outside. Then you are on your way.

The camera is useful to find out whether the insulation in your loft, wall or floors has any gaps or if any areas have been missed. It is also very helpful if you have cavity wall insulation and you want to check if it has settled or if there are spaces where it has come out of the wall as a result of DIY.

The camera is also useful for a number of other issues:

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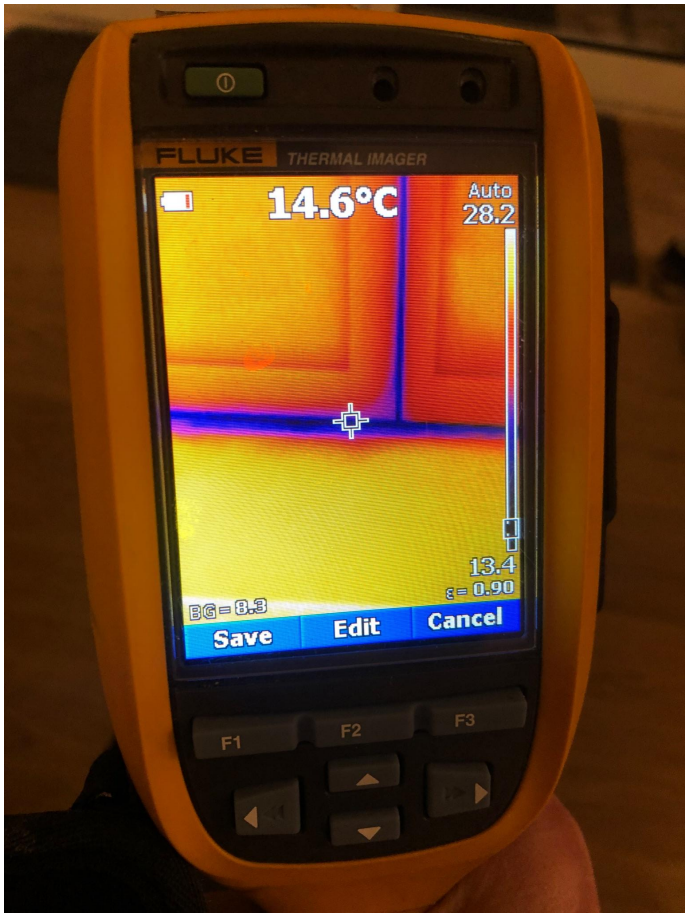
- Finding any cold air comes up between floorboards so you can seal them more efficiently.
- Radiators that are not functioning smoothly – colder at the top than the bottom or vice versa
- Hot air from radiators that is coming through the walls to the outside and needs insulation behind them.
- Windows that are really cold and need replacing or protecting by heavy curtains
- Letterboxes that let in cold draught
- Windows joints that are not fully sealed

The list goes on. It's quite an adventure taking the camera around your home. It's amazing what you can find out. Just take some time to understand how it works so you can get full value for your allocated time.



We used pictures from the camera to engage with the company that put in our triple glazed windows. The windows themselves were doing fine, but the camera showed us that there were cold gaps where the window frame met the wall. Without the thermal images it would all have been a matter of personal perception and I don't think we'd have had such a positive response.

Summary

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- Insulation serves to keep the house warm – like a duvet laid on the walls and under the floor.
- Decide if you want to use conventional or sustainable materials
- If using sustainable materials, the whole system will need to be breathable.
- Insulation doesn't ensure airtightness so make sure to seal up any joins in the system regardless of how well the insulation has been put in.
- If you have a difficult structure, a thermal plaster like Diathonite might be a good solution.

- Start looking for a lime plasterer early on or alert your builder to the need so they can start looking.
- Remember that insulation and airtightness are different, so before you do anything, read the chapter on air tightness first.
