HOUSE PLANNING HELP

Episode 32

Insulating a Period Property

With Tim Hulse from Ecovert Solutions

The show notes: www.houseplanninghelp.com/32

Intro: I asked him how he got into construction and doing things in a more sustainable way.

Tim: Well really it developed from an interest in older houses. I live in a barn conversion and it had already been converted before I bought it but in a really, as I learnt, not very good way. I learnt that it really wasn't performing very well. It was draughty. The heat just blew out in the winter. Then I bought another property which was also a barn conversion and that had been done equally badly and I was beginning to think, *surely there's a better way of doing this?*

At the same time I was looking for a career change and I'd come across the masters degree at the Centre for Alternative Technology in advanced energy efficiency, the architecture one, and it just sort of really struck a chord with me. As I was going through that degree I was thinking what I could do with it at the end of it and that combination of old buildings and how you could try and upgrade them, and I started to find some solutions for it.

I learnt more about sustainability on the masters and the pieces started to fall into place and I ended up focussing my masters thesis on old buildings in conservation areas and how to make them zero carbon.

Ben: Well, today I want to talk a little bit about insulation and I have to say although this topic has come up quite a few times during various podcasts I feel a total failure that I haven't dedicated a podcast to insulation.

When we've been chatting before you said that you quite like insulation and I thought well, you've used it in practice, we're talking old buildings as well, let's just go ahead and do this. So, first up, what is insulation? If we're coming into this fresh, what would we need to know about?

Tim: Well, it's simply a way of reducing the heat loss through a building element whether it's the floor, the ceiling, the window, the wall. How are you going to stop that heat from getting out of the structure? That's the simplest explanation for it.

But then you get into all kinds of other issues so it depends on the building. Is it an old building, a new building? Have you got issues with moisture that you need to consider? Are you interested in sustainable materials or are you okay using something that's oil based? Do you want the cheapest? Do you want something that's going to last a long time? Do you want something that might off-gas and reduce in value? There's lots of different considerations once you get into it.

Ben: I suppose new build, we should be able to go down the more sustainable route because when we're talking about these oil-based insulations it's normally when we've got to try and keep the wall size down. Is that correct? Have I understood that?

Tim: Yes, you're going to be able to get a similar ability to keep the heat in with a smaller thickness of the material, but when you're talking about new build it depends what style of building you're talking about. Now we've got a lot more options than we had with traditional construction methods. Generally there's starting to be a move away from brick and block, although there are some successful examples of low energy brick and block buildings, like the Denby Dale Passivhaus.

You've got lots more options. You can go with timber frame with render on the outside. You could go with something that's built on the Ziegel ThermoPlan based clay block system with render. You could have a brick exterior and timber frame on the inside.

You need to think about what the construction method should be and then what materials would best compliment that method. Generally if you're going with something, whether it's timber frame for example, I'd recommend a natural material because if you use a wood fibre or a sheep's wool or a WARMCEL recycled paper you are going to have less issues with moisture being trapped between an impervious oil-based product with a foil on it or something and the wood.

In a timber frame building you don't want to be trapping moisture somewhere next to wood because that's only going to lead to negative consequences.

Ben: So who in this process specifies all of this? As the client myself I know insulation is important but is this just a job that I leave to the contractors that I've hired, the architect?

Tim: Generally it would be the architect but then it depends on who the architect is, so if you hire an architect that's just used to working with traditional materials and methods they're going to just trot out the same old materials and methods.

Ben: Because it's easier?

Tim: Because it's familiar, it's easier. There's going to be more builders around that are going to be familiar in building in it. They're going to be more sure that the result is going to be what they expect but that's only because they're expectations are limited.

Ben: Is it worth going through some of these sustainable materials and if we wanted to use sheep's wool, it's this good . . . Maybe we should talk about U Values of these different materials?

Tim: Yes, when it comes to U values, sustainable materials are generally all around the same. You're looking at about 0.4 for sustainable materials like wood fibre or sheep's wool or WARMCEL versus around 0.22 for an oil-based product. You can go even lower if you go with something like aerogel – it's going to be about 0.1 something so it's about half that.

So automatically you're having to accommodate a greater thickness of material but the assumption tends to be that if you go on Passivhaus training or something like that they recommend allowing 500mm for the wall thickness and that can accommodate any kind of building solution that will result in a U value that meets Passivhaus requirements. So you could do that with brick and block. You could also do that with timber frame or other methods.

Whether you go with wood fibre, sheep's wool, recycled cellulose or hemp batts or whatever, all the natural products are fairly similar in terms of their ability to keep the heat in. They've got differing abilities to buffer heat to add what's known as a decrement delay to heat coming into the building, for example, which could be beneficial in a loft in the summer when you don't want the loft to overheat.

Then the materials themselves are different so you may use them in different situations, so a hemp batt would probably be better than

a lighter weight sheep's wool batt in a pitched roof construction where the hemp batt isn't going to slump as much as the sheep's wool potentially might.

Ben: So looking at some of your renovation projects with older buildings and you're saying you've got all of these different situations. Maybe you can talk us through something that you've done recently . . .

Tim: Yeah.

Ben: . . . And the choices you've made so I can get more of an understanding because it's still all a bit vague. [Ben laughs.]

Tim: Well, there's a project that we're just wrapping up in a Grade II listed building where we're ended up having to use a number of different solutions for different reasons. It's a ground floor extension at the back of the property that was suffering significantly from damp. It turned out that the damp was being trapped in the building both by concrete outside the building above the internal floor level, concrete inside the building with plastic sheeting under it which was really leaving only the walls as a means of getting rid of the damp in the ground.

So the damp was being forced up the walls, with rot in the skirting boards and black mould on the walls, and really not a very healthy environment. It was very musty and so on. Also it was very cold in the winter. It was suffering from condensation problems, so a number of different issues to try and address. The first thing is always to sort out the building fabric. You want to make sure that the water isn't getting in but the outside is lower than the inside and that you're getting rid of the excess moisture, you're not trapping the moisture in the building.

So the first thing we did was put a French drain outside at a suitable level, dig up the concrete inside, get rid of the plastic and we installed a Limecrete floor using a foamed glass aggregate, about 300mm of that which is breathable. It's also not capillary active. That means that it won't allow the moisture to seep upwards towards the Limecrete which is actually quite, it quite likes moisture so you want to try and keep that away. So the aggregate doesn't let the damp come up but it's still breathable and it's recycled – it's made out of old beer bottles in fact.

Ben: Hold on, how are you able to do this, because this is a building that already exists?

Tim: We just took a jackhammer in and dug the floor up.

Ben: Okay. [Ben laughs.]

Tim: Made a mess but had to be done.

Ben: And the building is safe during that procedure, that . . .

Tim: Yes, obviously you need to take care not to disturb the foundations. In this case it was built on sandstone so we didn't have any concerns about disturbing the foundations. In fact we had to dig out some sandstone in the middle to get the depth that we needed but were careful not to dig too close to the walls.

Ben: So that is the floor that we've covered there.

Tim: So the next bit . . . So we thought we'd look at the floor and the ceiling first and the ceiling had a minimal amount of fibreglass insulation at ceiling level, had about 50mm of insulation. What we did there was we took that out and put in 300mm of sheep's wool, which is breathable and it's a lath and plaster ceiling that they wanted to retain and added additional ventilation in the attic space that wasn't ventilated already, so we improved the ventilation in there above the insulation.

There's another issue in the ceiling too because the pitched ceiling backed onto an upstairs bedroom so that outside wall of the bedroom was within the attic space but above the sheep's wool insulation and we insulated that wall with a wood fibre board screw-fixed to the wall using an airtightness tape to make sure no air could circulate behind the insulation and take away some of it's usefulness.

Ben: How does this work in terms of making sure that it's a good complete envelope that you're creating? What is the actual process of making sure you've covered every single area?

Tim: Yeah, that was two elements. We wanted to get those two things done first before turning our attention to the walls. The walls were originally lime plastered, covered in gypsum and after discussion with the conservation officer we agreed that we would take all the plaster off the walls and add 60mm of Pavadentro wood fibre insulation which has got a built-in breather membrane. It's a mineral layer that acts like a breather membrane to reduce the possibility of adding extra moisture into the walls but still maintaining a breathable system.

So we screw-fixed the wood fibre boards to the external walls, we considered insulating the wall reveals into the main room to reduce thermal bridging and did some thermal bridging calculations using Therm to model those junctions and to see whether there was going to be an issue. Potentially there is an issue there.

We're recommending to the client that we insulate the reveals. They didn't want to do that because they were concerned about having a step in the wall so we agreed that maybe if it turned out to be a problem we'd come back and deal with that later.

So basically we've got all the insulation in place now. We replaced some old windows that really weren't period anyway so there's no historic fabric that we needed to maintain so we were able to replace them with good quality wooden windows that were double-glazed. So we've now got the structural elements, if you like, insulation in place. The next step was to make the whole thing airtight. We used a whole range of different Pro Clima tapes to tape the windows to the walls, sealing the edges of the wood fibre boards and taping the wall to the floor and the external wall to the internal wall and so on, at the same time as starting to plaster with a lime plaster, so some of the tapes were plastered into the lime in the internal walls.

We've ended up with a very airtight envelope. Really, at that point the whole envelope is going to be as efficient as it's ever going to be. The rest is just cosmetic, finishing off the plastering and so on.

Ben: At that point, what do you do about ventilation? What is your strategy?

Tim: In this case it's not the whole house and in fact the whole house is mostly not being upgraded at all. The room next door has got no insulation on the walls. It's got a fireplace in it. It does have double glazing but I don't think it's been sealed adequately to the walls. There's lots of draughts around. I'm not particularly concerned about ventilation in that particular project.

But I tend to find that in spite of all the talk about emission reductions and even reducing bill costs most people are generally concerned about two things. It's comfort and dealing with particular issues like mould. Mould tends to be a common theme with the older buildings that we deal with so they're either driven by someone not wanting to see mould around or the rooms are simply too cold to use in the winter.

We tend to find that projects often start by dealing with the most difficult problem areas of the house and once they see the benefits of that they tend to move onto other rooms.

Ben: It does sound as if you can do this as a retrofit in stages. Is that quite common that you get someone who perhaps can't afford to do a whole house and they start in one area as you've just mentioned?

Tim: It's very common. In fact I don't think it's necessarily just down to cost but it's really quite disruptive. You know, it can take quite a while to do a job like that. In a listed building you've got the . . . Because we're using lime plasters which I would generally recommend in a solid-walled property where we're trying to build a breathable construction you've then got the issues of you've got a base coat of plaster to put on, you've got to wait for 8 to 10 days for that to dry, then put another 8mm coat on, wait for that to dry then you've got the finished coats. On top of that we'd allowed some time for the room to dry out after stripping everything out before we started putting stuff back so you're talking a period of months to get a room from start to finish.

You can do other rooms in the same period of time but do you really want to have half of your house out of commission for two months, workmen in and out, and dust and so on?

So we find that unless someone is moving house . . . We've got a project starting in a large Victorian house in Manchester which someone's just bought, they've got an existing property. They're going to stay in that property whilst the new building is completely gutted and refurbed. They're, sort of, in the luxury position of being able to do that. Most people, I don't think, can do that. With the current economic climate I think more people are doing their houses up but it's hard to live in a house while it is being done up so it's easier to do it a bit at a time.

Ben: Do you have to have an over-arching goal of what you want to get to because there would be no point in doing some bits and then it doesn't add up to a whole eventually?

Tim: Ultimately . . . Ideally you would want to have a whole house plan so that you're working towards a goal that you're trying to achieve and you understand how everything is going to fit together, and you have to have a long term ventilation strategy because obviously once you make the place airtight you're going to start to run into air quality issues if you don't deal with ventilation and so on.

It doesn't really make it that much more difficult to do as long as you keep that goal in mind and you have a solution that's fit for the whole house. What I wouldn't want to be doing was chopping and changing the solution from one part of the house to the other. I generally try and come up with a solution that is appropriate for the house . . . We're doing another one in a 70s house at the moment, where we have used Kingspan insulation but it's a smaller house, they've got issues with space already. In fact we've used aerogel on one wall because otherwise the bed wouldn't fit in the room any more!

You've really got to think about what the rooms are going to be used for, whether the intervention you're making is going to impact on the ability to get the use out of that room, and really think the whole thing through before you start.

Ben: Would you always want to go down the sustainable materials route? I'm sitting here thinking that's what I would like to do but is there ever a case where actually it would make more sense to use something that's more effective and actually the embodied energy that's in it, you're benefitting more from investing in that.

Tim: Yeah, you really need to think about what it is that you're trying to achieve. Whilst ultimately I would prefer to use natural products with lower embodied energy, ones that are generally better for the occupants. You know, natural products tend to buffer moisture better, for example, so that can help maintain a better humidity level within the house, reducing the incidents of dust mites. It can help if you've got asthma. There's lots of side benefits to sustainable products. They also absorb CO_2. They also absorb chemicals like formaldehyde but that doesn't mean that they're fit for every situation.

If you've got a client who's got a restricted budget or they've got restricted room . . . There are a number of considerations at play and you've got to trade these things off. Sometimes I just can't . . . This 70s house we're doing at the moment, I could have gone with wood fibre insulation in the roof but given that we were using this oil-based stuff on the walls I really couldn't justify the extra cost to that client of putting wood fibre in versus the Kingspan that we did use.

Ben: I'm assuming that everything that we've spoken about so far is internal insulation. Would I be right there?

Tim: You are.

Ben: So let's take the external situation. When do you decide, oh I'm going to do this externally versus taking the internal route?

Tim: Well, ideally you'd do everything externally because that eliminates thermal bridging. If you wrap a nice warm blanket around the house that's going to be the easiest thing to do technically, potentially cheaper but not necessarily by the time you've taken into account scaffolding and other costs that you're going to incur. But that would typically be the best option.

Then you run into all sorts of other issues. The property could be in a conservation area. We work mostly with older properties and people have bought them because of their charm and the nice brick features they've got on the outside or the way the bricks have mellowed and so on. Generally they don't want to cover that up.

Ben: But what about putting it on the inside? Are you not destroying the historic fabric anyway, but just from the inside?

Tim: Yeah, but it doesn't ruin the streets and the curb appeal in the same way. In some ways it's easier to do on the inside without wrecking that fabric in the sense that if you've got fancy architectural moulding on cornices and so on in the room they can be rebuilt using a lime plaster. They can be run in place or built off site and stuck in place after.

So you can end up with a room that really doesn't look any different from the inside whereas on the outside you're going to radically change the look of it unless you're going to try and stick brick slips on your insulation which personally I wouldn't like.

Ben: I always think there are certain buildings that will be improved when there's external insulation. Clearly not historic buildings but can all building be improved this way? I was chatting to Paul Jennings in a recent podcast and he was saying some of the modern housing, to make it airtight will take so much work that potentially it would just be easier to start all over again.

Tim: Yeah, well that's a good question. When you look at the standard of building in some of these buildings, like the 70s one for example, there's just so many different issues with it, from the floor to the foundations, the biggest insulating element in the floor turned out to be a wasps' nest! It was about 3 feet long and 1 foot in diameter. There was no insulation in the floor. It was a ventilated cavity,

draughts all over the place but how many people want to have their house demolished and live in a caravan whilst the new one's built? You've got the same kind of issue. Again, if you've got the luxury to be able to afford to buy a house, knock it down and build a new one whilst you're living somewhere else that's fantastic but there's 26 million houses out there [in the UK], 9 million of them were built before the First World War and they're not all going to be knocked down and rebuilt.

In fact researchers from places like the Oxford Brookes University have shown that the embodied carbon in old buildings is still worth keeping them and refurbing them rather than doing that, just from a carbon savings point of view. So you're going to end up with a trade-off. You're not going to get an old house that's going to be Passivhaus, best case it's going to be something like EnerPHit, which is 80% lower but in reality it's probably going to be lower than that.

At the moment we're not making very much progress in terms of the whole housing stock anyway. So at the moment I'm not that concerned whether a house is 60% better or 80% better. 60% is massive.

Ben: But you only do this once!

Tim: Well yes.

Ben: Maybe.

Tim: If you made an 80 or 90% improvement it would only be once. Can you get most homeowners to go that far? Do they have the budget? Do they have the time? The energy? Everything else. I don't think they do and I don't think they care about the carbon emissions.

Most people, they might say they believe in climate change, does that mean that that's going to change the way that they behave? Are they turning more lights off or anything? Quite often they think that they're being more green than they are.

I've done my own surveys of homeowners and they tick all the boxes saying how green they are and that they're doing everything they possibly can but when they tick the boxes about behaviour they're still not doing all the things that they need to be doing. So you can make the house as green as you like but unless they live in it in a sustainable way and really think about how they live in it and

how they can reduce their use of energy, you're not going to get that energy reduction anyway.

Ben: We're running out of time so I'm going to jump to some listener questions that we've got but I wondered, is there anything, any key issue that I haven't really covered here? I'm sure there's lots more that I could ask you.

Tim: Well, I think a key one with older buildings is really thinking through condensation and particularly interstitial condensation. That's where condensation occurs between layers in the build-up of the wall. You really need to think carefully about that and start looking at using analysis tools like WUFI to model the behaviour of the wall. It's hydrothermal modelling. That means it models the balance of moisture in the wall over a period of time using historic data based on your location. So you can play a timelapse movie if you like of your building before and after interventions to see how it's going to perform and whether it's actually going to offload all the moisture that it's accumulated. So that's really important to use that kind of method rather than the simpler Glaser method that some manufacturers of non natural materials use which favours their products but really doesn't show the whole story.

The other issue is simply how do old houses behave and how much insulation can you safely put on them? Research recently is showing that you do need to be careful and if you try and increase the U value too much you could potentially cool down the wall. You're not allowing the internal heat to warm up the wall enough that during the summer it's going to offload all the moisture that it's accumulated. So there's some ongoing research in that area to try and give more accurate guidance about what level of insulation you should put on the wall. Currently the thinking is around a U value of 0.5 which isn't great when you look at something like a Passivhaus U value.

At the end of the day, if you stick a load of Kingspan on your walls and you end up wrecking the walls in 10, 15 years, if the brick starts spoiling because there's too much moisture and you happen to have used cement pointing instead of lime pointing, it's too late to come back on the architect or the guy that built it. Ultimately you're going to have a wrecked house that you're really going to have some huge costs trying to sort out.

Ben: Let's get to the listener questions then and we'll say hello to Neil Barnes first of all who asks:

'What's the most sustainable high quality and economic external wall insulation system and material? At approximately £10,000 per home, supply and fit, it would be good to find more affordable and green solutions to accommodate Green Deal golden rule and ECO. Can you help?'

Can you? [Tim laughs.]

Tim: So we had sustainable, high quality and what was the third criteria?

Ben: 'Sustainable, high quality and economic external wall insulation system.'

Putting you on the spot here a bit. Don't worry if it's . . .

Tim: Well high quality and economic don't normally go together, do they? You don't get a Rolls Royce for the price of a Ford. Sustainable and economic tends to be a bit of an issue at the moment as well, partly because, well I think two factors.

One is that some of the sustainable materials that are available in the UK today are made abroad, so the range of wood fibre insulation that most companies offer is made in Switzerland or Austria or France, not in the UK so you've got shipping costs and probably other mark-ups that have happened along the way.

The second factor is that they're simply not sold on the same scale as products like Kingspan and Celotex. There isn't the mass market so mass markets tend to drive prices down. I think we're already starting to see the prices of some of these products drop and as they become more widely adopted they will continue to drop.

So I think trying to find high quality and economic can be difficult. You could argue that some of the oil-based products are high quality and yes they are for certain purposes but as we've discussed I think you need to think carefully about what that purpose should be, so it depends what kind of home your listener is considering.

If we're talking about sustainability I think any of the natural based products are as good as another, whether it's WARMCEL or sheep's wool or wood fibre. It could be that if you live in Wales and you buy Welsh sheep's wool you're going to have less transport miles so you're going to have a lower embodied energy in that sense.

The processing costs for something like sheep's wool is, I would imagine, significantly lower, having gone through a factory where they make sheep's wool batts, it's a very, very simple process which I'm sure uses less energy and is easier to do than making wood fibre insulation.

So there are considerations about how the products are made, where the material comes from and how it's shipped but trying to trade all those things off.

Right now I'm trying to find a . . . I want to try and make life simpler for me as well. [Tim laughs.] As I go around multiple projects I want to try and have a repeatable solution that I have a lot of faith in, that I'm happy to recommend almost as a cookie cutter to clients and really I've settled on wood fibre boards on the walls, solid-walled properties, sheep's wool in the ceiling and a limecrete in the floor, if it's a solid floor, or sheep's wool in the floorboards if it isn't. As in everything in life there's a trade-off and you've got to try and find what that trade-off is.

Ben: Well, Neil I hope that helps. It's one of those situations that I think we probably need to know more details to be specific but good luck. Let's go onto the next question and this is from Bill MacGregor who says:

'My question is how do I increase the insulation levels of a 1980s timber-framed house, currently only 90mm of rockwool. I've made several enquiries and got no helpful suggestions. I currently consider that the best approach would be to remove the outer leaf of the rendered blockwork then build up extra insulation layers of vapour permeable wood fibre board onto the original timber frame, albeit a somewhat extreme solution!'

Tim: Well, I think Bill is going along the right lines with that. You've got two options, you can either go internal or external. We talked about disruption in the house and so on. If you're going to rip out all the internal walls and re-insulate internally that's going to be a massive disruption. Going externally, as we discussed earlier, is better from a thermal bridging point of view. If it's already rendered on the outside then he's going to end up with a building that looks that same. He's going to have to think carefully about detailing at eaves level and verge level, depending on how much overhang he has already, whether that can accommodate it or whether we need to use some aluminium flashing or something like that . . . Or extend the verges but ultimately that would give him a better solution and as we discussed earlier I like wood fibre insulation, I think it's very

compatible with a timber frame building. I think that would be a very good solution for Bill.

Ben: Well Tim, thank you for all your information today and for having a crack at those questions as well.

Tim: You're welcome, Ben. Thanks very much.