

## Episode 43

# Building an Energy-Efficient Home on a Tight Budget

The show notes: [www.houseplanninghelp.com/43](http://www.houseplanninghelp.com/43)

**Intro:** David and Penny Learmonth have created a fantastic house for their retirement. They've done three renovation projects before and the first of the houses that they tackled was in a particularly poor way. It even had rats in the very beginning but they managed to sort it out. So these projects that they've done in the past have given them courage to tackle a new build.

I started by asking David how this all came about.

**David:** There was an interesting article in the paper. John Christophers, in Birmingham, had found an early Victorian two bedroom semi with a spare plot beside it and turned it into a four bedroom, obviously still a semi, zero carbon house and this somehow inspired us.

If we were going to build a house and we had to build a house for financial reasons let's make it something different and that sparked off the interest and I spent the next 18 months, I suppose, researching it, finding out how it worked, what could be done and beginning to find people who could perhaps build it for me.

I'm not a builder, I'm not an architect, I am a retired electrical engineer so I understand the physics of these things. Finding out how to do it and finding people to do it for me was a bit more difficult, yes.

**Ben:** Penny how did you split the research between you?

**Penny:** Oh I have to say David did most of the research. I asked the questions that someone who's not an engineering scientist would ask and I suppose in answering those we did further research.

**Ben:** And where did you decide to build your new house?

**Penny:** Well we were very lucky that we owned a house in a large garden and the old house is at one end of the garden and the plot fell into two halves very comfortably without this new house in any way impinging on the old house.

- Ben: So there was an existing property that you then rebuilt.
- Penny: No no, not at all. This had been a paddock I think at one point and before that it had been an orchard and it was part of the Watch House Farm. By sheer chance and to our good fortune really this little corner of the road had fallen into the planning envelope of the village about six or seven years ago and we were beginning to get developers enquiring after it and we thought we could do this ourselves.
- Ben: So you were looking down towards the end of your plot and this comes into, as you mention, the planning envelope. Does that make it plain sailing for building a house?
- David: It helped a great deal. The original design was turned down: the old house was the old farmhouse it was a listed building, it is a listed building and this limited us as to what we could put on this plot. So we weren't allowed to do just anything so we came up with a design that looked a bit like a calf barn it's weather board, slate roof, rectangular, simple shape, simple looking and of course a very good shape for a high efficiency house.
- It's very fashionable these days, as perhaps you've noticed, [to have] lots of gable ends and dormer windows, complicated shapes that of course makes it very difficult to build an efficient house because you have got all the risks of thermal bridgings and insulations and nasty corners to get round. If you can build a simple rectangular house the chances are you are going to start off with a good design from the thermal point of view, from the efficiency point of view. So we ended up with this.
- There was enough room on the plot for the house to face exactly north and south, the planning people were happy with design. They wanted a decent roof and we said: "Well what about a second hand slate roof," which isn't cheap exactly but it looks fine and fits the bill, and of course the slate and the weather board are nothing to do really with the efficiency of the house. Because having been inspired to build an efficient house, a thermally efficient house, then what you put on the outside in a sense nothing to do with the case.
- Ben: Did you have a lot of restrictions in your budget or was it going to be easy to come within?
- David: No we were very hard on the budget. We were using our savings essentially to build this house, the idea being that the money we

might get from the sale of the old house is what would help us to look after ourselves in our old age. It's financially driven. The company I used to work for went bust owing its pension fund quite a lot of money. My pension became fixed, my occupational pension became fixed, I haven't had a pay rise worth the mention since 2008 and the inflation rate was pretty horrible after the crash, so this was a frightening time. What are we going to do to look after ourselves? Well we know suddenly that we are allowed to build so let's build. If we can build something interesting that has low running costs that might be a good thing. Do we have enough money, well let's find out?

So with the money that we had saved and to some extent inherited we found that we could just about, if we were really tight on it so the light fittings for example are very bottom of the range £5 or £10 a throw, this sort of thing. You can for example spend a fortune on lighting if you want to, but no we built this down to the cost to what we could just about afford. And the problem is if you are going to be efficient then you have got some very high ticket items and the triple glazed windows which in a sense are essential are terribly expensive but perhaps you don't have to spend much on the light fittings or socket outlets or what have you.

Ben: And Penny what were your priorities on the brief in the early stages?

Penny: Well once we had decided that we would go for a house you could call zero carbon then to have a really efficient structure but within that to have a home that would be nice to live in. So we managed to combine putting into this house all the things we've enjoyed in other houses but all within the budget. Those were just the layout of the house but as David says we have very cheap doors which could be upgraded another time, pretty cheap sanitation but that also all of that could be upgraded when and if we can ever afford that.

Ben: What were you thinking in terms of space? How much did you need, as obviously this is an element you are not going to be able to change?

Penny: Ah, we are very gloomy people. We see a long and disabled old age so we've put plenty of space in this house because if there is one thing that is certain of as you get older you actually require more space. We've looked after all our parents and there have been matters with hoists and wheelchairs and all sorts of wonderful gismos that allow you to stay in your own home but take absolute

space up and so this house has got a simple layout and quite a lot of manoeuvring space within it. It's also essentially a bungalow with some extra bedrooms over so in our old age we can live in the ground floor and not necessarily use the upstairs.

Ben: How did you get going on this project and finding the right people for it?

David: Some very good luck. A friend at a party one Christmas said: "Have you heard of the Uttlesford Sustainable Homes Network". No I hadn't, it had not shown up in searches that I had been doing for the best part of the previous year and it was there that I found the main contractor and the main heating contractor and an architect who could help realise the green things that this sort of house needs and that helped us get it forward.

As perhaps has become clear Penny's main contribution was very much in how are we going to use this house, how are we going to live in this house whereas my interest was in how is the house going to work from an energy point of view, heating, all that sort of stuff. Is it going to get too hot, what about thermal mass, all those technical sort of questions because I'm that sort of person, whereas Penny wants to know how are we going to arrange the kitchen to be efficient and we've learnt, as she said earlier, we've learnt from previous houses we've lived in or our parents or our parents-in-law have lived in, things that are good and things that are not so good.

So we are able to bring the experience of, I suppose, a large part of a lifetime, to avoiding some of these things. And indeed if you go around other people's houses, architects houses, you see things that are good and you like and think that's interesting and you see thing that you don't like and that is just as valuable in a way, things to avoid. I don't, for example like rope bannisters as an older person. If the bannister moves that's a disaster, it may look wonderful but functionally it's awful so you do see things around in all sorts of houses which are, well I call them, triumphs of design over functionality, they look great and are actually a disaster.

We sometimes quote something we found in a hotel room in Paris. It was awful, you couldn't find out how to turn the taps on, they looked wonderful but how do you turn them on? You couldn't see anything or feel anything. It was a disaster.

Ben: You are very much the technical man and I don't know whether that is an advantage but for other people going into this do you think

they would find it as easy because I get the impression that you are drawn to this area?

David: I think other people might want to have a project manager. Because we lived on site it was quite easy to take a lot of the project management job on. On the other hand, not having the experience we made a number of mistakes, all sorts of little things perhaps went wrong that had we been really experienced building project managers we would have anticipated.

Also in some of these, in this sort of house, things aren't perhaps always entirely conventional, so the house isn't built in the same order, in terms of a project planning sense as if we were building a standard house on an estate by one of the big house builders who have got it down to a fine art. Here you've got bits of equipment that they just don't have. The great big thermal store that needs to be placed into position, for example, before some of the walls are even put into position themselves, so you bring the thermal store in and then you build the walls. It is very easy then just to move the thermal store into the place it's going to occupy and find that you then can't decorate the walls because you've put up the plaster board and with the thermal store into position and now you can't get at that plaster boarded wall anymore. It didn't affect us in this case but, for example, you put up the plaster board here and then you blow in all the insulation. The main contractor, Touchwood Homes, who did this house, were well aware of this so that's all taken care of but it isn't normal the way you put it, normally put the insulation in, whatever you are using and then you put the plasterboard up but of course not if you're blowing Warmcel 500 into all the wall and rafter voids.

Ben: Penny were there any surprises for you as the build went along?

Penny: I think as David said that some of the building order was strange right from the very beginning the builder was interested in making a total airtight wrap of the house so this house is sealed from right in the bottom of the foundations to the very apex of the roof and this means that it quite quickly gets clad all over on the outside of the frame by this thick fibreboard, specialist fibreboard, that is then double sealed and for months you have what appears to be a great cardboard box standing in the garden and that was a great surprise and I think that a normal house doesn't start off looking like that.

Ben: David this is heated in a different way to I imagine most houses so I'm very intrigued with what sent you down this route?

David: Well if you are going to meet the aim of being zero carbon you don't really want to use oil and ideally you don't want to use gas either as both of them are fossil fuels. It seems to me that you are allowed to use wood because that is carbon neutral. Ideally you don't want to use much of that so the idea for this house was that we would use as much sunshine as we could and have a log burner.

If you put in a burner that just heated space what were you going to do for hot water and the house would get too hot quite quickly because it is very well insulated. Or you could buy a pellet burner that puts its heat into water but it quite clearly belonged in a boiler house and we didn't have a boiler house so at the time we had to come to some other choice so we've ended up with a log burner which doesn't unfortunately attract the renewable heat incentive.

It burns logs and we had quite a lot of wood because we had acquired it over the years living in the old house and just not used it. It just sat there. So I brought quite a lot with us, across to this house and chopped it down smaller to go into this relatively small wood fire F12 which is what we've got here and that's proved extremely good.

As I was showing you earlier we've got a graph that shows how often we burn the fire and that means for 2, 3 or 4 hours of an evening and that we find is enough to give us all the heat we need for hot water and space heating for the next 24 hours. And then if the following day the sun shines some or all of the heat will come from the solar thermal panels and that is very satisfactory too, and in the summer, of course, you don't burn the fire at all. So for six months of the year the sun will provide all the heat and hot water we need and then gradually as autumn comes in, depending on how many grey skies there are, you'll need to burn the fire occasionally and gradually more often.

Ben: It's quite unusual though, isn't it, for a low energy house to have a stove? I haven't seen that many so I'm intrigued what made you decide to go down this route and some of the challenges that you faced in choosing that.

David: Well I wanted to use the wood that we had got because this sounded a good thing. Obviously this is not available to everybody and indeed I imagine we will eventually run out of wood and we'll either have to buy logs in or maybe if it's all getting too much and bringing the wood in is too tiring as we get older we'll replace it with a pellet burner. If someone else was building this house they would probably say we'll have a gas boiler.

It's not entirely comparable but up the road at Wimbish there is a little group of Passivhauses built by Hastoe Housing Association, each of them has their own individual teensy weensy gas boiler and why not? Because Passivhaus says you will only use that very small quantity, the 15 kWh per m<sup>2</sup> per year for space heating whereas in most houses space heating is their biggest bill, Passivhaus space heating is really your smallest bill. So whatever it is that you burn it's not going to be much of it. I mean it's not zero carbon but even if you used oil it wouldn't be much oil, would it?

Ben: How has it been to live in Penny? Have you found it easy to have that change of how you're heating and knowing about your water's going to be hot?

Penny: It's been great fun actually. It's been an interesting intellectual challenge, it's been great fun. It hasn't been onerous, you obviously have to clean the fire and relay it after you've burnt it but it's not a difficult job. But I've much enjoyed it, a great sensation of satisfaction the fact that the fire was not on from the first week in April last year through until towards the end of September before we had to burn the fire at all. It might even have been into October I'm not quite sure but for five months at least we put no heating into this house whatsoever and have copious quantities of hot water – no problem!

Ben: What would you say is the difference between your old house, and I suppose we haven't had a great description of that but we know it was a listed building, and living in this property?

Penny: Well the old house was an old fashioned timber framed house. We had brought it's insulation up to as much as we could possibly manage, so the lofts were full of wonderful fibreglass. We had tried to seal it as well as we could but these old houses, the very fact that they are relatively thin walls between the studs means that the heat travels straight out, so in the cold weather the house is always warm up at the west end of the house because the cold weather is coming from the east and that was a very noticeable difference. So what you were doing was everywhere you were producing heat but it was all migrating to the west where the rooms were warmer but going then straight out through that west wall and the heat is travelling out of the house all the time. But a very attractive house to live in a wonderful house to live in, full of atmosphere and we enjoyed living in that house as well but we could see we really couldn't afford it any longer.

So this house is a great relief to us to be fairly certain that we will be able to afford to go on living here even in view of the fact that the pension has been frozen for some time.

Ben: David, what has been the biggest achievement in this or going through this whole process?

David: Oh, the fact that it works, the fact that we've done what we were setting out to do. Is this a zero carbon house? Yes, I think it is. Does it meet Passivhaus principles, Passivhaus standards? Yes, the airtightness exceeds . . . the Passive House Planning Package showed we were coming in at about 9 kWh per m<sup>2</sup> [per year] where the standard is 15.

We seem to be able to work on sunlight and wood and nothing else. The triple glazed windows are amazing. I had seen them, I think I went skiing years ago and saw them in France. Here people, older people, perhaps will remember that in the old days with single glazing in the winter you would get those pretty jack frost patterns of the frozen condensation on the inside of the windows. Here, and I never knew it was this good, here we had last winter the similar patterns but on the outside of the outer layer obviously of the triple glazing. So you could have the house which is sitting pretty well all the time at 20°C and outside the triple glazing is so good that you get condensation which can then freeze and form those patterns – the windows are that good. I had no idea that they would be that good and it was very impressive.

You get absolutely no draught at all from them, even good double glazing you'll get some draught if you put your hand close to the floor you can feel the cold air falling. Obviously it is vastly better than single glazing but I'd say that this triple glazing is as much better over double glazing as double glazing is over single glazing: they are really very good indeed but they are jolly expensive.

Ben: Have we talked about everything that's in this house?

David: We haven't talked about the MVHR. Obviously if you have an airtight house you have to have mechanical ventilation. Touchwood installed a Powell MVHR, I understand that this is the Rolls Royce of MVHRs, mechanical heat recovery ventilation systems and it works extremely well. You change the filters every now and then, you get an interesting collection of insects on the filter with the air coming in. You get a rather depressingly grey sludge on the filter of the air coming out of the house, which I was excitingly informed

was mainly dead skin, a really unpleasant thought but obviously you've got to protect the matrix from getting dirty otherwise it's not going to work.

So that runs, you cannot hear it, you cannot feel it but towels, washing, whatever dry because the air is moving, moving, moving all the time and cooking smells vanish within 20 minutes, the shower's dried out in no time at all, it's all taken away and you never even notice. It's very good indeed and of course you've got away from those terrible trickle vent windows that everyone insisted on and they are dire and they have no place in at all in a house of this sort.

Ben: It does seem to me as if you have actually had a really good experience on this build so I am wondering if you have any advice to pass on to others who may be just in their research stage at the moment?

Penny: I think that you must do very very thorough research and refine your design and refine your design and then don't change your mind. I think that this a hugely important thing that if you have worked hard enough before you actually break the ground you should be able to go through smoothly without anything traumatic overtaking you. Try not to change your mind half way through because that's where things go wrong, money vanishes, tears appear, take faith that you've thought this out before you've ever set off on it.

David: Yes I entirely agree. Actually that's a good design principal. In years gone by as a project manager in the telecommunications industry that's what you did, you tried to persuade everyone to spend a really long time and a lot of effort on the fundamental design and then you can get on with the actual implementation, secure that your design is good.

Yes it's things like is the kitchen really going to work, where are the plugs sockets and lights and so forth going to be and it is very easy for them to come out in the wrong places because of the drawings. It's something as simple as if you've got a light switch and a power socket more or less in the same place on the drawing they will tend to come out side by side because on a drawing you can't show them one above another so they tend to be shifted along and there are one or two places in the house where this was interpreted wrongly and when I came, because I did this myself, when I came to put the socket on the wall or light switch on the wall I realised that the wire wasn't really where I wanted it to be, but by that time

and with this sort of design it was too late. So the light switches 6 inches or a foot even, in one or two cases, further away than I would have hoped to be. That was sort of annoying, one or two case we found that and were able to move the wire without too much trouble but with all the walls being filled with insulation including the internal walls, because that's what's used to keep the sound, the sound deadening between the rooms it is very difficult with everything blown full of Warmcel to move wires once they've been pulled in and the plasterboard has been put on you suddenly realise that the wire is stuck out of the plasterboard not where you expected it to be or not quite where it should have been. It sort of looked alright at the time but once the plasterboard has gone in and the doors gone in you suddenly realise that that switch should have been much closer to the door. It's only in one or two places but it is that sort of level of detail.

Ben: David is there anything else that I should be asking you that perhaps I haven't?

David: The only thing we lost some time on I think that it's worth mentioning is that the stairs came wrong and because of that we lost two months in two months and that really was very annoying. I was close to throwing my toys out of the pram over that.

The stairs came in good time and they sat in this room here on its side and indeed I remember the kitchen fitters using it as a sort of bench and spreading out their tools on the stairs sitting on its side. If we had opened it all up and looked and found out that the spindles were all wrong and of course if the spindles are wrong then the rails are wrong and the bannister is wrong as well and the whole lot had to go back or at least all that bit of it had to go back and be replaced and that had all these knock on effects.

The stairs was late so then the plasterboard couldn't be finished, the plastering, the last bit a day's worth, just a day's worth of work, we couldn't do the second fix for that bit of the power circuit because the plastering hadn't been done. The Klargestor couldn't be commissioned because there was no power on that circuit and when the Klargestor was commissioned we found that its rotation alarm was firing because there was a defective reed switch in it. So everything went late and of course we couldn't move into the house until we had a package sewage system that was working so back it went day after day, four week to replace the stairs something like a fortnight to get the plasterer back, day after day after day went by. It was annoying, very annoying indeed and as I say we would have been in at the end of August when in fact we weren't in till the end

of October. So like I say it cost us big money because we weren't out of the other house.

Ben: Well I'd like to thank you both for your information today. I'm sure this is helpful to anyone who is listening, just more things that we can pick up on learn for our own projects. Thank you.

David: Thank you very much indeed.

Penny: It's been a pleasure, thank you.