

Episode 237

A SIPs Passivhaus build on a tight budget – with Richard Dudzicki

The show notes: www.houseplanninghelp.com/237

Richard: I grew up in the Sixties and Seventies going to building sites. My father's a retired architect in his nineties now and my brother is an architect in Australia. So, I come from a family of architects.

We all do a very different thing. My father did commercial, my brother does hospitals, and I do residential. Hence, I've gone down the Passivhaus route. Prior to that it was ecological buildings, and green buildings, but I've gone down this route because I just think it's the most practical way of achieving your goals. It gives you pure physics that tells you, this is what the house is going to do. This is how it's going to perform.

What we find with a majority of all of that is that it gives us results.

Ben: The Mews Development is quite interesting because this is the second project on the same Mews street. Is that just coincidence or recommendation from the neighbour?

Richard: It's recommendations. Plus, it's not the second project, it's actually the fourth house we've done now on that road.

Ben: Does that happen very often?

Richard: Well, for us it does, actually. We've got another road in London where I think we're on our seventh or eighth project. That's all quite large-scale projects.

Ben: Can you explain a little bit about the site then?

Richard: The site itself is in a very historic part of London. It's in Camberwell and it's just around the back of Camberwell Grove, which was built really as soon as the railways started coming out. It was one of the first Georgian streets in London that dealt with suburban living and living in fresher and better air. It's an amazing street. It's quite beautiful. And Stories Mews is a street which runs behind it, which used to be the old coach house street before the big mansions.

The buildings on the main road are Grade II Listed, whilst where we built the passivhaus, that all falls within the conservation area. There's also quite a prolific, if I'd say, element of a society which is called the Camberwell Society, which tries to preserve and maintain, as well as for conservation apart from planning.

The type of geology there, it's all clay. So, you've got London clay and that does lead to a few problems. And there's a lot of old, mature trees. You've got a hell of a lot of trees which does cause a lot of subsidence. Well, that doesn't really cause the subsidence because subsidence is caused by the poor foundations that were put in, a hundred-and-fifty years ago, and also the fact that the trees have grown so much. You can't blame the trees for that.

So, that's pretty much the site.

Ben: What exactly was on the brief for this, from the client's perspective?

Richard: The client, a really interesting lady. She's in the later part of her life, in her seventies. Yet, she still runs a business. She's a physiotherapist and she runs a fairly successful physiotherapy practice – one in Harley Street and the other one in East Dulwich. We've converted an old factory and made a Pilates studio and gym for her in the past. So, we've done a few bits and pieces for her.

Her boys have left home now – they're in their forties so, obviously they've left a wee while ago – and she lives in one of these big houses, or she used to live in one of these big houses. A Georgian house which was too big – five, six bedrooms, with a granny flat in the basement, effectively an annex, which is where she started her practice from. It just got too big, too cold, too drafty, the bills were high and so forth.

The money that she would spend on doing up the big house would be the same as taking a section of her garden off. She'd seen what we've done up the road, and she came to me and said, 'I'd like a really nice, modern house, three bedrooms, parking for a car off street, lots of light and I want a courtyard in it.'

I looked at the size of the site, roughly five-and-a-half metres wide by about eight or ten metres deep. I said, 'look, Elizabeth, I think that's going to be very difficult.' Oh, and the other factor was she said, 'I've only got two-hundred-and-fifty-thousand to spend.'

So, if you work that out, you think to yourself, for the sort of brief you've got about a hundred-and-twenty square metres, two-thousand pounds a square metre, it's just about doable. But that's really tight. But I thought it was possible because I built my house

ten years prior to this for about a hundred-and-fifty-grand. So, I said it was possible.

We discussed it, but then I said, there would have to be compromise. And the compromise was very much on the scale of what I could do and what I couldn't do. The compromise was also restricted through planning and conservation. So, our first design to keep the budget tight was designed with render on the outside, as opposed to brick. We made an application, and everyone was up in arms that it was rendered. And we were using render to save on costs.

So, that's really how the design developed. I can talk about how it developed from a planning point of view.

From a planning point of view, we took the street and the light industrial landscape, what was there before, and we had to apply a certain amount of this towards the fabric of what we were trying to create. So, the scale was a lot lower to a Georgian building. The planners, conservation department, Camberwell Society, certainly didn't want a mock pastiche of a Georgian building. They wanted something which was of the time.

Whilst we were developing the planning, at that stage I'd managed to persuade Elizabeth to perhaps look at Passivhaus. Of course, she was worried about this and I said, 'don't be worried. It's a fantastic thing.' She was worried about extra expense and extra money and whether you could open windows or not – all the standard things that people hear on Passivhaus. I explained to her 'there's one five doors away, have a look.' She had a look and she said, 'it seems like a normal house.' And I said, 'it is. There's nothing abnormal about it.' And I said, 'that's exactly what I would be doing because you want a house, you want to live in the same area, you don't want to move from where your existing place is, you're in your seventies, this is your final place that you're going to live in, make a Passivhaus. You'll have no bother for the next twenty-odd years or more.'

Anyway, I managed to persuade her but the problem that occurred really was with budgets. At that stage, she also said, 'by the way, I've bought myself a training pool.' I said, 'sorry?' She goes, 'I've bought a training pool and I've put a deposit on for a swimming pool.' I said, 'where are we going to put this?' She said, 'I want it in the garden. I'm a physiotherapist and I want a swimming pool. I've gone to a show and they've given me this amazing deal on a pre-fab training pool.'

So, I said, 'how do you heat this?' And we had to go through the whole issue of how it was heated. Fortunately, it didn't fall within the envelope of the building. So, that was something we could deal with. But we did design it in such a way that the solar panels on the roof of the house provide enough energy to run that pool. That's not to heat it. And she has bought herself a wetsuit now.

Ben: What else does the solar PV do in the house before it's exported?

Richard: The solar PV provides energy for the running of the pool – and it's on a feedback tariff so, there's a certain amount of energy that is reused, effectively. It's just got a standard Valiant combi-boiler on there and a number of solar panels. But that was something we took into account when we were looking at PHPP.

I'm jumping ahead of myself a little bit.

Ben: That was me. I took you off track. I was just interested while you were connecting up solar PV. But step back.

Richard: Right, step back a little bit.

I think from a planning perspective, she also wanted a parking space and a parking space was for a fairly large car. I said, 'all cars are going to be electric. Let's design it for an electric car.' So, we designed it for the size of a Toyota Prius. Not a Smart car or anything. I was trying to design it for a Smart car. Because the road is an unmade road, the local authority insisted that we have off-street parking and that's one of the criteria that was a necessity.

That caused a lot of problems with the building envelope because the building envelope, if you think of it as a rectangular box, it suddenly has an area which is taken out of it on the ground floor, for a garage space. Now, the house isn't wide enough to have a garage and door, so we used it as a sort of internal courtyard, an external space. So, it was outside of the thermal envelope. That meant that we had a larger surface area exposed to the cold which meant that we had to beef up the amount of insulation. But beefing up the amount of insulation, it added on to cost. So, this external parking space did cause us quite a lot of issues.

The costs were still within the budget. We still built the house for less than two-fifty. But that was one of the things that did add probably about six or seven-thousand pounds more in terms of the additional insulation that we had to wrap the building with.

We started very early on modelling it in PHPP and it took one-and-a-half, two attempts to get it through planning. We were fairly

successful fairly quickly. One of the logistical items when we were designing the building package once we'd got the planning and dealing with party wall issues and all the other statutory approvals that one needs to do, was really how we would get everything to site. And really, that's where the SIPs panels came in.

We designed it in such a way that we would do it in three lifts. Due to the complexity and difficulty of the site, I worked alongside a supplier who I've worked with before, Kingspan SIPs Panels, and we got a price of forty-seven-thousand pounds for the whole erection of the building. That's from ground floor, roof, all the structural aspects of it including the insulation. Which was quite reasonable at the time. We had cheaper quotes, but I'd worked with these guys before and I thought they were quite reasonable. And I knew that the product would be the genuine Kingspan product. That was something I was quite insistent on, having been to the Kingspan factory and seen how ecological their approach was and how they didn't really waste anything, or waste very little. Both myself and James were sold a load of spiel but it all looked really, really good.

Ben: What are the pros and cons of SIPs as you see it?

Richard: Pros are speed, you don't need to borrow money for a long time because you can be working, they dry very quickly. Once you've done the groundwork and foundations, you can have a house up in maybe two or three weeks.

The next item is logistics. It being done very quickly, you haven't got a lot of disruption.

The street outside is only wide enough really for one car, and if there's a lorry parked outside loading up – and remember, my site is five-and-a-half metres wide and ten metres deep – there's no room to move. So, if there's a lorry unloading, we've got lots of grab lorries – well, we can't even get a grab lorry down there basically. That's how tight the site was. We had to do it in small trucks.

The small seven-and-a-half tonne trucks could take the SIPs panels, unload it, put it in the middle of the site, and the building would be built from the middle of the site around the perimeter. As a floor would go up, the internal partitions would go on for the ground floor, then the next one. So, effectively the whole building was erected in about two-and-a-half, three weeks.

Ben: You have to add insulation to SIPs, am I right? Did you go for a thin insulation in the middle first?

Richard: SIPs are already insulated but you have to be really careful what SIPs panels you use. We avoid EPS in the SIPs panel because of fire issues, hence why we ended up using the Kingspan SIPs panels.

There is a debate as to how good it is in terms of VOC output and so forth because effectively, you're using synthetic insulation which a lot of people say isn't that great. I'd love to use rockwool or something which is very ecological at this point. We can't. Five and a half metres limits the wall build-ups. For wall build-ups we're limited to three-hundred mill, really three-twenty at the worst stage, I think. So, we're limited in terms of space. Space in London is a prime. For us to put in half-metre thick walls, we wouldn't have got the house built. That's one of the reasons we used SIPs panels. They're thin, lightweight and very efficient.

The way we built this, we used one-four-two SIPs panels with insulation on the outside. And different places had different levels of insulation. That was governed by PHPP. That changed the thicknesses of the build-ups in certain areas.

The issue with the build-ups, you've got to be really, really careful here when you use SIPs panels. This is something I'd really strongly advise. Be really careful about insulating on the inside of SIPs panels. If you insulate on the inside of SIPs panels rather than on the outside, you can have interstitial condensation. So, you have to do a condensation risk analysis at this stage. Super important.

There's a top tip here. If you use Kingspan, they'll use their service and you can actually get those guys to do all the risk analysis for you. But it's really important because if that's not done, then you can have a big, big problem and have a mushroom farm, effectively, on the inside of your walls.

Ben: Why wouldn't you want it on the outside anyway? That sounds like the easy solution.

Richard: I have a house made out of SIPs panels that I live in. I've got a little bit of insulation on the inside, probably twenty mill. or so behind the plasterboard. To get the u-values to the level that you require, you need more. To put more insulation on the inside is where you end up with a risk of getting interstitial condensation. By building on the outside, what it means is you can very easily adhere brick slips, because you've got OSB board. So, putting in insulation is an expense.

You can also use thicker SIPs panels. You can use one-seven-twos, but all of this you need to think through and calculate before you actually start on site. Very important you think it through. It all needs to go into PHPP.

Currently, for instance, we are working on a number of new passivhauses and we're working with Design PH. Design PH is where we have a 3D model of the building and as we're varying the window sizes, we can see what the wall thicknesses will do and so forth because it links it directly with PHPP. Very useful tool for an architect or designer at this stage. Really, really useful.

Putting the insulation on the outside is much easier because it's easier to adhere to, it's easier to deal with airtightness, it's easier to deal with a lot of issues. But occasionally, it is not possible. And that's why you might be putting it on the inside. For instance, if you're doing an existing building there's no way you can insulate it on the outside if it's in a conservation area and it's brick. For instance, we've got one in Kennington which we're doing that's a Georgian house and it's just got the EnerPHit certification. We couldn't do anything on the outside, so it all had to be done on the inside. Believe me, that was very difficult to achieve.

Ben: And the OSB isn't airtight, is it? So, where does the airtightness line go?

Richard: The OSB isn't airtight but depending on who you use and who makes the SIPs panels, it can be. Kingspan's OSB is. So, be really careful here.

Now, I've seen a passivhaus in Romania – I went to one in Romania – and they'd used a cheaper panel and it wasn't airtight. And it looked like someone had peppered it with a machine gun because when they were doing the air test, they were finding all sorts of leaks. So, they were putting tape on it and it looked a mess.

With this particular system that we used, it was airtight through the OSB board and through the SIPs.

Ben: Is this Kingspan Tech?

Richard: Yes, Kingspan Tech. We did put in an airtight membrane as well. We doubled up in certain places where we needed to. We did do three air tests whilst we were building this building. So, the costs for three air tests was in the builder's contract. And the first one we did was as soon as the building was erected, without the windows.

So, we had no windows, no doors, we just had the structural frame. We had done the foundations, the foundations were done first – well, demolition, foundations, that was a separate contract. Then we had the building arrive, it was erected and then we taped up some damp-proof membrane over the windows and we checked where it was leaking. Then we ensured that any leaks or any possible leaks – there weren't actually any leaks; there were some areas where it wasn't as airtight as we wanted it, but within a day it was. That's a really good tip.

The next tip was when we put the windows in, at the point of installing the windows we did another air test, literally just after they were installed. And again, we could see that the windows weren't installed correctly. The windows were installed by the window manufacturer who said they had experience in installing Passivhaus windows, and I as an architect know how to install Passivhaus windows and I told them how to install Passivhaus windows, but they said, 'of course we know, of course we know.' And they didn't install them correctly. They had to all come out and be put in again, but the air test proved that the manufacturer had got it wrong. So, really, be careful with things like this.

I know that you need to bunny-ear the tapes around the windows, you need to be very specific with what tape you use, whether it's an INTELLO, whatever it is, whatever tape you're using, you need to make sure it's specifically for the purpose and really, again, specify with whatever contract you're using – whether it's the window manufacturers who are doing it or whether it's your main contractors installing the windows – that you're clear cut and you've got a piece of paperwork before you're paying for it, that these will be installed to whatever airtightness you want them to. And then have an air test afterwards and then you can cross check it. Because without that, once the windows are in and you've started putting the plasterboard on, you're screwed. Because then you've got to take the whole load of building fabric, waste a load of material, there are costs, there'll be all sorts of legal disputes and so forth.

At this stage, we were really clear cut. Windows were put in, they were leaking, manufacturer came back and redid it. And he didn't even bat an eyelid about it. He just did it. He goes, 'the wrong crew came down. They weren't our experienced crew,' all sorts of excuses. But we had the evidence. Without that evidence you are absolutely – you need that.

So, it's about getting your contract as tight as possible and making sure, even if it's only a single sheet of paper, you need to make sure that all of these items are in there.

Ben: What was your contract?

Richard: For this particular project, we used two. We used the new RIBA domestic contract for the main building and we had another RIBA domestic which we used for foundations. But we coordinated it with the two contractors who were dealing with both aspects of the build. Then we also had a specific subcontractor, Thomas Carter, who installed the SIPs panels but that was under a RIBA domestic contract.

The RIBA domestic contract 2018 is pretty good. The one we used was for 2012 or 2014, I can't remember actually, but it was the older one which is not as good. It's quite loose. The 2018 is a lot tighter. For us, that is now the right contract. If it's a bigger project, then we move on to intermediate contracts. But be really specific.

We broke this into a number of separate contracts, and you'll hear also that our main contractor went bust effectively halfway through the project. That was also another issue. We noticed that the main contractor, who was a friend of a client's son – who we didn't actually put on the tender list; we were advising to go to somewhere else – was asking for more and more money. We weren't allowing it. Eventually, we realised he had other problems and he went bust. That caused us a few issues.

The client didn't really lose any money over this, they just lost a bit of time. Probably about four months when we were in the processes of stopping one contract and going through another one. At that point, the son who has got some development experience, decided to take on the same crew who had been working on the project. He managed it and he's now setup a building firm that we're working with.

So, he finished the contract off. And that's your protection, by having an architect, a proper contract, you are quite protected should anything go wrong.

This has happened to me in my twenty-four year career as an architect. I've had probably four or five cases of contractors going bust. And each time, the client hasn't been so out of pocket but they've lost time. Because the contract protects you.

Ben: Is there anything you can do upfront? It might be difficult. I know you do all your checks and stuff before tender but anything else?

Richard: I do. I do everything I can to check the various contractors, and I advise clients. The company checks, speaking to people who have had stuff built – but for instance, I was working with a contractor for ten years and he was a very good contractor – this is a different project – and he had very good recommendations, very good approvals. He got in trouble with the VAT man and he went bust half way through it. A big, million pound project.

It happens. A really good guy, been working donkey's years, got into trouble. So, you don't always know. You might have amazing glowing references, a fantastic track record, you might have known them for so long – you never know. It's always quite difficult.

So, protection is something I would say is important. The other thing that you can do is to insure for things like this and you can put bonds in place, but it's very expensive and it's not really done that often.

Also, just look at their turnover. A company check is free if you use it online initially. Just check people out.

Ben: What else do we need to know about this Mews project then? We know it was a tight budget, SIPs obviously very helpful. Anything else you're doing?

Richard: The other aspects about this project – I mean, we spent a lot of time working out the interiors. Libby wanted something which was incredibly palatial. She wanted something which was effectively a half-million pound house for two-hundred-and-fifty-thousand pound budget. Which we sort of delivered. I think we have in some ways. The bathrooms look like they're a lot more expensive.

The way we did that was by looking at what she wanted and then trying to substitute materials which we could buy at a budget. For instance, the tiles she came to us with initially were about fifty pounds a square metre. We found an alternative one for about twenty pounds a square metre. In fact, I think it was less. It was about eighteen. She came to us with a really grand white Corian type staircase; we ended up making the staircase out of MDF and painting it white.

Ben: That's what you have to do, isn't it?

Richard: Exactly. So, you design it in such a way that you work with the materials that you can afford, and then you come up with alternatives.

The kitchen, for instance, we imported the kitchen from Italy from a factory. So, it's unbadged. I know the factory as I go to the Milan Design Show pretty much on a yearly basis, I talk to all the suppliers. And to send a big truck over from Europe to the UK – I don't know what it's going to be like after Brexit – is about two-thousand euros, or it used to be.

So, a lot of the interiors was one of the items that we spent a lot of time shopping around, making sure that all the systems worked well.

But one of the problems I would say is avoid buying each individual piece on eBay. That proves to be an absolute nightmare. I have clients who have done that in the past. They go, 'I can get this on eBay a lot cheaper.' The problem is, you're going to have to store it somewhere. So, unless you've got a very cheap storage place where you can store it and you can fundamentally say that all these parts are there – because you've got different fixes that are necessary. At first fix stage, you'll need the different components to go into the walls than at second fix stage. And then you're going to be storing this somewhere. The likelihood is you'll lose the cover for something or whatever. So, allow the builder, the contractor to get these items, or if you are working with an architect or coordinator – like we consider ourselves as contract administrators as well as architects then we deal with those sorts of items.

Other items – so, the interior, we really thought about that a lot. We had a few very specialist, bespoke items such as the front garage doors which roll back. That was a specialist item. We had another very specialist item which was the deck to the swimming pool which is like a Thunderbirds deck. The deck basically rolls across and slides across after you've put the key in the lock, and then all of a sudden, you've got a swimming pool at the back there. Otherwise, it's a floor deck. That's the entire back garden. That was quite complicated, and we managed to get an engineer for about eight-grand to do all the engineering for that, which is fantastic.

So, just think of those other items which are a little bit more complex. For instance, for us here, other complex issues were for rooflights. How do we make the rooflights work with the glazing without spending an absolute fortune? We worked with a company that we'd worked with before and we designed the rooflight to sit in foam glass. So, we designed the thermal bridging calculations. So the rooflight sits in this foam glass sandwich. And then at the front, we've got the window which comes up to this foam glass. Then we've got stepped glazing which hits another bit of stepped glazing and it's sealed with a silicone seal.

Now, that's something we developed. It was our R&D which went into this to make sure that up-and-over type rooflight worked. And it does work. Though, the first time we did it – this was after the first builder went bust – we realised that the first builder who went bust had actually ordered double-glazing for the rooflight as opposed to triple. We'd specced out triple. We went on site, we saw it, and we thought, 'hang on, this is double-glazed.' And we thought, 'hang on, how is this going to work?' He'd obviously tried to save some money – it was about two grand – but we had to take both rooflights out and then now those rooflights are quadruple-glazed because we bought another double-glazed unit and put it in underneath that. So, we've got a quadruple-glazed rooflight there.

So, we upped its performance, but we had to take the unit out and then put it back in and drop it into the foam glass and then seal up the roof.

There are all sorts of little tricks.

The other thing that's important with anything where there's a tricky situation like Passivhaus. Passivhaus isn't complex. It's more a question of keeping an eye on the builder. What I mean by this is be careful when you go to site and make sure that you've got someone who's got experience, who's cross checking what the builder is doing. Because if you move past the stage where it's too late to fix it, that's where it can get really expensive. Whereas if someone's checking it throughout the process or at certain crucial stages – like, for instance, we hadn't plastered the ceilings and we suddenly realised that we'd got double-glazing instead of triple-glazing; we managed to nip that, effectively. We didn't have huge costs involved in replacing those units and adding to them. We had a few issues like that. There were a few tricky ones.

The other really tricky one with this was the services. The original builder said, 'oh yes, we've put the notices in to the water board and to the electricity board,' given us a receipt and everything so, we paid his deposits, only to find out that they surveyed it and they said they couldn't do it. So, when we'd actually come to try and get the water, gas and electric connected, that took a long time. Because we almost had to start again. Because this is a private road. They said they could take it to the bottom of the road, and then we had three houses from the bottom of the road to our house going across private land. We managed to deal with that through good neighbourly communication, really.

That was done, we hired metal plates to put on the road when we were digging it up, so people could get past. We'd dig it up very

quickly in a section, lay the pipes – so, there are complexities. And finding someone you can trust who you can work with is so, so important.

Ben: Finally, how has this all gone down with Elizabeth and any learnings that you've had, as this fits into your portfolio of projects?

Richard: Elizabeth absolutely loves her house. She loves it.

She had a big issue about downsizing. Going from a five or six bedroom house that she's lived most of her life in to a three bedroom tiny house – well, it's not tiny, it's small. Maybe tiny is a bit of an exaggeration – but everything's thought through here. So, the kitchen goes into the living room, there are doors that slide into walls – it's a bit like an aircraft. The toilet under the stairs has a washing machine in it which goes under the stairs, there's a laundry basket above that. Everything's been thought through.

She loves it. Absolutely.

Learning experiences from it, I suppose for me as a practice, don't listen to clients when they come up with builders ideas if you're not very sure that the builder is any good. From my first meeting, I wasn't keen on the builder, but the clients knew him, and he was a friend. I just thought he was a bit of a – well, when he turned up in his really flash car, in like, a sixty-grand Porsche, I just thought to myself, 'nah.' Apparently, he was an ex-footballer as well.

Ben: I don't think I've ever heard of a builder turning up in a Porsche.

Richard: Well, this guy did. I just thought to myself, 'I'm not sure about this.'

The next thing here really is be strong with your ideals, stick to your ideals. I stuck with Passivhaus. There was many a time when the client wanted to tell me to sod off and not do it. There was many a time, and I know that Libby did come to it. Now, she absolutely loves it. She wouldn't bat an eyelid about doing it again, I don't think, as a passivhaus.

Her son is doing other projects with us now and he's learnt from this. So, it's a huge learning experience.

We've learnt a lot about construction, we've learnt a lot about how the brick slips – because this was done with brick slips – how they adhere to the walls. There's a lot of R&D for us on this project. So, effectively our hours were at least three times the amount of hours that we should be charging for. So, effectively for us, we made a loss on the project as a practice. But for us, it's a huge research

gain, because there's a huge amount of information I've learnt from it, there are other projects that will benefit – we're doing a housing estate at the moment as well, for 2022, which is likely to be passive as well.

And one of the things I have learnt from this, one of the other items, is Passivhaus is a fantastic system but don't let you be swayed by just Passivhaus rules, regulations and what you can and can't do. Basically, you can do anything as long as you've got an architect who understands what Passivhaus is about. You can design pretty much any sort of building you want to and apply the principles to it. And I think that's really important.

One of the problems that I do find with people saying, 'this is Passivhaus, this is not Passivhaus,' is that really, what you're trying to do is approach a design problem and make that design problem the best solution you can possibly achieve for the client.

Now, Passivhaus comes into it as a bit of physics, which is probably about ten percent of the problem. The rest of the problem is to make the bloody house work and make it work for your client. That's an architect's problem. And I think that is something that you need to really think through, rather than saying, 'I want to design myself a passivhaus.' No, the problem is what do you want? How many kids are going to live there? What's the house for? Is it for you, are you going to be staying there? Are you planning on selling it? What's the longevity of this house? Is it going to stay there for another hundred years? All of this sort of stuff. Think it through. Think what you want out of it, think whether it's going to be left for yourself, for your children, are you going to be selling it in seven years' time? Do you need a ten year warranty on it? All these sorts of things you need to think through.

Ben: Richard, I've really appreciated all these insights today. Thank you very much.

Richard: Good. I'm glad. Thank you.