

## Episode 53

# An Introduction to the Passive House Planning Package

The show notes: [www.houseplanninghelp.com/53](http://www.houseplanninghelp.com/53)

Intro: Moving on to today's interview. It's with Mark Tiramani who lives in the UK's first certified Passivhaus . . .

We're going to hear the full story of Y Foel, the Passivhaus, but also [find out about] the Passive House Planning Package. Now Mark is not an expert but what intrigued me is that he clearly has a passion for it and he needed to do some of it on this project, which is a situation I know we are unlikely to find ourselves in.

You do need expertise. It's quite a sophisticated integrated spreadsheet system that runs under MS Excel. So I think Mark's story is fantastic and all I want to do in this session is explore what the basics are because we're not going to use it but what is PHPP and how do the people in the architecture industry, how did they use it and those wanting to build Passivhauses?

I started out by asking him why he wanted to build his own house.

Mark: Well we were actually backpacking in Upstate New York as an escape from New York City every now and then, and it was about treading lightly. We'd met somebody who really impressed upon us that you shouldn't even leave half a strand of spaghetti because you actually change the natural environment. That was a concept that gradually we understood. Then we started looking towards dreaming about building our own home.

I'd never had roots so I travelled a lot. I'd lived in several countries. My wife is from India and lived in Germany, and we are all a bit root-less so we wanted a home, we wanted stability. At the time we started looking at straw bale houses and we looked at it and we thought we *can* do that.

The first idea was we were going to do it in the US. We were probably going to try and become resident and stay there - I was working in New York. And things changed, life changed and we ended up in '95 back in the UK and after a couple of years, after

we'd found our feet again and settled in a little bit, we decided that we should try and realise the dream.

Ben: I'm intrigued because being travellers, and I love travelling, how do you put down those roots? When did you know *this is the right area, this is where I want to stay, this is where I want to build?*

Mark: Well it started off with me and two friends. There were the three lads from school with our art teacher, who had a . . . at the end of the 60s, early 70s bought a cottage in Penalton, just down the road here.

We used to come up here in his Vauxhall Viva, climb the mountains, have a fantastic time and I fell in love with the landscape. So that's why Wales, that's why we ended up in Wales. But also, to be honest, it was also an escape. It was a conscious . . . . I fought with that for a long time because I knew I was escaping the life behind me and the life that I was in, the life that I felt deeply uncomfortable with in many ways. This seemed like a good idea. We discussed it to death. In the end my wife Shirley found this property on the internet! [Mark laughs.] It was an abandoned cottage so we had, not a given right to replace, but more or less if we went about it the right way we'd be able to put a replacement dwelling here.

Ben: This is amazing to me because we are in the first certified Passivhaus in the UK and this was initiated from you. Is that right?

Mark: Yes. Well, the house build was initiated by us. I don't like the term 'eco house' because it's nonsense. It's meaningless actually. It used to have a meaning but now it's just confusing.

Ben: But those terms change, don't they?

Mark: They do.

Ben: It'll be one thing one year so eco house is . . .

Mark: We wanted to build an eco house. [Ben laughs.] Back then we didn't know anything about Passivhaus. We knew about straw bale but once we'd visited Wales a few times and we did a bit of camping . . . We weren't backpacking any more, a bit too old for that, but we did camping and mountain biking and hiking, and the love for the region grew - north Wales, mid Wales.

So we wanted to build a house here but we still thought we could build a straw bale house. Then we thought we could build a green oak timber frame house, in-fill straw bale, so the original idea was load-bearing, single storey straw bale where we literally gathered the straw from neighbouring farmers, put the bales together, strapped them up, tightened them up, got our friends in - which we didn't have at the time, really! - got our pals in and built this house ourselves. That drove us, the idea that you could do that, this feeling empowered to build a house. It ended up something quite different.

Ben: What intrigues me is that we are in the UK's first certified Passivhaus so I want to know when did you decide we are going down this route?

Mark: Specifically Passivhaus? Very early 2005. Our designer/builder Jon mentioned the word. We were living down in Hatfield. We could only visit the site relatively infrequently but that was the beginning of Passivhaus for us and at first I didn't know what it was. I had 'passive' in my head from passive solar, from living in the States, looking at various buildings but I'd already thought I'd understood what passive solar was or part of the passive solar story. So as soon as I heard the word 'passive' I got that muddled a bit but it was 'Passivhaus' and it was German. I'm spent 13 years in America, sorry in Germany. German was my first language for some years. That immediately triggered off a sense of trust rather than suspicion, which a lot of people here seem to treat Passivhaus with suspicion because it's foreign, should I say. It had the opposite effect with us because I thought, *ah right, it's actually a way of working out how much energy you would require to heat a house and run it.*

That got me interested. So that was the beginning.

Ben: One of the interesting things you've said to me is that you've played around with PHPP. Now you're not someone who's part of construction or all of this. Clearly you've got an interest and you've found out about it, but tell me about PHPP and what you've done.

Mark: Well, for our original certification in 2009, the house was certified, it was provisional certification in April at the Passivhaus Conference in Frankfurt. I did the windows, I had to do therms, I had to do primary calculations . . .

Ben: Whoa, whoa, whoa! Let's slow down here. *You* had to do it. Why were you having to do it? Was this a way of cost cutting? Were you interested?

Mark: No, no. There's a very, very long story and it's a difficult story but there were two projects going on at the same time, in parallel here. So Canolfan Hyddgen, which John did with Powys and Welsh funding down in Machynlleth. That build was going on in parallel to this one. So there was only so much resource and there was only so much knowledge and expertise, and time was running out and various . . . whatever! Cut a very, very, very long story - a story that started at the end of 2002 and if you like is still continuing . . .

Ben: Were you ultimately pleased that you did have to do this?

Mark: Absolutely. I mean for me actually getting to grips with PHPP, that's really what unlocked it. It dispels all the myths and mystery. It's just a tool to work out what the building is going to do thermodynamically. And using building physics it joins up all the dots. It was having to do something . . . I calculated - a very rough calculation - that I spent 700 hours, 695 of which were stumbling through stuff, bits of German documents, spreadsheets from all over the place, Google searches, EN whatever. I could probably come up with the numbers but I won't try . . . the various standards, the standard calculations and how you do it. The reason for that - and there are two reasons - one was the time pressure, so we wanted to get certification and we wanted to get it done for the Passivhaus Conference in 2009.

We were still in a caravan, on paper at least, and most of the time it was extremely cold. It had been a very, very long road to get the house up and more or less habitable. We were desperate, absolutely desperate. We were at our wits end. We had to move in somewhere. We had to get this place going, that we'd invested so much energy in and that had nearly crushed us to be honest.

So I was like I'm not going to fail at this point. I'm going to do it. I'm going to do it myself so I went through, did the window calculations.

It would have all . . . Yeah, go on.

Ben: How would that start then? You say you've done the window calculations. Let's just take one window. You've got the program, what are you putting in?

Mark: Well okay, for a start it doesn't start with PHPP. You need to have the specs of the window, you need finite element analysis, two dimensional, some sort of software. I use Therm, which is the freely available software, which is brilliant, a bit clunky but brilliant in terms of the algorithms and stuff. So I learned how to use that. I have to say I'm an IT professional so I deal with laptops, computers, servers mostly but sitting in front of a spreadsheet it's a pain, it's not something I particularly relish, but of course I'm comfortable with it. I know what it's doing. I've been a bit of a programmer as well.

It was complex but it's before that. It's working out what the frames can do, so you have to break down the window into all its elements, the glazing, the coating, the spacer, the actual frame and you have to do precise measurements, create a little CAD drawing and then do the window on its own according to the standards and the window installed in the wall, so the actual installed window. You have to get the numbers out of that and then you use that to put into PHPP.

That is not the normal route. The reason we had to do that was because of the three window quotes we had, we had to take the cheapest. [Mark laughs.] I suppose we could have gone for the middle quote. So we had something from the top, Optiwin, Internorm and NorDan. Now NorDan, this is a story I know. I might be slightly wrong but anyway they tried for Passive House Institute, . . . Passive House Institute, Darmstadt, they tried for official certification on these windows but what was being demanded of them, as I understand it, was a little bit so they didn't want to do it, relatively small company, couldn't see the gains at the time so they withdrew from the certification process. So the windows that we got installed were sold as 'NorDan NTech Passive' so as a Passivhaus window but without certification.

Now if you buy something that's in the database and is included in the PHPP spreadsheet and it's got a huge drop-down list, you select it from that, it's certified. [Mark claps signifying the much easier route!]

Ben: Right, let's see if I understand this because I certainly won't be going and putting all these numbers into PHPP. The reason that you had to do all of this was because you didn't have the data in the first place whereas if you'd used certified products the data is there?

Mark: Well, now I have to say, with the latest version I have completely re-done from scratch PHPP using version 8.4 and . . .

Ben: Why are you still using it?!

Mark: [Mark laughs under his breath.] Well, first of all I can't bear something that I don't understand and that can be a real handicap for me sometimes. It can be incredibly boring and tedious but if I've got something like . . . I used to be a glider pilot and it wasn't enough just to fly. That's probably why I stopped because it wasn't enough just to fly, I had to know why thermals happened and the dynamics and the aerodynamics of the aircraft and I just got distanced then from the actual pleasure of flying. That's me. That's my problem if you like.

This took years to understand that this wasn't just a well insulated house but gradually it dawned on me that there didn't seem to be anything else out there that you could actually . . . We're so used to stuff. We play with our smartphones. We just do stuff. We press buttons. We expect this incredible stuff, worldwide communication just to work. Right? We expect our car to do decent mileage if we've got a whatever. We expect it to be comfortable to drive. We expect the climate inside our car often to be better than the climate inside our house. We set our targets very high, our standards very high.

But with housing, across the world, our standards are almost non-existent. Our experience, our understanding of building physics up until recent decades has been either intuitive or in some cultures, some civilisations, they've built with local materials, where they don't have a heating problem. So where you've only got a cooling problem I wouldn't say it's simpler but there are, like in India, lots of places in India they've got incredibly elegant solutions for cooling a building. For heating a building there wasn't anything so we start to understand, wait a minute, so we started off with a woodburner in here.

Ben: When you say you started off with a woodburner this is before you've built anything. This is in your mind? There wasn't one right in front of us here. [Ben laughs.]

Mark: We live in the middle of a 3-acre, kind of woodland and whatever, very varied hillside and whatever, all sloping, but there's lots of wood. And our first question was . . . Before Passivhaus came up,

one of our first questions was, *would we have enough firewood from our own land?* Because we're 500m, half a kilometre, from the nearest asphalt road, six miles from the nearest town. We're not cut off at all but it's very rural and the idea of having to pay for wood or travel to get it seemed a bit daft. Do you know what? When we first asked that question the answer was, *well I'm not sure, I don't think so*, because you need dry wood, you need this . . .

Even the people that were helping us build the house their experience was to heat a house round here you need tonnage of wood. So then we don't have a woodburner. We've got nothing in here but that again that was partly time pressure, finance, just the pressure of wanting to get in. It wasn't certain. We couldn't find a woodburner that was small enough at the time of designing, yeah, so 2006/7.

Ben: Can I ask, has that in hindsight been a blessing that you didn't go down that route?

Mark: Totally. So there's two things there. It's like this being the first certified Passivhaus. This isn't the first highly insulated, airtight house. Not at all. We don't really see ourselves as . . . We see ourselves specifically as pioneers of seeing a project through to certification and that's because of my pigheadedness and whatever. So I was driven to make sure it was certified.

At the time nobody knew how much heat you had to put into a building like this, a detached building in the UK, if it was Passivhaus. There was no comparison. There wasn't really any point in asking someone down in Bavaria or in Darmstadt even or even in Bonn.

But in the end, that choice was almost . . . It was one day, we were umming and umming. We'd gone backwards and forwards. I calculated five times. We'd said: "We're having a chimney," and then "we're not having a chimney." There was going to be an Isokern chimney stack all the way through. The actual structure in the i-beam floor is still there to strengthen that area to take the thing.

In the end I said: "No, come on, we're not going to have it." My decision, we're not going to have any kind of burner. I don't regret that simply because we've now ended up with a house that has no fixed form of heating at all. There's no underfloor, there's nothing.

We got one single, oil filled electric radiator and a bio-ethanol which does about a kilowatt output that I made myself with three stainless steel things in a Thermalite block and we've got one £60 eBay, glass and metal thing that will hold about half a litre, a litre, of bioethanol. Those are the only forms of heating we've got.

Ben: How often are you using these?

Mark: The last time we heated, I think was the beginning of March . . . with anything, except twice, just because it felt right. And the thing with a little bioethanol burner is you can just carry it around the house and plump it down anywhere. So we have this little thing with this three lights, flames, flickering. And it's a live flame, it's a focus, it's makes you feel warm just looking at it. And it does give off significant heat. That and the week before last, I think.

Ben: Okay, just getting back to PHPP, what is it actually calculating, if that's not a really stupid question?!

Mark: No, it's not a stupid question because I'm sure that's what people want to know. What is it calculating? Well, it's calculating a whole bunch of things. The things that people know about are the specific space-heating requirement. That's the famous 15kWh per m<sup>2</sup> per year. You can pass on that alone plus overheating plus total primary energy consumption. So there's basically those three things but you can also pass on the heat load or heating load. That's calculated based on climate data. To try and simplify it really you have to use climate data, you try and use at least 20, 25 years. There's now good models available for the whole of the UK. Well, some are better than others. Part of that climate data is a calculated coldest temperature that is reasonable to assume outside. On that basis, that temperature outside, 20 inside, for our house it's nominally -3.7 outside, 20 inside, how much heat do you need to put in to maintain that temperature, that internal temperature? It's more complicated than that. I'll probably explain it wrong, but that's different to how much heat you will need per m<sup>2</sup> per year. So the heating load, if you've got that at 10 or below, you can certify on that, even though let's say your specific space heating requirement is much, much higher.

Ben: I think my mind's just going a bit blank here but that's fine. That's fine! For some people they'll just know exactly what you're talking about but that's good. Okay. [Ben laughs.] I'm going to shift it on a bit just because we're running out of time.

So how much work did you do on PHPP and what did it allow you to discover and see things differently?

Mark: For the initial certification I did the windows. Basically we had to prove to the Passive House Institute that they were good. This is a window that had already been pulled from certification. I looked at it and I thought this has got to be right. It can't be that bad. All the Therm's calculations said it was good so I did all that. I made a big deal out of it because it was new to me and I didn't have anybody really guiding me so I had to teach myself, so it was a big effort but I got that. I did my level best. I went round, measured stuff, got the materials as exactly as I could. Unfortunately we didn't get the data that would have been nice to have from the manufacturer. That's another story. So I had to do . . . That was good, that unlocked a few things but it left a load of mysteries. So that was in 2009. We're now in 2014 and it's only about two months ago that I completely re-did with the latest PHPP, just started from scratch because there were things in there I wasn't quite happy with. A couple of things are very difficult to do in PHPP, really. Shading is one. It's a bit down to guesswork, so it's that artistic licence, and you can make a big difference particularly in a house like ours where we've got . . . Some people don't like the fact that we've got this much east glazing. Now for us it had to be there. For me it had to be there. So we've got a full height, we've got loads of glazing on this south east corner, where we're sitting now and I love it. I love it. I would not be without it. So I wasn't going to compromise on that too far, but a lot of people would say we've got too much glazing in there, for example.

Now there were things about our original PHPP where the shading was simplified. We're on a site, as you've seen, it's kind of like a 90 degree angle and a bit more, but you can imagine the sun disappears quite early so woo, but you can't accurately enter that into PHPP. It's all done on four directions and horizontals, so imagining that that hill which I'm pointing to, which of course you can't see, that hill over there, which slopes at 25 to 40 degrees, it's imagining that as a horizontal straight line at a particular height. It's imagining those trees, what are those trees, all those trees there, are they opaque or not? No they are not. So, to get an accurate figure you've got to know a lot about a shading of a particular site. Right. It doesn't matter for many buildings and really to build a Passivhaus in a way you want to forget too much about the shading because you could have something built in front of it 10 years later.

Suppose something gets thrown up at that critical sector where you've relied on solar gain in the winter and it blocks out your sun!

Ben: Or trees. You've got trees out there. What if they grow massively?

Mark: Well, you see ours aren't going to because those ones that are blocking are massive and a couple of hundred years old, so they're not going anywhere really. And in winter, my estimate is between 40 - 60% still gets through of that critical phase, but then the sun goes behind a hill at a time of year where if we're on a clear day we're getting significant kilowatt hours and we're not getting them because, some of it, because of the trees.

So to enter all of that stuff, what I did was, there was that, there was the windows, the window sizing, the way the windows were placed in PHPP. If you've got two opening lights and a fixed light, so the middle one is fixed, right and left are opening, turn and tilt, the one in the middle has a much better thermally-broken frame. It's much simpler, it's a fixed bit of glazing. The ones on the left and right, there's much more wood in there. There's hinges, there's all sorts of stuff. So they're not as efficient. Now the side the windows open on is important, so where the handle is and that bit that opens. Is it on the left? Or is it on the wall side where the window is fixed into the wall? Or is it on the side next to the fixed glazing element?

Ben: Am I right in saying this is a lot of work, really? It's not that it isn't worth it, but it's a lot of work.

Mark: Yeah it is but I love it, because particularly doing this I'd say, now this is probably how we got to this point on trying to do a podcast on PHPP, I know I've made mistakes on it and I'm not properly trained. Whatever that means. Yeah, so I'm self-taught but I've got the time and the passion to dig and dig and dig. And I have some people who really do know what they are doing. If I think I'm not sure I can ask them and they do help. Thank you very much, guys. So I get help to questions that I can't answer or work out for myself with my IT and computer knowledge, spreadsheets and stuff. That then led to a PHPP which we now have where I've gone no. 90%, there's a couple of bits I've just taken that are bits that I'm not in the position to measure, assumptions which are okay but I'm confident that it's extremely accurate in terms of what you can do because it's 'as built' as the trees stand, as the wind blows . . . For example, if you're in a sheltered spot, how sheltered? That's another thing, in an urban environment, and PHPP gives you various options and

you can take a range of figures to describe how sheltered it is. Again, if you're very exposed it can make quite a significant difference to your space heating requirement if you're very, very sheltered like we are. Okay, I know now after, well we lived in a caravan for a year before we moved into the house so we've been here since 2008 and we've had two of the worst winters on record so we've got a good idea of what really happens here. And we're extremely sheltered. Pretty much, it's a spot which obviously a couple of hundred years ago somebody picked because it's a very good location, it's very sheltered.

Ben: This has been certified Passivhaus standard so you said that you made lots of mistakes, or some mistakes in PHPP, or you're not sure if you did. So, if it's met the standard, does that not mean that you haven't actually made those mistakes? [Mark laughs.]

Mark: No. Of course PHPP is a spreadsheet. I read recently, somebody described one of the recent Passivhaus projects in the UK: "Oh, it's a simple spreadsheet." Well, that nearly blew my mind because it's anything but a simple spreadsheet. There's always the struggle with something like that where you've got a user interface and you type stuff in. [Mark drums his fingers on the table.] That's me typing on the table now. If I make a mistake with a number, a decimal point or this or that, it's combining so many different factors about a building . . . You know, the properties of the ground, the thermal bridges, every detail that you can capture is in there somewhere, how do you really join all those dots in a way that corrects every mistake? It doesn't try to correct every user error. It can't. Every iteration of PHPP does that a little bit better but it's a very complex, behind the scenes, deciding which bit to take from where and how to join it on in the sense of, have I put in a number that is realistic? Where do I throw up an error? That's been one of the criticisms that it didn't throw up enough errors so it allowed users to put stuff in that they honestly thought was correct but actually if you go back and look at it you think, *oh no they misunderstood a little bit.*

So it does require quite a lot of time, attention to detail, but it's eminently learnable. I think there's a lot of architects and designers that are fearful of it because it suddenly appears as if something's dictating to you how you've got to put your building together. It doesn't do that, it doesn't. PHPP isn't a design tool. It's not telling you in the sense of aesthetics or architecture.

Ben: Well, I think that's a good point to leave it and I've really enjoyed coming here and seeing this and having a chat with you. So Mark, thank you very much.

Mark: You're welcome.