

HPH313

Ben Adam-Smith 00:00

This is House Planning Help - Episode 313. Hello, I'm Ben Adam-Smith, and this is the podcast for you if you're interested in self build or retrofit. I'm exploring what houses we should be building in the 21st century, and trying to break down the major roadblocks that may get in our way. Coming up in this session, my guest is Gwilym Still, Passivhaus leader and partner at Max Fordham engineers.

Ben Adam-Smith 00:25

Today's topic is really about optimization, efficiency, common sense, good design. What input would an engineer give your self-build on day one? We'll dive into that question in a few moments.

Ben Adam-Smith 00:40

The backstory here: I met Gwilym while we were doing some filming for the Passivhaus Trust, their awards that they hold. And this was at Cambridge University, fabulous site. Cambridge University is one of those historic universities and just lush even though you're right in the middle of the city, and everyone's on their bikes. And what was amazing about this, there's two quite big accommodation blocks, which were slotted into King's College garden. And somehow you don't even seem to notice the garden is so lush that you don't notice that these new buildings have even arrived here. Yet they have and affording a great level of comfort and all sorts of facilities for the students.

Ben Adam-Smith 01:23

But what I noticed while we're filming this is Gwilym was off, asking the students various questions. It was almost his opportunity, how has it worked? How are things, any trouble, anything that we can solve? I thought that's really interesting. Plus, when we were recording the interviews, he came up with so many nice sound bites that I thought there's more to expand on here. So we welcome him, we're going to start in a slightly different place though today. Max Fordham set up his engineering practice in 1966, from the spare room of his Camden home. Since then, his practice has grown to 220 people across five offices in the UK. Sadly, Max passed away at the beginning of this year, but he was an inspirational character. So I asked Gwilym to tell me a little bit about him as a person, and the practice that's still going from strength to strength.

Gwilym Still 02:15

He was quite an amazing person in terms of both the technical excellence of his engineering, but also his sort of character, and how good he was at communicating with people. He set the practice up as a partnership, and I think that's been one of the parts that's been really valuable. It was quite interesting some of the obituaries and memorials of people saying that he was as proud of the design of the practice as he was the design of any of the buildings that he'd worked on. And I think that's followed through into the culture of the practice. So, it's been set up so that we recruit people and then teach them about building physics, rather than recruiting people who've been formally trained in building physics or mechanical engineering or electrical engineering and so, some of the best engineers that

I've worked with, they've got backgrounds in chemistry, or botany, or zoology or something else like that.

Ben Adam-Smith 03:05

So is it driven very much by the people? Are you looking for a particular type of person? Obviously, they've got to deal with a lot of technical stuff. But it sounds like you're almost going for the personality match, someone who's going to take this and run with it?

Gwilym Still 03:20

I think so. I think we're really interested in people who are going to care about design and get excited by it and be interested in the purpose of the projects that we're working on, rather than just it being an easy way to get a paycheck and move on. They could probably earn more money somewhere else if they're purely motivated by money, but we, you know, we tend to recruit people who are just really interested in design and want to be involved in exciting buildings.

Ben Adam-Smith 03:45

We're going to talk a little bit about his house, we will just let that come into the conversation as it does. But also, you've mentioned Passivhaus. And I thought that this could be an interesting discussion. Very rarely do self-builders bring an engineer in on day one, but what would things look like if we did do that? What conversations would we be having? So, if you'd like to start us off? And we'll just lead through some of those topics. Because when I met you last year, I just felt with so many different insights, I know often from bigger projects, but yeah, if we're thinking about smaller projects, where would you like to start?

Gwilym Still 04:23

Some of the bits at the start are things which you get from any Passivhaus designer, but around things like the architectural form so, the overall shape and massing of the building, has it got a really good form factor, so a low ratio of the external envelope area to the internal floor area. Has it got sensible orientation so that it's going to be ideally, you know, easy to shade the windows against summer sun. It's not mandatory, it depends on the site, but it's a nice thing to aim for if you've got that freedom. And thinking about the glazing and shading early on in the design process so that you don't get wedded something with an emotional attraction of having huge amounts of glass and then realise later that it's going to be a bit like a greenhouse in the summertime.

Gwilym Still 05:08

And I guess tied through those is around construction types and primary structure. And is it going to be easy to make something that's airtight and really well insulated? Or is it going to be really painful to build that even if you've got this, this ideal that you've come up with at the start? So some of those, I think, it doesn't have to be very time consuming conversations. But getting those ideas in people's minds early on, I think helps them incorporate them in the design in a way, that's a synthesis of all the other things that are really nice design has rather than going off on one tack, and then trying to come back again later.

Ben Adam-Smith 05:44

So it's that starting point, you talked about the form of the building. But if we're breaking that down, you know, when does it make sense to change the form into something that doesn't look as good, you know, are you just always trying to get that compact form?

Gwilym Still 06:01

It's never a complete deal breaker, at least at the individual house level, if you've got something that's a fairly sensible shape. It's partly just encouraging people to understand about the impact of the choices they're making, and the tradeoffs that are involved. There's quite a good rule of thumb that the form factor times by 100 is roughly the insulation thickness you're going to need to get to Passivhaus levels of heating demand. And so using that is really useful at a stage when people you know, sketching designs and so on, because there's not saying "thou must have a form factor less than this". It's just saying you need to understand this change, is it worth the candle really so that nook at the end of the building, actually is the thing that really makes the design and it's worth it, or perhaps someone realises that it's going to mean an extra 50mm of insulation everywhere, and they'd rather spend their money somewhere else.

Ben Adam-Smith 06:55

Going back to what you're saying about getting people on board first, and then training them up. I feel like my introduction to architecture has been around people who think in a certain way. So, I like simplicity. And I like all of this, but how do you persuade someone that perhaps is not quite into this? They are learning on day one, they're researching what house they're going to build.

Gwilym Still 07:21

I think there's a mix. I think there's bits where it's nice to have, like we've got in the UK now, and there's lots of really lovely Passivhaus buildings of all different types and sizes, and structural approaches, and so on. So partly being able to show people well, this is what it can look like, this is what's been done before, you know, it's not automatically, just a cuboid. You can have something that's visually really exciting, or that you can picture yourself enjoying living in as well.

Gwilym Still 07:51

The earlier you can have those discussions, the easier it is, because I think in a design process, whether that's for an individual house, or for a massive multi storey building, the psychological part of it is really important. And people invest a lot of time, but also a lot of emotion into doing that design process and coming up with something and so the later you come in suggesting changing something, the harder that becomes because you're prising someone's beloved darling away from them. Whereas, if you'd said it at the start, and they've been able to think about it as just one of a huge number of different factors that go into really good design, then it becomes part of the process rather than a bolt on or attention at the end.

Ben Adam-Smith 08:34

It's funny that the more interviews I do, the more every professional, you find that they want to be in amongst the project on day one. But that's a very unnatural thing for someone coming to build a house, you don't, you would never do that bring in everyone. So you have got to think a little bit like that.

Ben Adam-Smith 08:52

Let's move on to glazing for a second because I think there can be tendencies as well to get carried away with glass. So what are the rules here or not rules? Where would we like to be with glazing ratios and so forth?

Gwilym Still 09:07

There's a tendency for people to fall in love with glossy architectural magazine pictures of massively glazed houses. And there's also been phases in low energy building design when people have aimed for really full on passive solar design and absolutely maximising solar gains on south facing elevations and so on. And then there's been bits of work done by people like Nick Grant, who I know you've had on before and so on, saying well actually the downsides of those are things like increase summer comfort risk, or that passive solar heating becomes quite an expensive way of buying a few kilowatt hours.

Gwilym Still 09:43

And so I think the general tendency is to aim for setting window sizes so they're going to give you really nice daylighting within rooms, so they're going to give you beautiful views out which match with the sights. To think about the, if you're designing an individual house to think about arrangements that you have living rooms and so on on the south facing elevation, if that's possible and bedrooms on the north. It's not always but that's a nice principle to follow. And trying not to put loads of glass down near the floor because it doesn't help very much with the daylighting further into the room and thinking about pushing the head height of the window up or better if you can, because that does help with the daylight penetration.

Gwilym Still 10:24

And then there's some tools around for doing things like daylight factor calculations to try and get a sense of a window size, but I think it's generally start with window sizing for daylight and for ventilation, and then check things like the solar gain and summer comfort parts of it as a check after that.

Ben Adam-Smith 10:43

You've talked about the south elevation, but is there a percentage of glazing, is that how it works, and how we think about the east and west, making sure that they're not going to struggle, because those are the difficult orientations, aren't they?

Gwilym Still 10:58

There is a bit of those. I can't remember the figures offhand right now, to be honest. There's some in the LETI, climate emergency design guides, and I think the Passivhaus Trust rules of thumb guidance as well. I've tended to start with those, but also to do some calcs on the project basis. Because the daylight factor you get through a window that's sat in a really really deep wall is different from, or the amount of daylight you get through that really deep wall is different from the amount of daylight you get through a fairly shallow wall build up is kind of the difference between being right at the top of a well, seeing the sunlight is quite bright compared to being right down at the bottom and feeling quite gloomy.

Gwilym Still 11:36

So I think those are good starting points, but it's worth also doing a project specific check. And I think for east facing and west facing and so on, the same sort of principle applies that you look at sizing the windows for daylight, because you still want the rooms to be enjoyable. And then think about things like the G value of the glazing as well. So how much heat it lets through compared to the solar energy that's coming onto the window, and how much visible light it lets through as well.

Ben Adam-Smith 12:04

Because the windows are interesting as well aren't they, that the energy can go in two directions can't it? Maybe you could explain a bit more about that because this is an area I get confused in. But on a simple level the seesaw, you've got either gains or it's going the other way.

Gwilym Still 12:19

There's a mix in there. So over the course of a whole heating season, you'll have conductive heat losses through the windows, because it's warmer inside and colder outside. And you'll have some solar gains coming through the windows based on your how sunny it is and how well shaded the window is and so on.

Gwilym Still 12:37

There's a split between things that happen over the course of that entire season where you could have, say, a south facing window where there's more solar gains that come in through that window, than there are heat losses conducted out through the window. But on the peak days when the grid is at its heaviest loaded, and the heating system for the house is working hardest and so on, the heat losses through the window are always going to be more than the solar gains. So that's part of that tension, I think between the design for annual energy use versus designed for the peak.

Gwilym Still 13:09

And again, there's quite a nice paper and presentation that Nick Grant and Alan Clarke have done around this. And we're making a PHPP plugin to let people test those bits as well, you know, look at the peak design case as well as the annual design case.

Ben Adam-Smith 13:25

Let's talk about construction systems, or how we're going to build. Are there any that are favoured?

Gwilym Still 13:33

On most projects, we've had a scheme by scheme assessment and figured out what works best for that particular scheme. I think at an individual house level, we've seen lots of really nice projects using timber frame around, we've got at least one on site at the moment which we're working on. WARM are the Passivhaus designers. And there's a really good track record of those both being material efficient, giving really good levels of airtightness and going up fairly quickly as well.

Gwilym Still 14:01

For some of the larger projects, we've got CLT based projects, which is a relatively low carbon construction technique, and has worked brilliantly for giving us good airtightness and getting it done quickly as well. And then for some of the even bigger ones, we've ended up with concrete frame and

infill, and maybe masonry on the outsides. And those have worked and we made them airtight, etc. They've tended to be driven in those cases by things other than Passivhaus, around fire or standard construction methodologies or things like that.

Ben Adam-Smith 14:36

And ventilation is something you said to me before we hit record, really important and again a day one thing which you wouldn't necessarily expect.

Gwilym Still 14:45

No, I went on a really interesting set of webinars by a guy called Monty Paulson called a Passivhaus Pattern Language, which is about designing and delivering cost effective multi residential Passivhaus projects. He basing it on his experience in Canada, but a lot of the principles apply everywhere. And one of them was saying, well, actually, when you start the design of this building, think about the ventilation systems as the first thing you think about. I thought that was a really interesting approach, not in terms of saying, we have to design this building so it's beautifully ventilated, even if everybody hates living there. But there's just some principles that people can incorporate really early on in terms of making sure there's space for the ventilation unit to go, making sure it's close to the external wall, making sure there's some sensible ductwork routes around and that people know which rooms they are going to supply fresh air into and which ones they're going to extract from and so on.

Gwilym Still 15:41

I know they're the kind of things where if you've incorporated that early, then you're going to get a really good efficiency from the system, and something that's easy to commission and to operate and so on. And if you haven't thought about it, then it'll either become painful to pick it up later, or you end up with something that's relatively inefficient.

Gwilym Still 15:59

I think there's some really nice examples of systems which have been done that are super simple and unobtrusive, and there's a utility room and the MVHR unit is tucked away in it. And there's some where it's more complicated and convoluted and past that is just around when it got thought about, and how well integrated it was in that design process.

Ben Adam-Smith 16:17

So you mentioned the utility space, and quite often that is the plant room. How do we define how big this space should be? Is this something that we want in the middle of the house again, for efficiency? What do we need to think about?

Gwilym Still 16:32

I think part of this ties back to making some early decisions around a kind of energy strategy for the building. So how are you going to heat the space up? How are you going to provide domestic hot water to it? For a lot of schemes that's electric based because people are interested in the decarbonisation of the grids. And particularly for a lot of schemes, like Passivhauses, at least when we've looked at the calcs before, the additional cost of a ground source heat pump, doesn't really make sense over the performance that people are getting out of air source heat pumps now.

Gwilym Still 17:05

So there's some principles in there of you'd like a hot water cylinder, and you'd like that to be fairly close to the things that are delivering hot water through the building, so wash hand basin, showers, kitchen sinks, and so on. And ideally, that it's fairly close to the heat pump unit, which goes outside. And again, that's worth thinking about, because they've got a fairly particular aesthetic to them. Some people like and some people don't. And so either being happy with what it looks like, and it just sits there, or thinking about how to integrate it into a design to conceal it a bit is worth going through. And also making sure that things like acoustics are thought around. They're generally quite quiet, but is it going to be near a bedroom which is more noise sensitive, or is it near a kitchen or living room, which is a bit less noise sensitive?

Ben Adam-Smith 17:54

Now I know, in our specific build that we did, the utility shrank. And that was largely because we were messing around with the kitchen and thinking, oh, have I got enough space here. And we're really pleased that we made those changes to the kitchen. But is that common that it ends up coming out of the plant room, and then you've got something that you're just scraping by with really?

Gwilym Still 18:19

Yeah, that's not unusual. There's a time honored tradition in some construction projects for the services consultant to ask for a plant room of a particular size, and the architect to kind of draw a room about half that size and see if anybody squeals or not! I think what's useful in there is having an early stage discussion about that. And someone sketching up saying, well, inside this room, we're going to have this unit and also need this space for access around it. And that's one of the key parts, I guess, is don't treat it completely like a game of Tetris, where your aim is to slot all of the blocks in with no gaps in between at all, but thinking about it as, how do you actually get the space to get the front off this unit and repair it if and when it breaks, or to change the filters or those sorts of things.

Gwilym Still 19:06

So a sketch, or an idea of space requirements from someone who's happy either designing or installing that system, and that at least gives you an envelope to work within. And then you can decide, like your kitchen example. Is it really going to be a problem or not? Or is it worth the pain or not? Is it the difference between being really easy to work on the system, but you're not going to use it all that often? Or is it the difference between if we have to change this pump and actually we have to dismantle the entire utility room and that's quite painful.

Ben Adam-Smith 19:39

Yeah, that is what you don't want. Interestingly, in our situation, we ended up having our MVHR in the garage, which is something that Alan Clarke has done before and our architect's weren't so keen on that idea. But I do think that's our fault completely. And maybe we didn't, we didn't grasp. It's so funny sometimes when you make all these changes, and then you look back and think why did I do that? But I guess it's because we've got all the accommodation exactly as we wanted, and that was just the last bit to be pushed.

Gwilym Still 20:10

What's often the case with this kind of stuff is that the two levels of feedback are often either silence or complaints if it doesn't work. Everybody expects or takes for granted that they'll have hot water at the tap and heating through the space and good levels of air quality. And the things that you normally picture in your mind when you imagine the experience of your house or the things about the space and you're occupying this space. So that's partly why it's useful to have some sketches and bits just to make sure that is in people's heads when they're looking at rearranging layouts and sliding things around and little bits.

Ben Adam-Smith 20:46

You talked a little bit about how you're going to heat with an air source heat pump. Is that pretty much the default for smaller buildings? I know there are lots of ways of doing it, but it does seem like a nice fit for a Passivhaus having an air source heat pump.

Gwilym Still 21:02

I think it is the most common one that I've seen recently. I think the challenges around it in a way really are that there aren't lots and lots of very low output units. And on Passivhaus houses where the space heating demand is so low, the problem isn't getting enough heat into the building, it's making sure that the heat pump doesn't switch on and off really quickly or really often.

Gwilym Still 21:26

But yes, I think that's the most common way of doing it. And I think there's now on the market, some air source heat pumps with low global warming, potential refrigerants, and so on. So they make sense from both an environmental point of view as well as efficiency and effectiveness point of view.

Ben Adam-Smith 21:44

Is there anything else we should think about in terms of this hot water system, ventilation, and so forth?

Gwilym Still 21:51

I think there's bits that follow through in the location of those spaces. So thinking about whether if you're going to have an en-suite, or you're going to have a bathroom or something, can it be fairly close to the hot water cylinder so that the pipework runs are minimised. Making sure there's space for some microbore pipe work to run through so you get the run off really quickly in the outlets.

Gwilym Still 22:15

And I think particularly on some of the sanitaryware choices, you know, looking at low-flow sanitaryware, so, showers that'll be nice at six litres a minute or so is worth a think, because there's the kind of delivery side of it of having a really efficient heat pump that's going to give you hot water, but that gets somewhat squandered if you've then put in a jungle deluge showerhead, which is running at 30 litres a minute, and draining it off really quickly.

Ben Adam-Smith 22:42

Yes. And I think back to my parents' house, which every time I go there, they have this shower that takes I'm not joking, must be almost 40 seconds to get to the hot water. And I've no idea why. I would

love to be able to follow that pipe and see where it goes around the house. So that's a stark contrast to ours, where you literally do turn it on and the hot water's there, so something's working right in this efficient design.

Gwilym Still 23:09

Definitely.

Ben Adam-Smith 23:10

And drainage, does that come into the equation?

Gwilym Still 23:13

Yes, definitely. So there's elements of that where things which you wouldn't normally think of in a construction project can have an impact on the heat loss from the building and the heating demand. So if you have a soil and vent pipe that goes from below ground, up through the building, and then exhausts above the roof level, then most of the year that's full of air, and it's taking cold air from the drainage system below the ground, bringing it up through the building, it gets warmed up. So takes heat away from the building and then exhausts outside, and so on.

Gwilym Still 23:44

Passivhaus projects it's quite common to have the soil and vent pipes or SVPs terminated inside the building with what's called an air admittance valve AAV. And then where building regulations want the drainage system vented to outside, doing that outside the building envelope or doing it in as few places as are needed. So that's quite a nice way of having a passive system which minimises heat loss. And again, it's just worth thinking about early on in the design. And also making sure that that AAV is in a place where it can be accessed and maintained in the future.

Ben Adam-Smith 24:21

Control systems then. This is another side, once we've done all this design, how can we keep things efficient with lights, with white goods?

Gwilym Still 24:33

A lot of the time I think people get good results by really aiming for simplicity as much as they can. So, particularly with the heat pump systems, keeping them fairly simple, not trying to have a really fancy thermostat which is doing lots of clever control. Or not having in your mind that it must be linked to your phone or to something else to work really well.

Gwilym Still 24:56

There's some really interesting discussions on Twitter at the moment I think, with people who are doing this sort of work at an individual house level. And what you see on some of the really well performing houses are that they, they don't have anything particularly sophisticated in there. They've got a really good design, they've got some controls that are nice and simple and are really easy for the users of the building to understand. And then they just let it run.

Gwilym Still 25:20

I think there's similar bits with, with lots of other things around lighting systems that if you choose really good fittings, then actually the control can be nice and simple for those. And then the ones that we found interesting on other projects, including some of the larger ones, so just the energy use of the other parts of the building, which often don't get thought about. So fridges, freezers, access control systems, IT equipment, all of that sort of thing. And I think they tend to be ones which you can think about a bit later in the design process, but it's just worth doing a check on those to see well actually, we might really like the particular colour of this fridge arrangement or something, but is it going to use twice as much energy as a really efficient alternative?

Ben Adam-Smith 26:05

I think when we were specifying the white goods, I was surprised how difficult it was that that was on our radar straightaway to make sure that we got the triple A rated, is that the best? Or is that just in the world of home consumer?

Gwilym Still 26:23

So they they've changed the rating systems now I think to future proof them a bit. So things that were triple A had dropped down to about a C rating or so. And hopefully over the next few years, things will creep back up to being B and A rated again.

Ben Adam-Smith 26:39

So hold on, is that progress? Is that why that has happened? But I found it hard back then to get everything triple A rated?

Gwilym Still 26:47

Yeah. So I think you'll find it pretty much impossible for things like fridges at the moment. Not because the appliances have got worse, but just because the grades have been made more onerous now. I think most manufacturers are being fairly transparent about it and there are certainly some consumer goods websites that we've looked at where you can, you can sort and filter by energy ratings, amongst other bits. So it's becoming, or certainly it seems like it is now fairly transparent for some of those things to find out what the ratings are at least, and to go shopping on that basis.

Ben Adam-Smith 27:24

When we look at that house as a whole, all of these things that we've been talking about are to make things more efficient to use less energy. So, how does it break down in a high performing house? Where are we still using the energy?

Gwilym Still 27:41

I think if you're going to Passivhaus levels of performance, then you tend to have a case where the domestic hot water is outstripping the space heating. And then after that, you get into things like the white goods and the small power and plug loads and lighting. Lighting's certainly improving quite a bit recently as well with improvements in LED technology. That kind of focus on things like domestic hot water, space heating, and then plug loads following that is quite a good approach. And also, there's the part of that of being aware of the split between annual energy use, but also the seasonal variation that in some ways, it's more attractive to save a bit of energy on heating, because that's a lower carbon

approach. Because the times when you really, really need the heating in the middle of winter, there's not much PVs around then feeding into the grids, and the demand from other buildings is ramping up. So that's one of the reasons that the Passivhaus PER metric penalises space heating use a bit more than other things like plugging in a laptop to sockets.

Ben Adam-Smith 28:49

We started this conversation talking about Max Fordham then, someone with a lot of experience. And when he came to build this, I don't know whether he'd built before but this final house, what did he want to do?

Gwilym Still 29:06

I think he had a mix. I think he wanted to test out some ideas that he'd had. And some experience he'd had on other larger multi residential schemes where he wanted to do a house that needed very little or no active heating. He wanted to have something that was built to a really high quality, and obviously he wanted to have an enjoyable house for him and his wife to live in as well. And so it's a combination of all of those.

Gwilym Still 29:33

And I, I think also from the conversations I've had with Ali Shaw, who was one of the engineers who worked on it with him, he was just sort of testing out those ideas and also looking at just interesting ways of doing design work. So, the insulated shutters in there, there's parts where the air source heat pump is actually a little sun trap, so that the sun should warm up the air a bit and improve the efficiency of the hot water generation, all of those sorts of things.

Ben Adam-Smith 30:01

Always looking to what could be next. How could things be better.

Gwilym Still 30:06

Yeah, definitely just that intersection of understanding of basic physics with a real interest in construction and what can actually be delivered.

Ben Adam-Smith 30:17

Is there any final thought or something that could just wrap up this conversation nicely?

Gwilym Still 30:25

I think for people who are designing and delivering an individual house for themselves, just take advantage of some of the resources out there. There's lots of really excellent publications by people like the Passivhaus Trust. Try to get an understanding of the principles early on and incorporate them in the design. And also get involved with things like, there's a really good Passivhaus community that engages on Twitter and places like that, and is really friendly and happy to share experience. So there's lots of good ways of getting involved and getting some advice at the right time so that you don't regret it later.

Ben Adam-Smith 30:59

Well, Gwilym, it's been really nice to have a chat. Thank you very much for your time.

Gwilym Still 31:03

It's great. Thanks Ben. It's been fun.

Ben Adam-Smith 31:06

Head online to take a look at the show notes that accompany this session:

[Houseplanninghelp.com/313](https://houseplanninghelp.com/313). Review the key points in our summary, we've got some photos as well, including the Max Fordham house that we talked about. If you've got a comment, or you'd like to ask a question, either do that within the show notes, or we've got social media links. We'll link to Gwilym, to Max Fordham. houseplanninghelp.com/313.

Ben Adam-Smith 31:32

My call to action is to check out The Hub. This is our membership community for those tackling a sustainable build or sustainable renovation. We're a bit like a boot camp. We're giving you more information, trying to provide a path, maybe a few shortcuts, just get you straight to what you need to know. So, hopefully this will save you time. You'll be surrounded with like minded people as well. We've got courses, we've got in depth video case studies, so you can follow entire projects through. Watch the videos, a members-only forum and get input from me during our office hour calls.

Ben Adam-Smith 32:09

We've added a live training. This is from Hugh Whiriskey, the founder and technical director of Partel, and it's looking at ventilation. We often know about centralised systems, but what about decentralised? Quite interesting, I was learning a lot on this call as well - it's always useful! So houseplanninghelp.com/join if you want to access The Hub. Thanks for listening. The House Planning Help podcast is produced by Regen Media - content that matters.