

HPH334

Ben Adam-Smith 00:00

This is House Planning Help episode 334. 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 Jonathan Dixon. Not only are we going to be hearing about his retrofit story, but we're also going to be looking at the home automation he's incorporated.

Ben Adam-Smith 00:30

So this was another finalist at the UK Passivhaus Awards. And just remember, that means there's also a video connected to this, which I'll embed into the show notes, so you can take a look today. And it was lovely for this one as well to bump into Jamie from Jigsaw Construction. He was working with Jae Cotterell a few years ago on another Passivhaus building, so it's always fun to see. They're still in these Passivhaus circles doing the projects, although this was their first retrofit.

Ben Adam-Smith 01:00

So Jonathan Dixon and his wife Emma tackled this project in Harpenden, Hertfordshire, not a million miles from me. And when you hear more about Jonathan's working life, you'll probably understand why I thought this was a good opportunity to dig into what he's learned about home automation.

Jonathan Dixon 01:18

I graduated in Information Systems Engineering, which is half computing half electronics from Imperial College, and went straight from there into working at Symbian, which was software and eventually became Nokia. But in the years I was working on their first Bluetooth stack, so I've worked quite a lot on them, the Bluetooth technology in its early days, sort of '98 through to 2002/2003. Worked a lot on other communications software for them, and quite a bit on location as well.

Jonathan Dixon 01:50

And in 2006, Google was getting into mobile application development. This is still the early days, you know, long before Android and iPhone. So an American company writing applications for mobile phones was pretty much unheard of. But they set up an office in London and I was the first software engineer in their London office working on apps on mobile phones that existed back then, mostly Nokia phones. So I led the first version of Google Maps on Nokia phones, and went on to quite a few other teams there working on Android and Chrome and so forth. Had a great time before sort of then venturing into some of the more exploratory parts of the company working on Google X for a while and on medical imaging and AI and various other projects.

Ben Adam-Smith 02:35

Now, where did you live before this house that we're going to talk about?

Jonathan Dixon 02:40

Right, yeah, so the two key places really, I mean, for a long, the longest period of time other than student digs, was in South London. We lived there from 2005 through to 2012. So yeah, seven years or so. That was like a classic 1930s terrace in suburban London. And then for five and a half years, six years, we were in California, which was the classic Californian bungalow, wood-framed and quite draughty.

Jonathan Dixon 03:12

What did that teach you about homes? And coming back to the UK - what were you looking for?

Jonathan Dixon 03:19

Yeah, so when we moved back for about a year, we were back in our house in South London again. And we'd become very aware of the risks of overheating from our time in California, and also the challenges of keeping our house warm enough in winter in the UK, and in particular, keeping it warm but also managing damp. Because we found that the house we were in we were always on a knife edge between letting all the heat out the building and just becoming completely overwhelmed with humidity and damp inside the building. So those are the sorts of things most actively on our mind as the two real big challenges. On the flip side, the house in California had no issues whatsoever with damp, because it was you know, the huge fist-sized holes in the walls everywhere - you could see outside from inside. But obviously, when you did have the odd cold night over winter, it was absolutely freezing, you were just wafting hot air straight out of the building.

Jonathan Dixon 04:16

And then I think we'd also been to Europe into the Alps quite a bit on ski trips and things, and saw that there was a better quality of construction that existed but didn't really know much about it. I joked in California that my ideal house would be in California, but designed by a Swiss person. That was sort of setting the scene.

Jonathan Dixon 04:37

And then when we moved back to the UK, by chance the manager I was working for at the time, actually at DeepMind that was who I'd previously worked with in the early days of Google Maps, Andrew Eland, he happened to be just working on a Passivhaus retrofit himself. So I started learning more about that from him and then doing my own research into that whole area. And also, serendipitously, he had a spare Loxone mini server which he gave me just to play with, which is sort of like two separate strands that we might talk more about today, I think.

Ben Adam-Smith 05:13

So this is a key point then, I'm assuming you visited. Tell me a little bit about this house and what you thought going around it.

Jonathan Dixon 05:22

Yes. So being a four storey including the basement, end of terrace, they had their work cut out doing an EnerPHit retrofit, because the front facade was part of a listed conservation area, and they couldn't make any external appearance changes. So they ended up building a house inside a house.

Jonathan Dixon 05:40

But what was really exciting about the way that the project was working there was the methodology they were using with the architect, which happened to be the brother of the client, and also the build team and other key trades. It was all being driven through an Ajira-like app on their phones, so they could all kind of communicate on a daily basis about what each individual trade is doing, what the work was doing, change management through that quotation, and sign-off of work completed with photographs. And then the photographs and that would then go forward eventually to become part of the Passivhaus documentation package. So it was a very comprehensive way of working and it reminded me much more of the kind of like, the typical workflows we have in the software development world than you might have in a conventional build.

Ben Adam-Smith

Welcome to construction!

Jonathan Dixon 06:30

Yeah, this is, oh, well, this is how construction is! Maybe it's something I can get a little bit more involved in!

Ben Adam-Smith 06:37

Clearly, your background is going to lead you to some building control. But I'm very interested in this trade-off. Is it just about having enough money to be able to do both a decent low energy retrofit or new build if you were doing that? And home automation? Or will some people find themselves just tented in one direction and have to ditch the other part?

Jonathan Dixon 07:01

Yeah, I think, to do the comprehensive job of both, what it requires is to, if we're talking about renovation rather than new build for the moment, then it requires that sort of deep retrofit mentality where, and we found that just simply on the energy efficiency alone, and even before we get to the automation is the sort of like a cascading effect in the decision making process. You decide you're going to do one thing and you go, Well, while we are doing that, we may as well do this other thing. And then Oh, well, if we're doing that, we might as well just go the whole way and do this, this final thing.

Jonathan Dixon 07:35

And I think the tipping point for us was when we decided we were going to insulate underneath the floor, because our floor had a solid concrete slab, actually it turned out to be a very thin concrete slab as a floor, uninsulated. And as soon as we decided we were digging that out, going to dig down half a metre, put fresh insulation and put fresh foundation in and a whole new slab on that, we knew we were moving out of the house for quite a period of time, and so then we may as well do the full job and do everything else.

Ben Adam-Smith 08:02

So the house itself, did you buy it with this deep retrofit in mind or the other way around?

Jonathan Dixon 08:10

We knew we wouldn't find, in terms of build quality, it'd be extremely unlikely we would find our ideal house. So we, we were looking based on location, we wanted the convenience of the commute to London, and to be able to get out on our bikes and walking sort of in country without having to have an hour of junk miles as we used to find in South London, just by how far into the city we were in. So that was really the key thing, was location, location.

Jonathan Dixon 08:40

And then knowing that when we found the right place, we would almost certainly have to do some work on it, so we may as well choose somewhere that needed quite a lot of work doing because otherwise we'd always be in that sort of Oh well, it's a pretty good state, how far do we go, you know. We're ripping apart stuff that's actually quite livable, whereas as it was, the house hadn't really been touched for 30 odd years. So nothing major done to it. No alterations in its whole 60 year lifetime. So it was right for a bit of development, and it required quite extensive refurbishment at the very least.

Jonathan Dixon 09:13

And then the home automation side of it wasn't the driver, it was very much a case of while we're doing the other stuff. It's something I've always been interested in. And I'd been playing with this mini server for about a year by this point and got my head around what I could do with that. And by reading up on that spurred other ideas about what else we might be able to do. We were going to have to re-wire the whole building anyway, so let's re-wire it with a forward-looking mentality.

Ben Adam-Smith 09:37

Right, let's just stop at this mini server. So you get loaned this Loxone which we talked about on the podcast before, Mark McCall. I know he was a big fan of this route and went down that too, and his website's Automated Home. But you get given this, is it the base building block?

Jonathan Dixon 09:56

Yeah, it's very much the base building block, or sort of like the brains that runs the house. It's quite small, about 150 mil wide, it could sit inside a consumer unit inside your fuse board if you'd like to put it in its own dedicated box. But it's in essence a microcontroller, programmable logic controller, that just runs an event loop, seeing what's going on in the house and then executing commands that are programmed into it to make changes based on, you know, the changing temperature or the changing light, the changing time of day or season or whatever it may be. It just executes the programme. It's told in a reliable fashion without going offline to do updates at 1am or something like your typical computer or other system might do.

Jonathan Dixon 10:42

And I think for me, the key thing there is the programmability: the fact that it's really the logic of the house becomes software defined. The whole purpose of software and the reason we see it being so successful over the last, my career indeed, but certainly over the last 10 years in particular is because it's easy to change. It's off, you can change the logic of the house rather than having to go Oh, yes, well, somebody's staying in that room now so I need to rewire this thing and get pipes out and change

them around or change wires in a box. It's, it's as easy as opening a laptop and changing a few bits of programming.

Ben Adam-Smith 11:15

What experiments did you run then during that year?

Jonathan Dixon 11:18

I actually had the benefit of it being two years because there was a bit before we got to the breaking ground and starting, but then of course, we were then moved out and living in another house for the duration of the build, which happened to also be the first year of the pandemic as well. So I had a lot of time locked in this house on my own with my server and could, you know, experiment with various bits of technology.

Jonathan Dixon 11:39

A lot of it was around the technology stack selection. I was taken by the ease at which I could just pick up this one particular component and use it but then I also sort of needed to figure out every other piece of the house, like the lights and the switches and the communication protocols that they would use to talk to one another. And then more esoteric devices, blinds and shading and automated windows and so on and CO2 monitors and all these kinds of thing. So there was a lot of just exploring technology stack and evaluating different options.

Jonathan Dixon 12:11

One key thing there was whether I was going to go for a KNX backbone, for the communication in the house, because that's really the standard approach for doing digital communication between sensors and actuators between light switches and blinds and lights and so forth, or use Loxone's own proprietary system. Because I was doing it very much DIY, I decided to stay within Loxone's system because it just reduced the learning curve for myself personally. But I made sure the wiring we put in could be switched over to use a different protocol in the future. That was the trade-off point. A sweet spot I chose for myself on that.

Ben Adam-Smith 12:47

I remember Mark saying something about, over the years he's come to love the proprietary system more and more, which I thought was a really interesting comment.

Jonathan Dixon 12:55

If you'd asked me three, four years ago, I'd be bristling at that comment, whereas now I have myself become softened to it. And this is not just simply talking about this one particular proprietary system, but as a more general rule, when you're building something into a house when you want it to last a long time, you do have this very natural tension between a proprietary system where you're worried that if that vendor goes out of business, you're going to lose ability to upgrade or maybe even maintain every single piece of your house. That's quite a strong concern.

Jonathan Dixon 13:28

But on the flip side, the more we move to IP and internet connected technology, the more we find that there's always a much bigger security envelope around everything. You're always having to keep everything up to date with patches, knowing where every single thing is connecting after its own server and remote servers being available or not. And then what happens is you find that one of the vendors no longer supports the latest version of WiFi, but you need to update to the new version of WiFi because the other thing you've got really needs it. And now you have to update everything anyway, because you're using this mishmash of different technologies that you bought over different years. And while compatibility was great on one day, over time, it slightly falls apart. Whereas a proprietary system tends not to have that drawback. It tends to work with itself because that's its one job.

Ben Adam-Smith 14:14

And it's also very much not only established, like you say, but focused on homes, and in Austria has some ridiculous uptake. So it's hard to see it not moving forwards rather than the other way of just collapsing, falling by the wayside.

Jonathan Dixon 14:32

Yeah, absolutely. And I mean, it's always a risk which horse you put your money on and and you can't spread it around in the house. You do actually need to just choose one and go with it at the end of the day.

Ben Adam-Smith 14:42

Were there alternatives? Did you look at anything else?

Jonathan Dixon 14:44

So yeah, yeah. So, KNX was the key one, which is the open standard, which would allow I think over 100 different manufacturers are really behind that. And then there's a few others. Logic Machines, mostly held up by sort of not much UK footprint in terms of distribution or, you know, really information available on that. And then a few others Hubitat and Homatic. And then also there's open source alternatives as well.

Jonathan Dixon 15:11

There's, again, there's the maintaining the machine it runs on and keeping it up to date, there's a weekly update cycle where it's out of order for a few minutes while it updates. And then of course, your whole house is offline, and you're not quite sure when it's going to come back online. So that was the worrying aspect with that, I suppose.

Jonathan Dixon 15:26

But the thought I was just going to come back to was yeah, in the time I've been following Loxone, specifically, so almost five years now, four years I suppose really, they have grown quite a lot and invested in moving their platform forwards and taking on much larger projects now. Hotels and office blocks and things as well as homes. And so that has scaled up the robustness of their system, and then seeing the latest releases, they've really invested a lot in stability and robustness. So that's quite reassuring.

Ben Adam-Smith 15:58

Let's swing back around for a moment to give people an idea of the retrofit. So from what you've said so far, the home automation, it's good to keep learning on that in the background, but you had other things to focus on first. You got your inspiration about low energy build. So can you describe the house and how you came about developing designs, working out who the contractor was going to be, and so forth?

Jonathan Dixon 16:25

It's a 1960s, cross wall construction build. So it's a very typical looking 1960s detached house, apart from the row of six that were built, two of them are a different structural design with cross wall, which is where the facing flank walls are supporting walls and the front and back as was were non structural. They were non load bearing, they were just infill walls or curtain walls. It's quite common in concrete construction in modern apartment blocks and all but in the 60s it was considered a fairly experimental build type.

Jonathan Dixon 17:00

So when we were talking with architects, we did a building survey when we were buying it, and then we spoke with in total nine different architecture firms, which was quite a high number. We went for four with local knowledge and four with Passivhaus expertise, which was quite niche in 2018. And still quite niche now, but it was particularly so then. And we found that every time we spoke with one, we were missing their lack of knowledge on the other side of that fence.

Jonathan Dixon 17:28

And we'd almost made our decision and then just at the last minute, I happened to notice on Facebook, somebody writing a little blog post about their Masters they were just doing at the Centre for Alternative Technology in Wales. And they were just graduating in retrofits and working towards becoming a Passivhaus designer. And they happened to be very local to us, just in the next village over. And I was like, Oh, well, that's serendipitous, let's go and chat with her. And so Heather McNeill, AD Practice, with Dave there, Dave Perry. And they both came over to talk to us and look at the house. And before we even opened the door, they were already having a look at the front of the building. And they were the first people to mention this cross wall construction methodology and how that would enable them to do some quite different approaches on the retrofit. And it was just amazing that they were already thinking at that level when nobody else had.

Ben Adam-Smith 18:18

Now, I'm intrigued by this. Is it because they know the local area and what's around here? What were the clues?

Jonathan Dixon 18:24

Partly. Dave is a structural engineer by training. So obviously, he thinks about the bones of the building quite a lot. But yeah, they also in particular Heather being new to retrofit, she was very optimistic about the possibilities. And also thinking with a pretty clean sheet of not what have I always done before, but like what am I going to do this time. And so it was a beautiful mix. And also I think everybody else we'd

spoken to was a sole trader whereas having a number of people in the practice meant that you got that team spirit right from the get go. And I really enjoyed that. So that was nice to have a team to work with.

Ben Adam-Smith 19:02

Now Heather was one of the people that really stood out at the awards this year. Firstly, for being so young and for achieving this project as her part two, which is an extraordinary feat and sets you up. I think she's straight into her own project as well. What gave you confidence? You can clearly have the experience versus that enthusiasm, and she'd clearly been on the courses but you're going to be the first one.

Jonathan Dixon 19:33

Yeah, there's a risk there of course. I mean, like my wife and I the biggest project we'd ever taken on was getting someone to refit one bathroom. So you know, this was a real big step up for us in terms of... And of course, we'd been renting property in California for six years so hadn't done any building maintenance whatsoever. So it was Heather's first project, her first retrofit project, but really first project in the professional architecture realm. And also the contractor, as it turned out, it was their first retrofit. And that was always going to be likely because EnerPHit retrofits are so rare.

Ben Adam-Smith 20:06

Yeah, but these are guys that I know because we followed a project, Buckinghamshire Passivhaus for our hub members. So Wayne and the team, love them. How'd you find them?

Jonathan Dixon 20:16

Right, so knowing that it was going to be a company's first retrofit, and the rest of us were all beginners as well, our one kind of real requirement was they must have at least built a Passivhaus. Or be extremely serious about that being the future of the company to be in the Passivhaus industry, because we didn't want to be trying to reluctantly pull, you know, some friend of a friend kind of builder along on a journey they didn't want to be on because we were not in the situation to do that, as all beginners ourselves.

Jonathan Dixon 20:16

And how we came to meet them was I believe Dave had worked with them before, but they were certainly known to them being Hertfordshire based as well. So it was really just the local network. I think, a couple other companies I found with my own research and we asked to tender, but as it happened, the ones that our architects pointed out for us.

Jonathan Dixon 21:04

And we're coming back to the confidence to go with somebody learning on the job, I think one of the key things there was the fact that we knew as the client we were very engaged in the whole project. And if I would have just wanted an architect to throw the whole project over to and come back in a year's time and say, Where's my Passivhaus, I would have been a lot more nervous, I would have obviously been looking at a track record of Passivhauses built or retrofitted by that particular project management architectural company, but because I really wanted to be involved throughout the process, and then seeing the enthusiasm and the training and specifically focusing on retrofits as the

master's thesis, was all the right boxes being ticked there. And I was quite keen to support somebody early in their career, because this is the future rather than somebody in the middle or end of their career as it were. So that all lined up really nicely as well.

Ben Adam-Smith 21:57

Yeah, you said that perfectly. So what did you want from the house? Let's just talk a little bit about the architectural design, the transformation of the house.

Jonathan Dixon 22:07

Yeah, I particularly wanted to install an MVHR. I thought that was the solution to this tension we'd always had between not throwing warmth out of the building, but trying to get all the humidity out of the building, and that side of it. And so that was one of the early decisions. When we got the house in particular, before we bought it, we already knew there's an issue. Once we moved in, we really felt strongly that the entrance hallway was huge, but on the north corner of the building where it was very dark, and there was no light in it at all, so it was taking up a quarter of the ground floor and not really doing anything for us. So we wanted to change that.

Jonathan Dixon 22:41

And then we wanted to try a much more open plan with the kitchen. And so easy access to different parts of the house from the kitchen area, because we both would like to cook together or be in and out of that area while working on other projects and things around and about. Those were the really key things.

Jonathan Dixon 22:59

And then during the build a new requirement came in as well, which we hadn't foreseen entirely, which was we suddenly both went from being office based in London to being home based workers. And so we needed to change up the plans a little bit to make more space for working from home as well.

Ben Adam-Smith 23:16

So the build itself, what were the key challenges? You've obviously mentioned the pandemic, but yeah, what else did you have to contend with?

Jonathan Dixon 23:24

Yeah, so the challenges were actually more conventional, you know, surprises that come up, as we went along. To list a few of the things: we first off did the groundworks and foundation for the extension. That was all signed off by local building control. Heather had gone for a fairly modern kind of way of building it with a raft foundation for the extension, which was signed off by building control. But then after that was all dug out, they had a look at it and changed their mind and decided they wanted it done a different way. They always reserve the right if in the ground there's any issues but the ground was actually perfect. There was no issue whatsoever with the strength of the ground, it was just simply that they decided that that was not really the design they would want to see.

Jonathan Dixon 24:05

And so we had to dig the foundations a second time as a strip foundation, which meant we'd also already carted away more ground than was required to put in a structural slab that we were no longer going to need to pour. Because the whole goal was to reduce the amount of concrete and this was as a result increasing not decreasing the amount of concrete. And so we were going to then have to cart in MOT to backfill that area. And actually I was talking with the architectural team and the builder and said, rather than put MOT down, sort of gravel and what have you, why can't we just put extra insulation down because then at least all this work's doing something for me. And it was like oh, yeah, insulation, that's actually the same price as carting in the MOT isn't it? Why don't we just do that? And so we ended up with twice as much insulation under the extension than was originally specified just because of a change of mind of the building control. So that was a nice way of getting something out of turning an error into a benefit.

Jonathan Dixon 25:01

The other challenges yes, the internal supporting walls were not built as supporting walls. They were just sort of, by happenstance playing that role with clink a block. And every time we touched one, they disintegrated underneath any tool we put against it. So we had to do more rebuilding of internal walls and certainly every internal wall upstairs and large swathes of it downstairs. That was the other big surprise.

Jonathan Dixon 25:25

I mean, the third one was actually the roof needed to be shored up and made absolutely straight and true in order for the fully integrated solar array to sit on it, because it's a very different installation method for this complete roof of solar, using an aluminium frame which can't bend at all. A sixty year old roof's always got a little bit of a natural curve to it. And that took the build team I think about an extra week just going around and getting that absolutely straight. But they did achieve it in the end.

Ben Adam-Smith 25:54

I remember Jamie from Jigsaw saying that he was really impressed that you were always open to changes and coming around to things where, you know, I imagine he's dealt with lots of clients. And I certainly know this as well that sometimes he can advise people to do things, and they don't do it, they decide they want to do it their own way. And you perhaps have years of experience as someone who runs a construction company, so you're trying to help them from something you've learned in the past. So how did you have that mindset going into this project?

Jonathan Dixon 26:29

Yeah, interesting. I suppose some of it is based on the fact that we weren't simply being led by the aesthetic or form of the final build, but we did also care about the invisible elements of it: we knew we wanted to not compromise the airtightness, we knew we wanted to have the right levels of insulation, and so on. And so we cared about the actual construction itself, as well as the end result, or the visible elements of the end result. So that may be one side of it.

Jonathan Dixon 27:01

And I think the other probably the strong element is having worked for 20 years in software development, where we think in a methodology of do a little bit, see how it works, do a little bit more,

this sort of iterative development process. You're always in the mindset of learning and adapting based on what you learn. You don't think in the classic waterfall model of okay, I'm going to spend two years designing it and then walk away and come back in a year and it'll all be built and perfect 100% as conceived in the design. It's like you know, as you learn, as you discover the walls are full of clink, well, maybe there's an opportunity there to move some of the internal doors around, we left them where they were because we didn't want to rebuild the walls. But if we're going to have to do that, well let's see what opportunities this gives us if we are doing that additional bit. So it is that iterative development mindset is probably the strongest element.

Ben Adam-Smith 27:51

Now, before we go back to home automation, is there anything about the architecture, the build, that you think is important to mention?

Jonathan Dixon 28:02

I suppose the one thing that is unique is the way that we completely demolished the front and back walls, with this cross wall construction, and then the new wall could be built to a much higher standard much more efficiently. It was a 300 mil timber frame construction, that we built those in rather than having to externally insulate a very poor quality wall and then worry about all the junctions between those different build methods.

Jonathan Dixon 28:25

So the existing supporting walls, the flank, the gable ends are 300 mil plus 200 of external wood fibre insulation, so 500 altogether, whereas the front and back are a more efficient size and a simpler construction. We lined the entire inside with OSB as the airtightness layer and as a breathable airtightness layer. That's a very conventional approach. And then also we did the full roof solar, as I mentioned, the GB Sol RIS system, I think it's called Infinity now, but it's the same thing. And that works extremely well, because we had a very simple form roof, you know, just a front and rear pitch. Once the chimney had gone, didn't need a chimney anymore. There's no obstructions whatsoever on that front pitch. So we could do 100% of it in solar panels rather than having to go on a more complex route there.

Ben Adam-Smith 29:16

While you've mentioned solar. Is there any clever stuff that the home automation is doing? So we know you get energy in, do you have a battery here? Are you trying to use as much as possible here on site first all of that sort of stuff?

Jonathan Dixon 29:33

Yeah. Okay, so one element is does home automation complement the sort of energy efficiency goals of the building. And yes, solar or energy management, more broadly, time of use shifting is one of the key areas I really wanted to push into. We have a weather station on the building so we can see what the current conditions are, but also that feeds into a forecast API. And so with that, I am able to run the heat pump at times of high solar production. And in particular, shift the set points on the building so that if there is sun in the winter, it will be slightly overshooting for heating, or if we're actually doing active cooling in the summer, we'll actually undershoot and go for a slightly cooler temperature at that point

when there's excess energy available. So effectively, you're then using the whole fabric of the building as a store for that additional energy that's available by sort of overshooting slightly, and just by one degree, the target temperature of the building.

Jonathan Dixon 30:32

Likewise, hot water can easily be moved to be heated at the time of maximum solar production. And there's always this trade off with the hot water, whether to run that from the heat pump, where you get the two and a half to three times efficiency of the heat pump itself, the CoP, versus using a solar diverter into the immersion heater, which means it's exactly just using spare solar and no more energy than that. Whereas the heat pump's kind of got a minimum threshold, so if the sun's coming in and out of clouds, you might end up using some from the grid as well. We tend to favour using the heat pump because overall that's a more efficient system, even if we did happen to be for a few moments pulling back a bit of energy from the grid, because of the way that system works.

Jonathan Dixon 31:18

And in terms of other time of use shifting, I'd looked into a few more ideas. But the real savings I think will come a bit further down the line, certainly with an electric vehicle, charging an electric vehicle at the right, specific times of day. Whereas the surge management of being able to turn off some of the base load just for a short period of time like fridges and freezers and this kind of thing, that area I've not gone down that road so far at this point, because it really has its biggest impact when it's being applied in a small amount across vast numbers of properties. And it's really something that's looking more for large scale systems and product direction rather than an individual house doing it. The amount of savings you can make on one individual house at a time is quite marginal.

Ben Adam-Smith 32:11

Let's rewind then to when you were talking about playing with your Luxone system. What happened from that point in, and where are we in time roughly?

Jonathan Dixon 32:20

The way I approached it on this first project I worked on, and it's not exactly the way I would do it now. But my mindset at the time was I wanted, wherever it was reasonable and practical to do so, I would put the infrastructure in the building to allow me to automate things that made sense too. So yes, light switches and light fittings, blinds where we could but also other things like being able to shut off the main water supply to the building, putting an electric stopcock in, that kind of stuff.

Jonathan Dixon 32:50

So as far as this sort of the build team tender went I had a lot of the details in about where I wanted wires in the building and where I wanted sensors and actuators, you know where the junction boxes for them would be and so forth. And some of the termination for those devices I did myself. So that allowed me to vary my plans a little as I went along through the build. Then in the main sort of control and the central cabinet, I was building that out, really from a mindset of flexibility that I wanted to be able to support a bunch of... A lot of equipment's taken up with lighting controls actually in many of these systems. So if you've got mains dimmed, phase cut dimmers on lights, that's a chunk of space you

need to allocate to that and equipment for running dimmers. And then likewise dimmers for low voltage LED strips or future lighting and all these sorts of things.

Jonathan Dixon 33:45

I kind of went from it from a shopping list point of view as I will just go and buy a bunch of those and a bunch of those and get them all wired in and then once I'm absolutely sure what lights are actually being installed I can then just hook them all up and maybe choose lights based on what I know I have the dimmers available for.

Jonathan Dixon 34:03

That got flipped on its head. Just as we were preparing for first fix I realised that we'd done quite a lot of work to reconfigure the space and the light of the building, and I had this automation system that should allow for far more complex and interesting lighting scenes to be controlled within each space, certainly the main spaces of the building. But the lighting itself I hadn't really thought that much about so at that point I got slightly panicked. Found again by a rather serendipitous posting on Facebook, a lighting designer had just set up her own company and so it was her first project as well. I was like Okay, great. I like having people on the project all doing it for the first time! So employed Claudia at Focal Glow and she really helped build out the concept for the lighting and actually choose high quality fittings where it would make a good difference.

Jonathan Dixon 34:54

And then I had to go back and sort of reconfigure what I was doing in the control cabinet a little bit being a lot more design led on the lighting side. So, yeah, TL;DR I was trying to wing it and then decided that there's only so far I could get on that.

Ben Adam-Smith 35:07

This is a real strength though I think of home automation, that idea of having these different settings that they can completely change a room. I guess the only comment might be that you go over the top.

Jonathan Dixon 35:20

Yes, yeah, so we really tried not to do... A lot of Loxone advertising material has 20 different colours and all that colour changing based on just like...

Ben Adam-Smith 35:31

Disco mode.

Jonathan Dixon 35:32

Each minute of the day it would seem, but we tried to minimise that. But on the flip side, I mean, I think one of the most appreciated facilities that it provides is comprehensive night lighting in the building. So when a guest is over, they can just, simply opening a door turns on the hallway low level lighting, and guides you to the bathroom or clearly delineates where the staircase is and all this sort of stuff without it being a really strong bright glare in your eyes, or you're not fumbling around trying to find a light switch on the hallway you're not familiar with.

Jonathan Dixon 36:04

And so just automatically doing the right thing based on time of day so that it just brings on subtle low level lighting, when it's in night mode is a really key thing. And for anybody I'm sort of advising or helping today with their home automation, it's like that's one of the key things I can say is like, if you want to cut your lighting budget, completely cut it. But if you're bothering with the home automation, you should certainly think about that night lighting: you feel the value of that very quickly.

Ben Adam-Smith 36:30

So you mentioned that this is something that you've gone on to advise others. So when did that happen?

Jonathan Dixon 36:34

Yeah, so there's a few steps along the way there. Having worked in large corporations on software development for a while, I fancied a bit of a change. And in particular realised I'd really enjoyed a lot of the aspects of doing the home automation and our own house - both being engaged in the more practical elements of building out a house and getting systems installed, you know. It speaks to my earlier interest in engineering, before software took over the world I was sort of interested in the tinkering side of it quite a lot.

Jonathan Dixon 37:10

But secondarily, it allows me to work directly with the customer / user of a thing, without having lots and lots of other people in between. It's like, you know, somebody can talk to me about how they want a particular item to be automated. And you know, I can come up with a design for that, do the programming of the system, and then deliver it and then get the feedback. The sort of intuitive development idea, you know, is continuous learning and improving a system. It requires that feedback loop, and that communication with the person who's actually using it and benefiting from it is absolutely key to that.

Ben Adam-Smith 37:45

Let's come back to some of the Passivhaus crossovers almost. So you've got your little server, cupboard room, whatever you would like to call it. So does that get factored into PHPP? Or, you know, how much heat is coming off that, how do you control gains in summer?

Jonathan Dixon 38:04

Largely, the actual compute power of it doesn't appear in PHPP. PHPP models an electrical budget based on the occupancy and that's kind of a standard model of electrical usage for television sets and personal electronic equipment per person in the house. But yeah, I think the control equipment for the building is an interesting overlap. I mean, fortunately, the actual main central server is 10 watts. So with all of the other the overhead of all the dimmer things, so it's a very small amount on top of everything else that's going on in the building, probably in the noise of measurement of everything else anyway, compared to a few fridge compressors going.

Jonathan Dixon 38:47

But the key thing that does get factored into PHPP from that side is actually all the circulation pumps and so on in the heating system. That was actually one of the big variables in ours was like how many circulation pumps there were and how often they're running. And that's one thing with the home automation you can actually optimise quite a lot.

Jonathan Dixon 39:06

For example, if you have secondary return to give you instant hot water at every tap in the house. In a larger house this is a more interesting thing where it's continuously circulating hot water through the pipes. With home automation, we can very easily manage the amount of time that circulation pump's running, both based on the temperature in the pipe so you don't need it running if there's already hot water available, but also more importantly on the activity in the house. If there's nobody at home, there's no point circulating that pump. Or even if there's nobody in a bathroom if you're watching a film for a few hours, why bother running the circulation pump? The time it takes you to walk from the living room into the bathroom and need hot water at the tap is enough time for the pump to fire up and get the hot water to the tap.

Jonathan Dixon 39:49

And this is actually a perfect example, like I can add that logic to my house with zero wiring changes because I already have the motion sensors. I already have the relay on the pump for the secondary circulation pump. I think of a new way to optimise it, it's just software that needs changing. I don't need to go and rewire that motion sensor and that motion sensor to that relay over there. So it makes it very easy to experiment.

Ben Adam-Smith 40:15

We talked a little bit about overheating in California. Back here, if you didn't have any external blinds, first of all, how is overheating risk on PHPP?

Jonathan Dixon 40:28

I think without the blinds we had 5% overheating risk on this property. Because of course on a retrofit, you can't change the aspect and to a large degree even the openings, the fenestration is all defined already. And so being in a conservation area, we didn't want to radically alter any of those aspects.

Jonathan Dixon 40:47

And the automating blinds for the building as a whole, I think it's a lower benefit for the rooms you're specifically in because our office is on the southwest side. Having it automatically keep heat out but still let the light in is a very nice thing. Then sort of later in the afternoon, it just comes on and does that. And then likewise, the bedroom over there, if you're using that room, having it automatically manage it on a really hot day, the sun has been kept out stops you walking in at 9pm and finding the rooms absolutely sweltering. So it's extremely convenient for those rooms which have the sun blasting straight into them.

Jonathan Dixon 41:23

But I think the high level the home automation adds, another thing with the Passivhaus was in a low efficiency, poorly built house where the only challenge is heating the building, you kind of just need one

thermostat and one heat source blasting out heat everywhere. And then you turn it off when you're up to temperature and then turn it back on when you got too cold.

Jonathan Dixon 41:42

And that kind of works all year round, really. Whereas in the passive house, there's actually several different things that all need to be balanced. There's perhaps some heating in the winter. But then also, we have shading, which are multiple units on different windows being automated, and also ventilation. So the skylight at the top of the reconfigured hallway sort of acts almost like a chimney - stack venting - that can open up when it's sufficiently cold outside to let heat out of the building. And then also the MVHR has a bypass mode.

Jonathan Dixon 42:15

So you've got already there's four different systems they're running. And it's great potential for them to be in conflict with each other. And so one's trying to heat and one's trying to cool and then you're ending up wasting a lot of energy with things. Or at the very least, it just being very inconvenient, because you're going between bits of the house and different things are playing their own game. You're having to adjust the thermostat in each room. And also go and manually play with the app that manages the shading or whatever it might be, whereas doing a home automation system, you know, well designed and implemented will be able to integrate all these different things together. And so you just have a single goal target for the house or maybe areas of the house, and then it does whatever is needed with all the different components to achieve that goal.

Ben Adam-Smith 42:57

With Passivhaus, you commonly have your stable temperature around the house. Do you play at all with adjusting temperatures? Was that something you were interested in, or you're happy with the constant?

Jonathan Dixon 43:08

Yeah, so one of the key things with the Passivhaus is the airtightness means there's very few drafts. A slightly lower temperature feels very comfortable because you're never in a breeze from a gap beside the windows as we used to have. Nor are you playing with that temperature gradient between that really cold wall and that really hot radiator over there. And there's always, the hotter the radiator, the colder the wall, the more that temperature gradient is so the more you kind of feel like you're always going in and out of hot and cold areas of the building, whereas where the temperature's stable everywhere, it makes it more comfortable.

Jonathan Dixon 43:41

One of the things about digging out the ground floor is we were able to lay underfloor heating across the whole ground floor area, and so we use that to heat the whole building. We have no heating upstairs, we've never required heating upstairs at all. And originally I had the whole ground floor area working as a single underfloor heating zone, because a heat pump works most efficiently when it's running the lowest output it can which effectively means you want the largest emitter area and that that will give you the most efficient system.

Jonathan Dixon 44:11

And with a Passivhaus there's not a lot of point in trying to manage the temperature in different rooms because ultimately, the outer envelope of the building is where the insulation is and everything inside will sort of converge to the same temperature. And so that's the normal mentality; you may as well just run it as one zone that's simplest. But what I did find is we've got this one room downstairs which happens to be the room we're sat in right now, our snug, which is quite pleasant to have at a slightly warmer temperature if you're just hanging out in here and using it as a cosy space. However we also use it occasionally as a guest room. And the first time we had a guest stay over here they said it was a bit too warm and they'd like it a lot cooler, and then I realised Oh yeah, okay. So that's running as part of the rest of the downstairs zone, but being a smaller room without direct access to the hallway, and the vaulted ceiling and the upstairs space, it's not contributing to heating up the rest of the building in the same way that the rest of the area is, and so it's retaining more of the heat for itself. So in terms of temperature grading, it is actually sitting slightly higher, which is what we want for one purpose, but not the other. So I had to invent a way to make it easy for our guests to be able to set this room to a cooler temperature. And so that was the one bit of zoning we did just like avoiding overheating in some some specific parts.

Ben Adam-Smith 45:29

Well finally, maybe, how do you reflect on this marriage of Passivhaus and home automation? And I'm imagining as you're going forwards to other projects, you're finding that they're not necessarily Passivhaus? So can the home automation give you any energy savings without going this whole hog?

Jonathan Dixon 45:49

Yeah. So based on sort of the happenstance, the network of builders, currently I'm also working on a couple of projects for friends and they weren't building Passivhauses until I got talking with them, and they now are building Passivhauses! So as it turns out, I'm largely working on Passivhauses! And the one key theme across those as well, from the Passivhaus point of view, is automating stack venting is one thing that everybody wants to do, and there's no kind of like, simple turnkey solution for that. And it often involves integration and managing it with the heating system and everything else in the same way.

Jonathan Dixon 46:25

Outside of Passivhaus development, I think, a few people I've spoken with more on an advisory consulting role have not really gone on to do any implementation at this point. It's where people have purchased typically quite large period properties that are very, very energy inefficient. And, and often it's just a case of there's one thing that's absolutely slaying the energy bill, and they have no idea what it is. So just installing simple logging and monitoring, setting that up.

Jonathan Dixon 46:56

So even some people not sure what's on gas and what's on electric, and so you kind of get that level of delineation. So in an all electric house, you can't just simply use the gas versus electric bill for heating versus everything else. So you've got to go down to that next level and see what are the individual circuits in the house, where is your energy going, ideally log it over a whole season, a whole year and get a baseline and then start making those improvements from there.

Jonathan Dixon 47:23

And then the second layer there is beyond just monitoring. Monitoring both to diagnose the property, but also over the lifetime of it, see if anything regresses and goes backwards. That's a really important point.

Jonathan Dixon 47:33

But then working out your usage patterns, can you turn off heating in areas of the house which aren't used for when they're not in use, and especially if it's not the Passivhaus square box, it's a warren of different rooms and large interconnections. And you might be able to make quite large savings that way, by keeping some areas cooler when they're not being used, either using motion and presence sensors to automate bringing back online areas when they're used, or even more predictive models, or just a simple schedule.

Ben Adam-Smith 48:07

We're just about out of time. But one little question, you know, you obviously have the knowledge and can keep on tweaking. But is that a difficult point for some people?

Jonathan Dixon 48:17

Yeah, I mean, that's going to be a very exciting thing to work on a project I'm on at the moment. A few are also from a software engineering background and very keen to have that level of control. The full programme configuration for everything running inside the house and be able to change anything at all they like.

Jonathan Dixon 48:36

I think for others, they'll always want a professional to be involved to support that. Certainly, quite a few systems have a way of doing this. In Loxone there's a way to make it simple if then automations in a higher level, building block format, that allows simpler sets of interactions to be done. You're not necessarily writing drivers for individual proprietary lighting, heating, shading controllers, but you're more just doing that sort of the high level automation management. And that's something I'd always want to be able to at least show people how they can do even if they decide that it's not really for them to be using it.

Jonathan Dixon 49:16

And then for sort of like the most tech savvy adopter, I do use Home Assistant for a few things in my house, which is the open source package, one of the many open source packages for home automation. And that has an API where it can talk to the house itself. So Loxone has an API, local API. So you know doesn't require the public internet to be working you know, even if the cable to the house has been cut for some reason, this stuff can still keep going and key building systems can keep working. But how I try and do that in my house is keep the Loxone more for the stuff integrating the build. Whereas Home Assistant I use more for the personalisation layer which is very specific to the people that happen to be living in it right now.

Jonathan Dixon 50:00

There's always a bit of a blurry line here. But my mindset is, if we ever moved house and sold this one, the Loxone system would stay in the house running the key things which are part of the house, whereas the Home Assistant piece would be what I took with me to my new house. And so that's got much more of the logic about our music preferences, our login to Spotify, it knows where the car currently is, it knows where us ourselves are as human beings and what time our alarm clock is, and much more individual aspects live in that system and are very easy to alter. But I can turn that server off and the house still works, the lights still come on, the heating still works and the core infrastructure of the building is still functioning.

Ben Adam-Smith 50:41

Well, Jonathan, really enjoyed my chat today. Thank you very much.

Jonathan Dixon 50:45

Thank you.

Ben Adam-Smith 50:47

Head online to take a look at the show notes for this session: houseplanninghelp.com/334. You can review the key points once again in our summary, or perhaps look at some of the photos - we've got before and after - so you can see the transformation that occurred during the retrofit. Perhaps you've got a comment or you'd like to ask a question. You can either do that within the show notes, just head down to the bottom or on social media. We'll give you the links for that. And we'll give you the links to Jonathan if you're interested in his home automation services, houseplanninghelp.com/334.

Ben Adam-Smith 51:24

My call to action is to check out The Hub. This is the membership community that I run alongside House Planning Help, just trying to help you further in any way we can. Whether it's the in depth video case studies, the Ask the Expert feature, the courses, the live training, the members-only forum, or a new strand. This actually falls within the courses: self-build success stories. And what I've been doing is collating information on projects that I visited over the last few years, trying to underline what they got, right. And also the flip side of that, which is the lessons learned that are just as important. Those things to pass on. So that within The Hub. We've got office hour calls if you fancy a chat with me, that's a weekly feature too. More information at houseplanninghelp.com/join.

Ben Adam-Smith 52:11

Next time architect Anne Thorne is my guest, and we're going to be exploring how you design a cohousing scheme. As one of the key members too and this was also a UK Passivhaus Award finalist for this year, the last one that we'll be featuring in this little run.

Ben Adam-Smith 52:27

So thanks for listening. The House Planning Help podcast is produced by Regen Media: content that matters.