

Episode 265

Preserving the beauty of a building while renovating to EnerPHit standard – with Jonathan Kearns

The show notes: www.houseplanninghelp.com/265

Ben: First of all, maybe you could tell me a little bit about your background?

Jonathan: Well, I come from Dublin in Ireland and I started out as a bit of an environmentalist. But it was some decades too early to gain much traction and the economy in Ireland wasn't very strong in the mid-Seventies. So, I migrated through the UK to Toronto, arriving in Toronto in 1975.

I became a Canadian architect and returned to my original interests later on when it started to become really relevant that the environment was absolutely key to the future of the human race as well as of the planet.

So, my practice, which by that time –fast-forwarding to about 2008, 2009 – was about thirty architects working in a small to medium sized firm in Toronto taking on the most challenging and interesting projects possible. We were looking for a way to make our buildings really effective in terms of sustainability, wellness, comfort, health, durability, and not just necessarily an accounting system such as some of the sustainability standards appear to be, but rather to go straight to the science of building.

When my partner and I discovered the Passivhaus methodology, we became very interested in it. I went and took all the training that was available and I started not long after actually taking on a project which was the Reach Guesthouse. That was a late 1800s post and beam farmhouse in a community that's about two hours east of Toronto called Prince Edward County, not to be confused with Prince Edward Island, even though the county is an island in Lake Ontario.

That's a house of about seventeen-hundred square feet. It's a one-and-a-half storey house we would call it here. It's got a larger

ground floor and a smaller second floor. And so, that project became my learning tool and sort of an experimental exercise in how to renovate an older building and draw all the best qualities out of it while at the same time enabling it to be superbly energy efficient.

That really is the scope and intent of that project. SO I could describe it to you in more detail if you like.

Ben: Well, I was just going to say that it was Lloyd Alter who pointed me in your direction. I tend to chat to him every so often and say, 'anything interesting going on that I should know about?' Firstly, that's quite a learning curve, coming into Passivhaus doing a retrofit project. Had you a full grounding of what lay ahead of you?

Jonathan: I would say not. Basically, I had learned what it would take to design a new passivhaus. Even if you're doing a standard renovation, they are always more complicated and more difficult than doing a new building.

So, in this instance, I had to begin by stripping away and selectively demolishing all of the worst parts of the house so that I could even begin to think whether the house was really worth renovating. But the more that we stripped and the more we could see the raw structure, the more we thought yes, this is really interesting, and we could get something very unique and valuable from it.

So, what we did was, we demolished some parts of the building that were just very badly built. They were later additions to the original farmhouse. We stripped out every scrap of the interior so that we were only left with the wood. We were looking at the insides of the exterior of the house. So, to apply then the Passivhaus methodology to this renovation, we had to somehow encase that wooden structure with an air vapour barrier to create the thermal seal and then massively insulate it, install triple glazed windows and doors and also address any thermal bridges that were existing as part of the original structure, and then install the heat recovery ventilation system.

So about a year-and-a-half to two years after we started, because it's always a little slower in the country, we had the project more or less complete such that I was able to heat the house through one entire winter with a twenty dollar twelve-hundred watt electric heater that kept the temperature inside at about seventeen or eighteen degrees while it was minus twenty-five outside.

Ben: This really does make sense where you are in the world. One aspect – you obviously talked about having this sizeable firm. What role did you play within this project?

Jonathan: Well, I played the role of co-owner with my wife, Corrine Spiegel. She and I are the clients and then I'm the architect. Then my office would do some support work for me as well, like I worked with my office to do the PHPP on this. And I installed a friend of mine, an artist from Toronto, in a trailer on the site and he was the one who did most of the selective demolition and he brought his artistic eye to seeing things that were worth keeping or not keeping.

Every weekend, we'd get together on site and decide what to do next. This is partly why it was a rather slow and somewhat drawn out process and sometimes we didn't agree on what we should keep.

Ben: Can I just question you on that? An artist? What other skills? Was this literally an artist or an artist who also was in construction? Why that particular person?

Jonathan: Yes, for that reason, because this artist would sustain himself in-between the crests and valleys of selling his own artwork by doing construction work. So, he would invariably do some carpentry work, drywall work, plastering work, all of those things that came to him very easily as a sculptor and a painter.

But it did slow us down because taking the artist's approach to this kind of a project means that there's an air of consideration about every component of the building before you decide to keep it or not keep it. So, the time schedule got a bit stretched out but nevertheless it was all time, I think, well spent.

In the meantime, I had engaged with a supplier of SIPs – Structural Insulated Panels. This is a local contractor; Adam Cronk and his company is called Green Giant. He specialises in Passivhaus home projects and builds modular pre-fabricated components in his shop in the local town.

Ben: Now, did you choose this build route partially because he was a local person and that's how we worked? What was in that decision for SIPs?

Jonathan: The SIP was the most appropriate way to achieve the insulation value for this building because it's already a wood structure and the SIP is a composition of wood material, OSB typically, and extruded polystyrene insulation. So, with twelve inches of SIP cladding

basically, we were able to bring the R-value up to about r-43 using the North American standard for thermal resistance.

So, the fact that he happened to be local was just a huge bonus because it enabled him to be hands on with the manufacturing and the installation of those panels on the house.

Ben: Correct me here if I'm wrong, but basically you're protecting the old structure within the SIPs?

Jonathan: Yes. In many regards, the project was a bit like an archaeological dig where you had to burrow down to the raw, original structure built in the 1890s and then preserve it, over-clad it.

And the end result is that you see a house form that's very similar to the original and made somewhat surreal by being entirely white on the outside, and when you cross the threshold through the front door, everything inside is the original wood. So, white outside, wood inside. It's a very powerful contrast between the exterior and the interior.

Ben: We'll try and put some of those images in the show notes because it is a stunning interior and I imagine that's one of the aspects that must have caught Lloyd's eye.

In terms of the building, you obviously had an opportunity to modernise it a little bit. Did you take any parts of it that you thought you needed to do something different, or was this all about preserving that original beauty?

Jonathan: Well, certainly the original 1890s structure, which is the rectangle in plan of the original farmhouse, it had been added to sometime in the mid-twentieth century; a very poorly built, low-ceilinged, mono-slope on the back of the house. We found that it was so improperly built that we essentially took it away entirely. But using the same masonry foundation, we constructed the kitchen dining room on the back of the house as a storey-and-a-half high space.

So, again you have a contrast of the intimate, richly wooded finishes of the original house, and then you go through into the kitchen dining room and it's a one-and-a-half storey high open cathedral ceilinged space that is white on the inside and is white on the outside and has larger windows that overlook the garden.

That was a necessary change to the house based on how we found it.

Ben: Were there any other big challenges on this project?

Jonathan: I think at some point we had to decide that the basement could not be included in the Passivhaus. The basement was very shallow. It's all built of local stone. Most of the mortar had leached out of that wall. The walls are about two-and-a-half feet thick. There wasn't a lot of opportunity to incorporate it into the house.

So, we had to decide that the ground floor was going to be an insulated, sealed layer to the building enclosure. To achieve that, we had to put a lot of insulation on the underside of the floor and we had to achieve an air seal in the floor.

When you have very beautiful old wooden floorboards that you want to keep, we had to make the decision to lift every floorboard and record where they were, preserve them, set them to one side and install a layer of OSB where every sheet is taped and sealed, and then all the edges of that floor of OSB had to be sealed to the outside of the exterior cladding of the original house so that when we wrapped the house with an air vapour barrier, we could tape it to the edge of the floor.

That was a very painstaking process because the cladding of the exterior of the house together with the four posts made up the structure of the house and had to basically go a board or two at a time to prise it free, to enable the air vapour barrier to go from the floor membrane to the outside of the cladding. So, tuck it down outside and up the outside face of the cladding and then fasten it back in place. Then the whole jacket of air vapour barrier could be taped to that.

So, that was how we managed to get the air seal. And then we put the floorboards back down on top of the OSB and it looked like it had never moved. But we did get the airtightness. When we did the door blower test, we came in at point-five air changes per hour at fifty pascals of air pressure.

Ben: This can sometimes be one of the trickiest bits with retrofits. So, did you have to play around at all or were you there off the mark? That's very good for EnerPHit too.

Jonathan: Yes. Well, the hardest part the structure of the posts. Now, fortunately there were only four of them. We could not install the air vapour barrier through those posts.

So, at the point where the OSB floor, which is representing our ground floor level air seal, where it abutted the posts, we had to tape about three or four inches vertically up each face of the post and tape down to the floor membrane so that the net effect of that

was that only the cross-sectional area of the post was not sealed. But given that it was already an over-a-century old cross-section of six-by-six wood post, the amount of air that would leak through it would be so tiny that it became an acceptable gap in the air seal and it was all enclosed within the over-jacket of twelve inches of EPS. So, it was completely inside the insulation layer.

Ben: Having gone through all of this – I know you said it was your first time for Passivhaus full-stop – what does it make you think both about new build and also renovation projects?

Jonathan: It makes me want to do new build more than renovation, because with renovation it's a journey and you don't know the route. You know what your objective is but you're starting with something where you can't see all of the challenges. So, it's not until you get in and you strip away and you discover all the nuances, that only then can you really make the right decision, make the right design choice.

So, the renovation project really needs you as the architect and designer to be very hands-on and very engaged in the process all the way through. Whereas with a new build, you can really design and think out, calculate and detail every aspect of your new build before you start construction.

I'm currently building a new Passivhaus which is another guesthouse and it's called the Endymion Guesthouse. It's also in Prince Edward County and it's maybe about fifteen minutes away from the Reach Guesthouse. It's completely new build. I was able to site the house the way I wanted to, so it faced south. I was able to choose how to build it so that a not wholly experienced Passivhaus builder could build it.

It's an ICF construction; it's a concrete house. I have reached the point where the roof is on, the windows are in, we're installing the electrical and the plumbing right now, and we hope to be occupying it before the end of the year.

Ben: Just going full circle back to the beginning when you were saying that even in the early days you were very interested in sustainable building, what lessons do you think you've learnt as a practice?

This doesn't necessarily have to be Passivhaus related but in terms of building for today, I suppose, facing climate change, some of the big issues that we've got coming, what other things do you find yourself doing more of as a practice?

Jonathan: Well, at the beginning it was a kind of a groping around in the dark, looking for the right way to build super sustainably. I collaborated with Ken Yeang who's a famous eco architect at the early days of this exploration. So, I always liked the ecological approach to architecture and I always liked the landscape approach to architecture.

I went through periods of being very immersed in looking at photovoltaic solar panels to heat water, small wind turbines, the use of geothermal for heating and cooling, but in reality when I got into the methodology of Passivhaus, it makes all these other approaches not irrelevant but secondary to building first of all the primary architectural enclosure to be superbly high performance.

It's like going back several, if not many centuries, to a very early pre-technology period, when you had to use what nature gave you as a way of being warm and being sheltered, or being cool, and so it's always fascinating to look at very early civilisations, how they sited and addressed their buildings all to catch the south sun and to use the south sun to heat their homes in the winter and keep them cool in the summer by shading the main apertures, and to build building enclosures invariably with very thick walls or very thick roof structures, but to keep the passive thermal energy created by humans, by fire, by animals living in a part of the building or the farmhouse and keeping the thermal energy inside.

Once you've created the ideal envelope, and you can quote the examples of the thermos flask, that is the objective. Make the building envelope superbly thermally efficient so that you don't have to put much energy in.

Then when you start looking at geothermal, and photovoltaics and wind turbines and other methods of adding to the sustainable menu, they're not so critical. Because the amount of additional energy you need is so small, you don't need to be overspending because geothermal is quite expensive. But you might still need to add actively generated heating and actively generated cooling in our climate at least.

Typically, we would have to resort to some small-scale, very efficient method of heating and cooling, and typically what we like to use is a small mini-split that is very low energy consumption and really is only needed for a few months in the summer and a few months in the winter. Whereas through the shoulder seasons, we very often don't need to heat or cool but just keep the energy inside the building that's been generated by humans, by some appliances, by cooking and so forth, and keeping the house superbly ventilated

with a highly efficient ERV, many of which are now in the ninety-five to ninety-seven percent efficiency.

Ben: In terms of materials and how things have developed, do you have any thoughts on materials when you tackle a project?

Jonathan: As an architect first and seeing Passivhaus as the application of science to architecture, I like to feel I can work with any material that is appropriate to the design, to the programme, to the location, to the landscape. So, I find the choice of material is unique to each project. And at this point in time, our practice is building in concrete, in wood, in hybrids of concrete and modular panels that are factory assembled with the windows installed in the plant.

I like the freedom that Passivhaus gives me as an architect to use whatever material I want but apply the science as stringently as possible.

Each building has its own needs, and our tendency would be to have a preference for wood because of the low embodied energy in the material itself and its low carbon nature, and it's a renewable resource. So, our newest multiple unit housing project is going to be a wholly wood structure and also a passivhaus.

Our largest passivhaus currently, which is about to start on construction, is ten storeys and accommodates about a hundred and forty-five suites. So, we work in small, medium, large and extra-large.

Ben: Jonathan, I just want to thank you very much for your time today. It's been really interesting to find out about the Reach Guesthouse and how things are going at your practice so, many thanks.

Jonathan: Okay, all the best. Thank you very much.